Thika Power Limited

MSD Power Plant, Thika, Kenya

Environmental and Social Impact Assessment

Final Report

August 2011

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Final Report

30 August 2011

Reference 0124250

For and on behalf of
Environmental Resources Management Limited

Approved by: Eamonn Barrett

Signed:

Position: Partner

Date: 30 August 2011

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ACRONYMS

AfDB	African Development Bank
API	American Petroleum Institute
CBOs	Community Based Organisations
CIMAC	International Council on Combustion Engines
CMP	Contruction Management Plan
CO	Carbon Monoxide
DCC	Diesel Combined-Cycle
DEC	District Environment Committee
DFO	Distillate Fuel Oil
DMRB	Design Manual for Roads and Bridges
EHS	[IFC] Environmental, Health and Safety [Guidelines]
EIA	Environmental Impact Assessment
EMCA	Kenyan Environment Management and Coordination Act
ERC	Energy Regulatory Commission
ERM	Environmental Resources Management Limited
ERP	Emergency Response Plan
ESIA	Environmental and Social Impact Assessment
ESMPs	Environmental and Social Management Plans
ESMS	Environmental and Social Management System
FGDs	Focus Group Discussions
FSA	Fuel Supply Agreement
GDI	Gender Inequality Index
GHG	Greenhouse Gases
GIIP	Good International Industry Practice
GM	Grievance Manager
GNI	Gross National Income
GO	Grievance Officer
HAZOP	Hazard and Operability [study]
HDI	The Human Development Index
HFO	Heavy Fuel Oil
ICCOBO	International Consortium of Community Based Organisations
IFC	International Finance Corporation
IFC PSs	IFC Performance Standards
IPCCs	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IPPC	Integrated Pollution Prevention and Control
KPLC	Kenya Power and Lighting Company
LCPDP	Least Cost Power Development Plan
MD	Managing Director
MENR	Ministry Environment and Mineral Resources
MPG	Melec PowerGen Inc.
MSD	Medium Speed Diesel
MTP	Medical Termination of Pregnancy
NEMA	National Environmental Management Authority
NER	Net Enrolment Ratio

NGOs	Non Government Organisations
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxide
NWPC	National Water Conservation and Pipeline Corporation
PC	Process Contribution
PEC	Predicted Environmental Concentration
PID	Project Information Document
PLC	Programmable Logic Controller
PPA	Power Producer's Agreement
SCADA	Supervisory Control and Data Acquisition
SEP	Stakeholder Engagement Plan
SI	Social Investment
SIS	Social Investment Strategy
SO_2	Sulphur dioxide
TCMP	Traffic Control Management Plan
TPL	Thika Power Limited
UNDP	United Nations Development Program
WMP	Worker Management Plan
WRMA	Water Resources Management Authority

1 INTRODUCTION

1.1 BACKGROUND

This document presents the Environmental and Social Impact Assessment (ESIA) for a proposed power plant development in Kenya ('the Project'), prepared to meet the requirements of potential financing institutions, as described later in this introductory chapter. The Project proponent is Thika Power Limited (TPL), a Kenyan-registered company established for the purposes of developing and running the Project. The major shareholder is the Matelec Group of Lebanon, through its affiliate Melec PowerGen Inc. (MPG), with additional investment from a Kenyan partner.

TPL proposes to develop an 87 Megawatt Medium Speed Diesel (MSD) power plant in Thika District, Kenya, and appointed Environmental Resources Management Limited (hereafter referred to as ERM) to develop the ESIA to international standards (specifically those of the International Finance Corporation (IFC) and African Development Bank (AfDB)) to ensure that potential environmental and social impacts associated with development of the Project are identified, assessed and managed appropriately.

1.2 THE PURPOSE OF THE ESIA PROCESS

1.2.1 ESIA objectives

The primary objective of this ESIA is to ensure that construction and operation of the Project are carried out in the most sustainable manner that is compatible with its economic and operational parameters. In doing so, it will facilitate TPL gaining access to the international financing that is required in order for the Project to proceed to construction. TPL has engaged with the IFC and the AfDB to discuss the potential for these institutions to act as a lending source and both require that the Project comply with international standards on environmental and social management and performance. Therefore, this ESIA aims to achieve an acceptable level of compliance with the applicable international standards i.e. the IFC Performance Standards (IFC PSs) thus providing financial insitutions with assurance that environmental and social risks are comprehensively understood by TPL and that systems and processes are in place to manage these to an acceptable level.

The ESIA will also:

- provide input to the TPL Project team and design engineers to ensure an optimised design that reduces as far as practicable, environmental and socio-economic impacts;

- identify, and aim to enhance, positive impacts and opportunities arising from development of the Project;
- be thoroughly integrated, meaning that impacts and related mitigation measures for environmental and socio-economic aspects are coordinated;
- incorporate stakeholder feedback throughout the ESIA process; and
- communicate at key points with a full range of stakeholders.

1.2.2 Purpose of the ESIA

An ESIA is first and foremost a process. Thus, while the ESIA process includes the preparation of a comprehensive report (this ESIA document), it covers a variety of other activities such as stakeholder consultation, and the production of a number of supporting and complimentary documents that deal with specific environmental and socio-economic aspects of the Project such as the Stakeholder Engagement Plan (SEP) (see *Annex G*).

A Project Information Document (PID) (see *Annex J*) has been prepared and distributed amongst local communities. It provides an overview of the Project (headlines and benefits), as welll as a summary of key impacts and mitigation, an indicative project development schedule and contact details for providing feedback. The PID was shared with stakeholders as part of the stakeholder consultation process:

- to facilitate rigorous identification of key issues for the Project;
- to highlight the key potential positive and negative impacts arising from the Project; and
- to understand local stakeholders key concerns.

1.2.3 Scope of the ESIA

It is important to note that this document does not represent the culmination of the ESIA process; rather it documents the results of the ESIA process to date and clearly sets out future actions to be taken (including monitoring). This assessment evaluates the environmental and socio-economic impacts of the following aspects of the Project:

- site preparation and earthworks (i.e. land clearance, infrastructure development, etc);
- construction;
- comissioning and operation; and
- decomissioning.

1.2.4 *The ESIA in the context of Kenyan regulatory permitting*

Under the Kenyan Environment Management and Coordination Act (EMCA), 1999 a proponent of a project is required to submit a Project Report to allow the National Environmental Management Authority (NEMA), Kenya's national regulatory body, to determine whether or not an EIA is required. This initial Project Report was prepared by Kenya Power and Lighting Company (KPLC) in February 2010. Following receipt of the Project Report, NEMA deemed it necessary that an EIA be completed for the Project.

Matelec was successful in KPLC's tender process to select an Independent Power Producer (IPP) to develop the Project, and then established TPL as the special purpose vehicle developer/operator. TPL appointed a local consultancy, Enviroplan & Management Consultants of Nairobi (Enviroplan) to undertake the Project EIA to meet the requirements of Kenyan legislation. See *Section 2.6* for an update on the current EIA permitting status.

This ESIA has been prepared in parallel, to meet standards of international good practice for ESIA as embodied in the IFC Performance Standards on Social and Environmental Sustainability. This report will not form part of the Kenyan regulatory or permitting process, but will provide a consideration of Kenyan EIA legislation, will draw as appropriate upon the results of the locally-prepared EIA and report on the outcome of the Kenyan permitting procedure, as part of the international standards' requirement for a Project to meet applicable host country laws, regulations and permitting requirements.

1.3 *APPLICABLE STANDARDS*

The ESIA has been prepared to meet with, and take account of, the following international standards:

- International Finance Corporation (IFC) Performance Standards for Social and Environmental Sustainability, April 2006 ('the IFC PSs)[1] ;
- IFC Environmental, Health and Safety (EHS) Guidelines, and EHS Guideline for Thermal Power Plants[2];
- The Equator Principles [3], as they relate to ESIA; and
- African Development Bank's Environmental and Social Policies.

These standards are described further in *Section 2.5*.

(1)http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards
(2)http://www.ifc.org/ifcext/sustainability.nsf/Content/EHSGuidelines
(3) http//www.equator-principles.com

1.4 THE STRUCTURE OF THIS REPORT

The ESIA is structured in the following way:

- Chapter 1: Introduction;
- Chapter 2: Legislation, Policy and Project Standards;
- Chapter 3: The ESIA Process;
- Chapter 4: Baseline;
- Chapter 5: Project Description;
- Chapter 6: Impacts and Mitigation; and
- Chapter 7: Environmental and Socio-economic Management.

1.5 INTRODUCING THE PROJECT

1.5.1 *Project Overview*

In January 2010, KPLC (see *Box 1.1*) issued a Request for Proposal document to solicit tender bids for the construction, commissioning and operation of a 60-80MW MSD power plant at Thika (1). As noted above, Matelec was the successful bidder.

Box 1.1 Kenya Power and Lighting Company (KPLC)

KPLC is a Kenyan parastatal company engaged in the transmission, distribution and retail of electricity. It is the only licensed electricity distributor and supplier in Kenya, and it purchases electricity in bulk from Kenya Electricity Generating Company Limited (KenGen) and several independent power producers. The company currently owns and operates an electricity transmission and distribution network of more than 43,000 kilometres.

The proposed site for the Project is adjacent to the Nairobi – Thika highway, approximately 30 km north of Nairobi city centre and 5 km south-west of Thika Town (see *Figure 1.1*). KPLC acquired an area of approximately 8 hectares from Agro Tropical, the company who owns the adjacent coffee farm land, for the purpose of constructing a substation as part of the wider *Kilimambogo – Thika – Githambo – Kiganjo (Nyeri) and Thika - Kiganjo (Gatundu) 132 kV Transmission Lines and Associated Substations Project* (see *Box 1.3* for further detail). Of the 8 hectares acquired by KPLC, the TPL Project will occupy approximately 4 hectares. However, the exact land division between KPLC and TPL has not been legally agreed as yet, and will be finalised in TPL's lease agreement for the Project site, expected to be signed in April 2011.

1.5.2 *Project Context: Kenya's Energy Policy and Objectives*

The policy framework for Kenya's energy sector has been operationalised at a strategic level via the Least Cost Power Development Plan (LCPDP), which was developed by the Ministry of Energy and energy sector parastatals

(1) Request for Proposal 60-80MW MSD Power Plant at Thika, Tender reference KPLC1/9AD/PT/16/10-11, KPLC, 22nd January 2010

(including the KPLC) to serve as an energy sector blueprint for provision of cost effective energy sources to consumers in Kenya. The LCPDP is updated every year, to provide a twenty-year planning scenario for meeting Kenya's growing energy needs (see *Box 1.2*). The high level of economic growth predicted in Kenya's Vision 2030 [(1)] suggests that the electric power generation system's capacity will be outstripped by demand, unless the development of new cost-effective energy generating resources is fast-tracked.

Box 1.2 Kenya's Least Cost Power Development Plan (LCPDP): Key Points

During the twenty years 2009-2029 Kenya's need for power is forecast to increase six-fold:

- energy demand will rise 660% (from 6,928 GWh to 52,623 GWh); and
- maximum demand for interconnected electricity is forecast to increase 598%, from 1,172 MW to 8,183 MW.

Consequently, installed generating capacity will have to increase from 1,317 MW to 8,817 MW to meet these increasing demands for power, to fuel economic development and to support the rising standards of living amongst Kenyan consumers.

Increased generation requirements will be met through the continuing process of diversification of power generation, which has historically been heavily dependent on hydroelectric power. Hydropower will remain very important in Kenya's energy "mix", but whilst the development potential of further hydroelectric power resources is being assessed, a strong emphasis is being placed on the development of:

- geothermal sources, to take advantage of Kenya's favourable position straddling the highly active Rift Valley;
- both oil- and coal-fired thermal power plants;
- wind power; and
- power-sharing agreements to facilitate imports from neighbouring countries, e.g. Ethiopia and Tanzania.

Increased generation requirements will be met through the continuing process of diversification of power generation, which has historically been heavily dependent on hydroelectric power. However, with increasing climate variability, especially the prevalence of drought in recent years, the reliability of supply from hydropower has been brought into question. Electricity shortages have occurred, due to reduced hydropower generating capacity, and with oil supplies being diverted to emergency power generation there have been a variety of economic impacts, such as increased costs of goods to consumers caused by fuel cost inflationary pressure on prices.

Hydropower will remain very important in Kenya's energy "mix", but whilst the development potential of further hydroelectric power resources is being assessed, a strong emphasis is being placed on the development of, amongst others, oil- and coal-fired thermal power plants.

(1) Kenya Vision 2030, Government of the Republic of Kenya, 2007

The proposed power plant at Thika is included in the LCPDP, one of a group of three power plants around Nairobi, all of which will contribute to the aim of increasing the availability of electricity to Kenya's national grid via KPLC's transmission and substations project: see *Box 1.3*), currently in the latter stages of construction.

Box 1.3 ***The Proposed Kilimambogo – Thika – Githambo – Kiganjo (Nyeri) and Thika - Kiganjo (Gatundu) 132 kV Transmission Lines and Associated Substations Project***

The Ministry of Energy and KPLC are in the process of constructing a total of 170 km of 132kV power transmission line from Kilimambogo in Thika, through Githambo in Muranga to a terminal station in Kiganjo (Nyeri) and from Thika to Kiganjo (Gatundu).

A section of the transmission line, from Kilimambogo to Mangu will be a double circuit which will be separated to proceed to the Githambo – Kiganjo (Nyeri) route while the other line will process to Kiganjo in Gatundu where a terminal substation will be constructed.

The main components of the project include:

- construction of a total of 70km 132kV transmission line in 175mm2 conductor comprising approximately 15km double circuit between Kilimambogo and the Thika substation and further 5km from the substation to the junction at Makwa, 50km single circuit between the Thika substation and Githambo;
- construction of new 132kV substation at Thika. The substation shall be double bars equipped with five 132kV bays and two 30MVA 132/66 transformers shall be connected to a new 66kV double bus bar substation which shall be equipped with four outgoing 66kV feeder bays;
- construction of a 132/33kV substation equipped with 23MVA 132/33kV transformers and four outgoing 33kV feeder bays;
- construction of a 50km 132kV transmission link between Githambo and Kiganjo 132kV substation equipped with a takeoff bay at Githambo substation and an entry bay at Kiganjo 132kV substation;
- construction of a 50km 132kV transmission link between Karakuta and Kiganjo (Gatundu); and
- construction of a 132kV/33kV terminal substation at Kiganjo.

Source: Transmission and Substation EIA, prepared by Professor B.N.K Njoroge on behalf of the Ministry of Energy and submitted to NEMA in July 2010

1.5.3 Site Selection Process

As noted in *Section 1.5.2* above, the Ministry of Energy, through KPLC, is in the process of developing a major transmission and substation project around Nairobi. This was conceived, and is being developed, independently from the TPL Project with separate funding, separate contractors and separate operators, and although now rather delayed was originally due to have been operational prior to the date of this report [(1)].

(1) As reported to ERM staff by KPLC, October 2010.

The TPL Project site was selected by KPLC prior to the tender to select the Project's developer/operator; the KPLC RfP, issued in January 2010, stated in *Section 3.3.1 Location* that:

> *"The Plant will be located on part of plot L.R No. 8380/2 Thika Road, Thika. KPLC intends to lease to the Selected Bidder".*

KPLC's decision on locating the power plant took into account the following objectives:

- access to a high voltage loop (via the adjacent substation, already programmed for imminent construction);
- proximity to well-maintained access roads (for fuel deliveries) and potential for future use of the nearby railway line;
- availability of land for immediate sale which was suitable (i.e. willing seller, only clearance of coffee trees required, no redevelopment of site or resettlement required); and
- location in an area that, although predominantly agricultural, is considered by government authorities as suited to industrial development, indicating that it would be likely to receive the necessary "change of use" permit from the Thika District authorities.

For the reasons described in this section, ERM concludes that the substation and transmission lines connecting to the TPL Project are not an associated facility in the sense that the term is used in the IFC Performance Standards: they are not being developed or controlled by TPL (or its contractors), and their viability does not depend on the existence and operation of the Project. Rather, the substation and attendant transmission lines represent infrastructure that was planned, is being implemented, and will operate irrespective of whether a power plant were to be built adjacent to the Thika substation. Nevertheless, an overview of the EIA process carried out for the transmission line and substation project is provided later in this document.

1.5.4 Planned Project Site

The Project is located on a greenfield site, previously part of a coffee farm, in an area which comprises primarily residential and agricultural land use activities. It is located to the west of the Nairobi - Thika highway which is currently (2009 – 2012) in the process of being reconstructed, resurfaced and expanded from two lanes each way to three or four lanes. The upgrading in the area close to the site will include sections of elevated highway, service roads and an underpass. The work is being undertaken by a Chinese contractor on behalf of the Kenyan Highways Authority.

Key features in the area include:

- the highway;
- the neighbouring coffee farm (from which the land for the TPL Project was purchased by KPLC);
- an informal housing area, Witeithie Estate, which is located to the southeast of the site, across the Nairobi - Thika highway; and
- Mang'u High School, a 1,500 pupil boys' boarding school to the south of the site.

Figure 1.1 shows the location of the site in relation to Kenya and Thika District.

The Project site, which slopes south-north, is at an altitude of approximately 1,500 metres above sea level. The topography of the surrounding area is gently undulating, with hills up to 2,144 m above sea level further to the west, and generally flat lowlands to the east. The site previous use as a coffee farm was long-established: it had been in operation since colonial times (i.e. over 60 years).

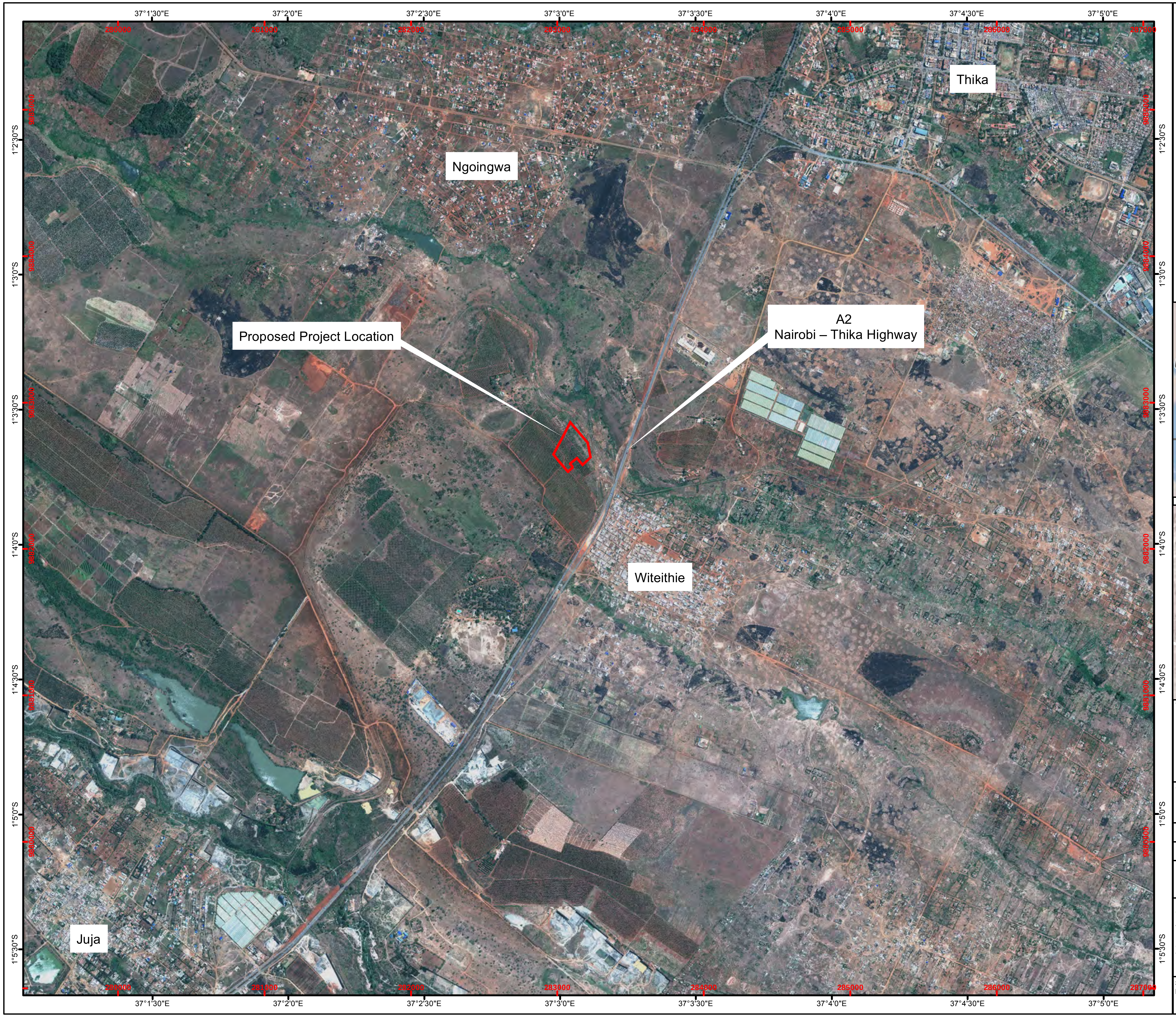
Key events to date to prepare the site for construction of the power plant have included:

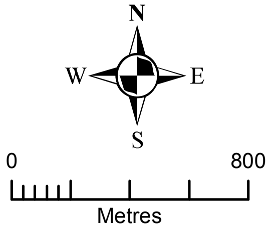
- after purchase of the land from Agro Tropical in mid-2010, KPLC cleared the coffee trees from the entire site (including the TPL project area);
- in August 2010 KPLC obtained a 'Change of User' approval which states a re-designation from 'agricultural' to 'electrical substation' land classification from the County Council of Thika;
- a further change to include "power station" as a permitted land use, approved by the County Council of Thika in August 2011;
- issue of a licence by NEMA on 27 July 2011, authorising construction to go ahead; and
- following preparatory activities in October and November, in December 2010, KPLC began civil works for the construction of the substation and adjacent transmission tower bases for the transmission line project.

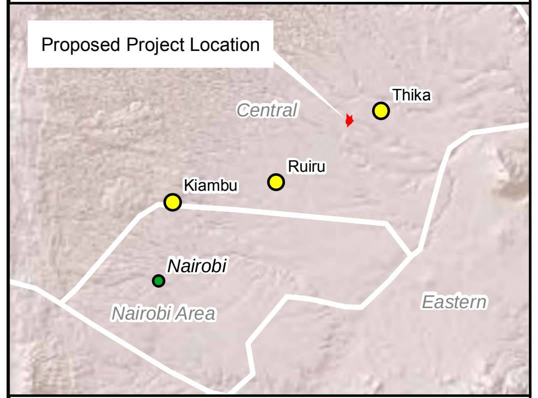
Greater detail on the Project site and surrounding area is provided later in this document, as part of the environemntal and social baseline chapter (see *Chapter 4)*.

KEY:

Site Boundary







TITLE:

Figure 1.1
Site Location

CLIENT: Thika Power Ltd.		SIZE: A3
DATE: 13/04/2011	CHECKED: PH	PROJECT: 0124250
DRAWN: AK	APPROVED:	SCALE: As Scale Bar
DRAWING: SiteLocation.mxd		REV: 0

ERM
Eaton House
Wallbrook Court
North Hinksey Lane
Oxford, OX2 0QS
Tel: 01865 384800
Fax: 01865 384848

SOURCE: GeoEye Data is owned by GeoEye, Inc. © All rights are reserved by GeoEye, Inc.
PROJECTION: WGS 1984 UTM Zone 37S

File: 0124250_ThikaMapping\mxd\March2011\SiteLocation.mxd

1.6 *DEFINING THE ESIA'S AREA OF STUDY*

Although the scale of the Project is such that it has the potential to have an influence at the national and to some extent an international level (e.g. in terms of procurement, contriution of Greenhouse Gas emissions, etc), the majority of impacts – both positive and negative - will be experienced by the more immediate environment and communities in closer proximity to the Project site.

Baseline data collection focused on providing information to support the assessment of such impacts. Information was therefore collected at the following levels:

- *National and provincial level*: Secondary information was collected at a national and provincial level to provide a contextual overview.

- *District and local level*: Secondary information was collected at a District (Thika District) and local level. This was supplemented and validated by primary data collection at both levels. Specific study areas for environmetal and social topics were chosen to ensure that the relevant resources, receptors and processes within the Project's potential Area of Influence were included.

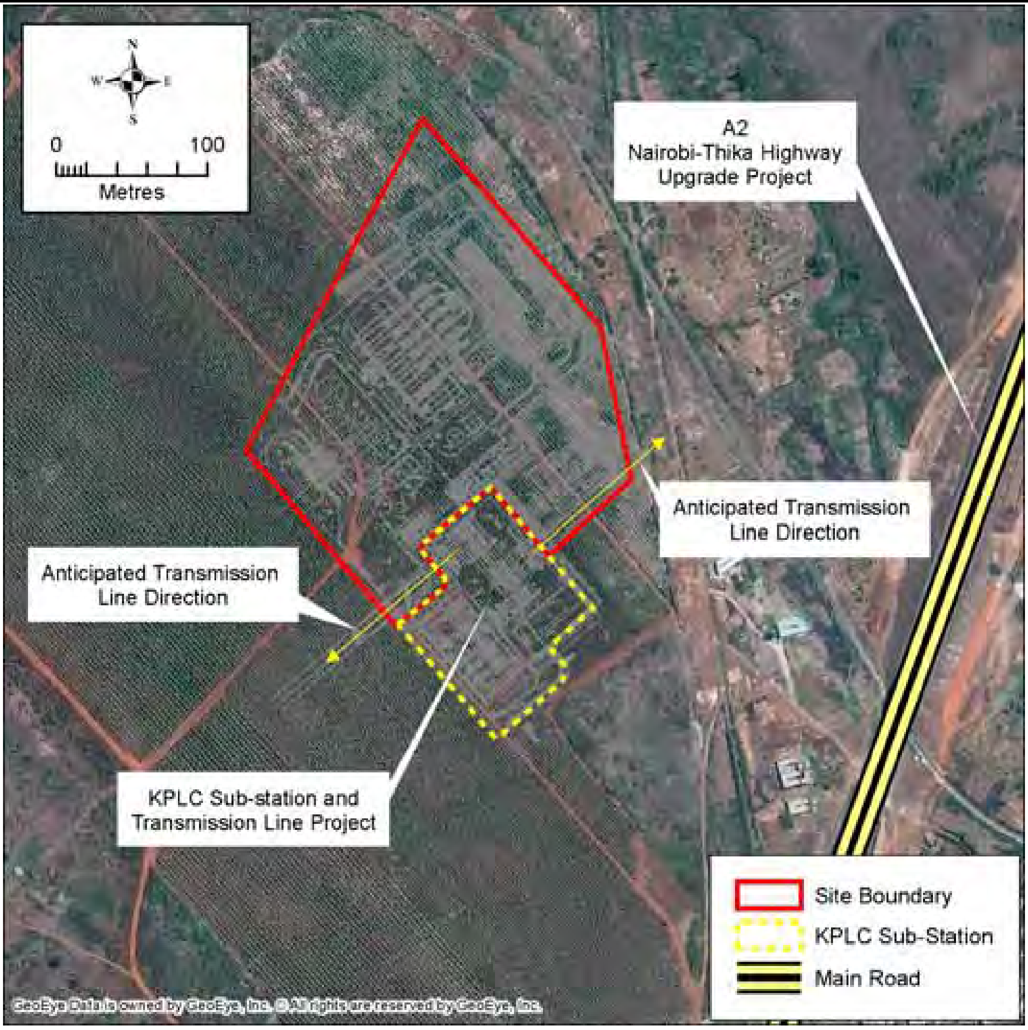
The primary study area includes the physical Project footprint as well as a zone of 2 km zone radius around this site, which is defined as the Project's major area of influence. This includes key features such as Mang'u High School, Kuraiha Primary School, the Witeithie Estate and several small clusters of houses close to the site (and adjacent agricultural plots tended by people from these communiites), the coffee farm and staff housing, and the River Komu downslope (north) of the Project site. Further detail on the location of these features, and others in the area, is provided in *Figure 4.1*, and *Chapter 4* provides a more detailed basline description of each of the study areas covered by specific data collection studies, and the environmental and social resources, receptors and sensitivities identified.

Other project developments that are currently ongoing in the Study area, and which have been taken into account throughout this assessment arew as follows:

- the KPLC substation and transmission line project; and
- the Nairobi-Thika highway upgrade project

Figure 1.2 shows the location of these two projects in relation to the Project site

Figure 1.2 Other Developments in the Study Area



2 LEGISLATION, POLICY AND PROJECT STANDARDS

2.1 INTRODUCTION

This chapter outlines the applicable international standards and relevant Kenyan regulatory framework that set the context within which the Project will operate. As noted in *Chapter* 1, the EIA to meet Kenyan legislative requirements and obtain the required permitting approvals, was undertaken on behalf of TPL by Enviroplan; however, international standards require adherence to host country legislation and regulatory processes as a fundamental requirement, and so the Kenyan regulatory process is also considered here, as it applies to the TPL Project. Laws of Kenya relevant to the successful implementation of all components of the Project have been considered, and applicable licensing and permitting requirements have been identified.

The Project has committed to comply with international requirements as a condition of accessing international financing, and to support TPL's commitment to development of the Project in a way that manages environmental and social issues responsibly. Therefore, the environmental and social requirements of TPL's prospective international financial institutions are considered within this ESIA.

In summary, this assessment aims to comply with the following requirements:

- the IFC Performance Standards for Social and Environmental Sustainability, April 2006 ('the IFC PSs) (1) ;
- IFC's General Environmental, Health and Safety (EHS) Guidelines, and the EHS Guideline for Thermal Power Plants (2) ;
- African Development Bank (AfDB) Policies, in particular the Integrated Environmental and Social Impact Assessment Guidelines and the Policy on the Environment;
- the Equator Principles (3) , to which Absa is signatory; and
- to report on compliance with Kenyan laws, regulations and permits applicable to the Project.

(1) http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards
(2) http://www.ifc.org/ifcext/sustainability.nsf/Content/EHSGuidelines
(3) http://www.equator-principles.com

2.2 *KENYAN ADMINISTRATIVE AND INSTITUTIONAL CONTEXT*

2.2.1 *Kenyan Administrative Context*

In August 2010, Kenya adopted and introduced a new constitution which replaced the one in force for almost 50 years, since national independence. Implementation of the new constitution means that Kenya is currently in a period of transition, administratively. Key changes which might be relevant to the TPL Project are described in *Box 2.1*; however, many of the changes under the new constitution will not take effect in full until after the first general elections under the new constitution (scheduled for 2012), including the 47 devolved government structures at County level that will become the Project's "local authority", which have yet to be established.

Box 2.1 Sub-national Administrative Structures in Kenya under the 2010 Constitution

Kenya is split into eight Provinces (Central, Coast, Eastern, Nairobi, North Eastern, Nyanza, Rift Valley and Western) administered by appointed officials. Provinces are divided into Districts and further subdivided into Divisions, Locations, and Sub-Locations. Provinces are administered by presidentially appointed Provincial Commissioners, Districts by District Commissioners, Divisions by District Officers, Locations by Chiefs and Sub-Locations by Assistant Chiefs. The Government supervises and appoints the heads of administrative units, while elected officials represent constituencies and wards. The Project is currently located in Thika District, which lies within the Central Province. However, as part of Kenya's administrative restructuring, the Thika area has been divided into Thika West District (within which the Project will reside) and Thika East District.

County Government will consist of a County Assembly and a County Executive. The County Assembly will be composed of members elected from different wards within the county. The County Executive will be headed by the County Governor. Voters in each county will elect their governor and deputy governor directly. The governor will then appoint other members of the county executive committee with the approval of the County Assembly.

County Governments will be in charge of, among other services:

- agriculture;
- health services;
- public amenities;
- trade development and regulations at county level; and
- planning and development.

2.2.2 *Environmental Management in Kenya*

Between independence in 1963, and prior to 1999, Kenya did not have EIA legislation: it started to be developed following the adoption of Sessional Paper Number 6 in 1999 on Environment and Development. Kenya began to develop environmental legislation. This Sessional Paper identified key priorities for protection and management of the environment, including the need for EIAs to be conducted on Projects which might result in impacts to the environment and human health, and the need to establish a national authority to manage environmental issues. The paper led to passage of the Environmental Management and Coordination Act 1999 (EMCA), the primary legislation that relates to the EIA process in Kenya.

2.2.3 *Ministry of Environment and Mineral Resources*

The mandate of the Ministry Environment and Mineral Resources (MENR) is to monitor, protect, conserve and manage the country's environment and natural resources. This should be done through sustainable exploitation of natural resources for socio-economic development aimed at the eradication of poverty, improving living standards and ensuring that a clean environment is provided now and sustained in the future. Following the EMCA, the National Environmental Management Authority (NEMA) was set up under the MENR as the principle government authority for managing environmental issues across all sectors in Kenya.

NEMA and the EIA Process in Kenya

See *Figure 2.1* for a process diagram depicting the EIA procedure in Kenya. For proposed developments falling under the EIA regulations, a Project Report must be submitted to NEMA in order for it to confirm whether an EIA is required. Project EIAs, if required, must then be submitted for review and comment as part of Kenyan project permitting requirements. NEMA relies on the technical advice of other government agencies when reviewing and approving new projects through the EIA process, and also receives guidance on local issues and the opinions of neighbouring communities and stakeholders from the relevant District Environment Committee (DEC).

Together with the Kenyan Standards Committee, NEMA has developed a number of environmental quality standards and regulations which include the following:

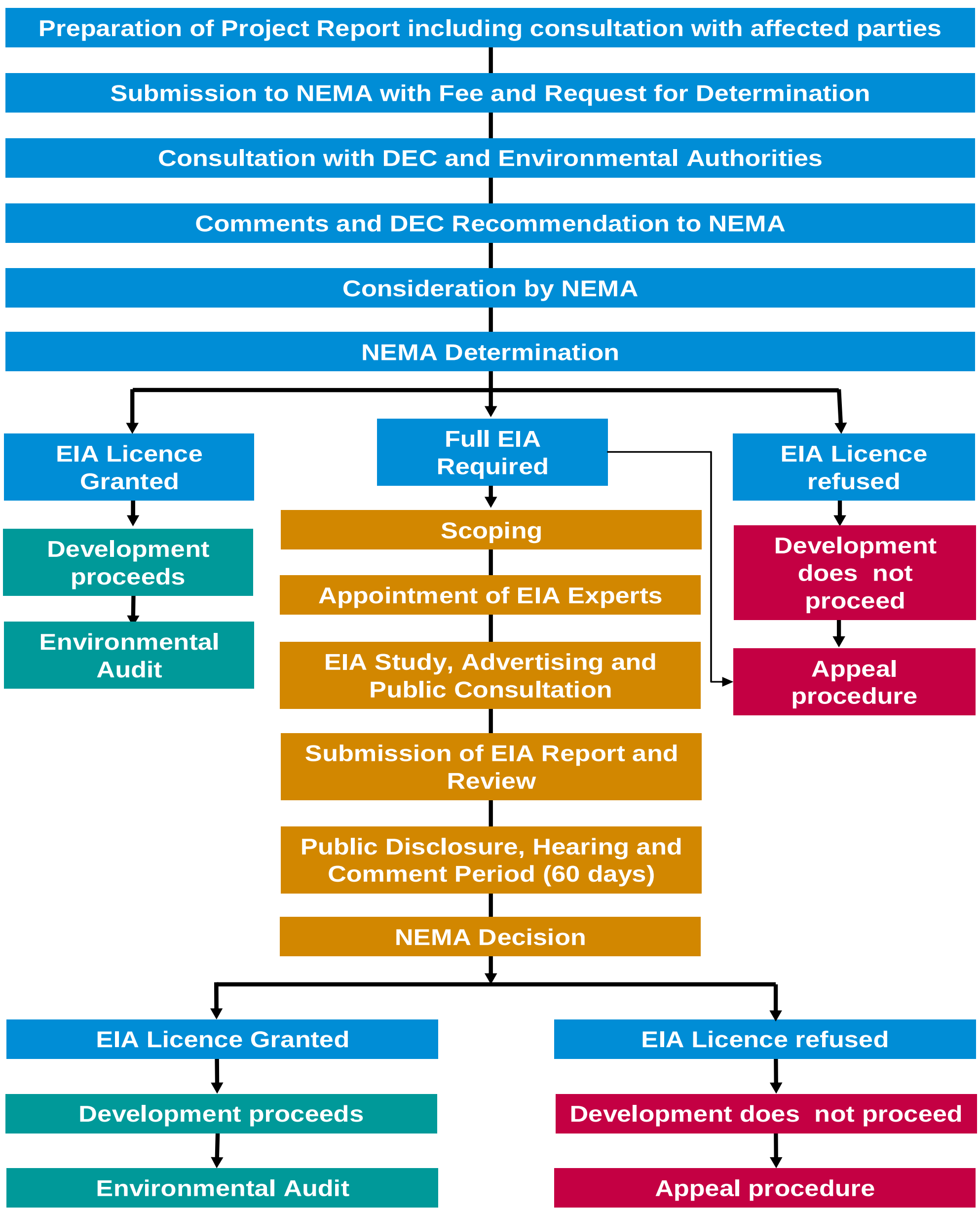
- *EIA and Audit Regulation, 2003*: Sets out guidelines on conducting EIAs and audits in Kenya;
- *Water Quality Regulation, 2006*: Sets out the water quality standards that should be met for various water uses;
- *Noise and Excessive Vibrations Regulation, 2009*: Sets the maximum permissible levels for noise from various sources and zones such as construction sites, residential and commercial areas;
- *Waste Management Regulation, 2006*: Sets guidelines on the management of waste including the handling and transportation of waste; and
- *Draft Air quality Regulations 2008* (not yet adopted): Sets the standard for ambient air quality tolerance limits, emission limits for various parameters, guidelines on air pollution monitoring parameters and acceptable emission control technologies.

2.2.4 *Ministry of Energy*

The Ministry of Energy is responsible for the provision of clean, secure, sustainable and affordable energy services for social-economic development while protecting the environment. Relevant departments include the Department of Renewable Energy and the Energy Regulatory Commission (ERC).

The ERC regulates electrical energy, petroleum products and other forms of energy. The ERC's functions include the protection of consumer, investors and other stakeholder interests as well as monitoring the energy sector as a whole. Other functions include licensing, enforcement, dispute settlement and approval of power purchase and network service contracts. KPLC, and other power sector parastatals in Kenya, fall under the authority of the Ministry of Energy.

Figure 2.1 Kenyan EIA Procedure



2.2.5 *Traditional Leadership System*

The formal government of Kenya is represented at the village level by Chiefs or Assistant Chiefs, appointed as administrative heads of Locations and Sub-Locations. These positions, although centrally appointed, tend be held by the traditional leadership in the Thika District.

At a village level formal leadership is provided by Chairpersons who are selected by the village population. Although the role of Chairperson is not related to the traditional leadership structure, in practice the village tends to select the senior traditional leader to act as Chairperson.

The traditional leadership system currently functions in parallel to the formal governance system with considerable overlap between the traditional leaders and the positions of Chairperson and Chief.

2.2.6 *Civic and National Level Stakeholders*

At the national level, civic organisations relevant to the Project include:

- KPLC: Provision of power to stimulate the growth of enterprises;
- Environment and Public Health Department: Primary responsibilities include raising awareness regarding environment legislation, conservation of the environment and implementation of policy on environment;
- Lands, Survey and Settlement Department: Registers and surveys land and issues deeds;
- National AIDS Control Council: Responsible for managing and funding HIV/AIDS awareness activities;
- Cultural and Social Services: Registers groups and mobilises communities;
- National Water Conservation and Pipeline Corporation (NWPC): Responsible for managing the provision of water and regulating the use of water resources;
- Department of Trade, Industry and Micro Enterprises Development: Facilitates the development of agro-industries by providing funds and training of artisans and management; and
- Works and Roads Department: Responsible for maintaining buildings and roads.

At the District level, key civic organisations relevant to the Project include:

- The District Planning Unit: The district organisation tasked with managing planning and national development with the aim of fostering socio-economic development at the grass root level; coordination and development of district plans; and coordination of policy formulation and implementation;

- The District Treasury: The district organisation tasked with managing finances with the aim of instilling a high sense of discipline in all spending units in the District; put in place a mechanism to maximise revenue collection for all revenue centres; and public financial management;

- Social and Gender Development Department: Responsible for managing and coordinating social development initiative both taken at national and district level;
- Adult Education Department: Responsible for managing the adult literacy and education initiatives; and

- There are an estimated 1,193 active women's groups in the district, with approximately 24,000 members [(1)].

In coordination with the District administration, these groups are likely to have a role to play in relation to development initiatives within the Thika area.

2.2.7 *Thika District Development Plan*

Thika District has a District Development Plan for 2008-2012 (developed prior to its sub-division) established by the Ministry for Planning and National Development for implementation of the National Population Policy for Sustainable Development. The District Development Plan sets out how to achieve development objectives in line with the National Economic Development Plan 'Vision 2030' [(2)], which aims to produce annual economic growth of 10% through a series of five year plans.

2.3 *KENYAN PERMITTING REGIME*

2.3.1 *Regulatory Framework*

The body of primary environmental, health, safety and social legislation considered to be relevant to the Project includes the legislation and regulations listed in *Box 2.2*.

A summary of the main environmental permitting and licensing requirements relevant to the Project is provided in *Table 2.1*.

(1)Thika District Development Plan 2008-2012, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009
(2)Kenya Vision 2030 The Popular Version, Government of the Republic of Kenya, 2007

Box 2.2 *Relevant Kenyan Regulations*

- EIA and Environmental Audit Regulations, 2003;
- Physical Planning Act (No. 6 of 1996);
- Land Acquisition Act (Chapter 295 of the Laws of Kenya);
- Water Act (Act No. 8 of 2002: Section 25);
- Water Quality Regulations, 2006: Parts II, III and IV;
- Public Health Act (Cap 242: Sec 130);
- Way leaves Act (Chapter 292 of the Laws of Kenya);
- Trust Land Act (Chapter 288);
- Waste Management Regulations, 2006;
- Noise and Excessive Vibration Control Regulations, 2009;
- Noise Prevention and Control Rules, 2005;
- Penal Code (Cap. 63);
- The Safety and Health Committee Rules, 2004;
- Fire Risk Reduction Rules, 2007;
- Medical Examination Rules, 2005;
- Hazardous Substances Rules, 2007;
- The Energy Act, 2006;
- Agriculture Act (Chapter 318 of the Laws of Kenya);
- Wildlife (Conservation & Management) Act Chapter 376 of the Laws of Kenya;
- Forests Act (Chapter 375 of the Laws of Kenya); and
- Land (Group Representatives) Act (Chapter 287 of the Laws of Kenya).

Source: Project EIA, Enviroplan, 2010

2.4 INTERNATIONAL CONVENTIONS ADOPTED/RATIFIED BY KENYA

Kenya has adopted, ratified, or is signatory to a number of intentional agreements, treaties and conventions that have an environmental or social aspect to them. A summary of these international conventions is provided in *Table 2.2*.

2.5 INTERNATIONAL STANDARDS

As noted previously, the Project has committed to comply with the international requirements as a condition of accessing international financing sources as well as a way of committing to the development of the Project in a way that manages environmental and social issues responsibly. The requirements of the IFC PSs and EHS Guidelines have been specifically considered as part of this assessment. Insofar as they are the basis for the Equator Principles as they apply to ESIA, they are also relevant to Absa's requirements.

The AfDB's policies are also outlined in this section.

Whilst all the PSs have been considered during this ESIA, during scoping it was concluded that the focus should be on PSs 1-4 (see *Section 3.4* for rationale).

Table 2.1 Key Environmental, Health and Safety Permits, Licences and Authorisation Requirements Relevant to the Project

Issue/Resource	Applicable Legislation	Permits/Licence/ Authorisation	Government Administrative Agency	Monitoring/ Enforcement Government Agency
Electricity Generation & Distribution	Energy Act no 12 of 2006 Section 27	Permit for electricity generation and transmission	Ministry of Energy	Electricity Regulatory Commission
Surface Rights	Land Titles Act cap 282	Title deeds or leasehold documents	Ministry of Lands Relevant government ministry depending on activity	Ministry of Lands District Lands office
Town and Country Planning	Physical Planning Act, 1996	Planning approvals for infrastructure.	Ministry of local government Ministry of lands	Local Authority
	Local Government Act cap 265		Department of Physical Planning	Local Authority
Building plans And Workplace Registration	Building Code, Local council by-laws	Building plan approvals	Ministry of Local Government	Local Authority
	Occupational Safety and Health Act, 2007	Workplace registration license, approval of building plans	Ministry of Labour	Directorate of Occupational Health and Safety Services
Atmospheric Emissions	Air quality regulations, 2008 (Draft)	Emissions to air license	Ministry of Environment, National Environment management Authority	National Environment, Management Authority
Water Abstraction/ Discharge	Water Act no 8 of 2002; Water Quality regulations, 2006	Abstraction and discharge license	Ministry of Environment, WRMA; National Environment Management Authority	National Environment, Management Authority; WRMA
Transportation	Traffic Act cap 403 part V and VI Kenya Roads Act Cap 2 of 2007	Application for exemptions from the provisions of the traffic Act for bulk carriers and abnormal loads	Ministry of Transport Ministry of Roads	Traffic Department Kenya Urban roads Authority Kenya National Highways Authority

Table 2.2 International Conventions and Protocols Relevant to the Project

Convention/ Protocol	Signatory Since	Ratification Date
The Vienna Convention for the Protection of the Ozone Layer	9^{th} November 1988	9^{th} November 1988
The Montreal Protocol on the Substances that Deplete the Ozone Layer	16^{th} September 1987	9^{th} November 1988
Montreal Amendment		12^{th} July 2000
The London Amendment to the Montreal Protocol	-	27^{th} September 1994
The Copenhagen Amendment to the Montreal Protocol	-	27^{th} September 1994
United Nations Framework Convention on Climate Change	9^{th} May 1992	30^{th} August 1994
The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	-	26th March 1999
Stockholm Convention on Persistent Organic Pollutants	-	24th September 2004
International Labour Organization (ILO) Convention concerning Discrimination in Respect of Employment and Occupation	-	7^{th} May, 2001

2.5.1 The EHS Guidelines

The World Bank Group's EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP), as defined in IFC's PS 3 on Pollution Prevention and Abatement. The Guidelines contain performance levels and measures that are generally considered to be achievable in new facilities at reasonable costs by existing technology (see *Box 2.3*).

The EHS Guidelines for Thermal Power Plants are the specific-sector guidance relevant to the Project, providing an overview of the key environmental, health and safety topics that are particularly relevant (see *Box 2.4)*.

2.5.2 African Development Bank Policies

The overarching goal of the AfDB is poverty reduction through measures that facilitate national ownership, participation and a focus on measurable outcomes representing the welfare of the poor. The AfDB Group Policy on Poverty Reduction recognises that poverty is characterised by more than just not meeting basic needs in terms of food, shelter and warmth, but also incorporates broader social issues such as lack of respect and dignity, social exclusion, inequality and vulnerability to risks. In terms of action, the AfDB

Box 2.3 *Relevant General EHS Guidelines*

Environmental

1.1 Air Emissions and Ambient Air Quality
1.2 Energy Conservation
1.3 Wastewater and Ambient Water Quality
1.4 Water Conservation
1.5 Hazardous Materials Management
1.6 Waste Management
1.7 Noise
1.8 Contaminated land

Occupational Health and Safety

2.1 General Facility and Design and Operation
2.2 Communication and Training
2.3 Physical Hazards
2.4 Chemical Hazards
2.5 Biological Hazards
2.6 Radiological Hazards
2.7 Personal Protective Equipment
2.8 Special Hazard Environments
2.9 Monitoring

Community Health and Safety

3.1 Water Quality and Availability
3.2 Structural Safety of Project Infrastructure
3.3 Life and Fire Safety (L&FS)
3.4 Traffic Safety
3.5 Transport of Hazardous Materials
3.6 Disease Prevention
3.7 Emergency Preparedness and Response

Box 2.4 *Sector-specific Guidelines for Thermal Power Plants*

Environmental topics

- **Emissions to air;**
- **Energy efficiency and greenhouse gas emissions;**
- **Water consumption and aquatic habitat alteration;**
- **Effluents;**
- **Solid wastes;**
- **Hazardous materials and oil; and**
- **Noise.**

Health and safety topics

- **Non-ionizing radiation;**
- **Heat;**
- **Noise;**
- **Confined spaces;**
- **Electrical hazards;**
- **Fire and explosion hazards;**
- **Chemical hazards; and**
- **Dust.**

is prioritising a number of areas of intervention including supporting private sector development.

The AfDB has a number of internal policies that relate to environmental and social issues and these are broadly aligned with the sentiments of the IFC PSs with some additional focus on certain issues such as poverty and gender. AfDB environmental and social policies include:

- Environmental Review Procedures for Private Sector Operations;
- Integrated Environmental and Social Impact Assessment Guidelines;
- Policy on the Environment;
- Policy on Resettlement;
- Policy on Poverty Reduction; and
- Policy on Gender.

Key issues covered by the environmental policy include water resource management, integrated ecosystem management, soil conservation, energy sources, protection and management of natural parks/reserves, climate change, and waste disposal.
The AfDB Gender Policy provides a set of guiding principles for the consideration of gender aspects in the development and implementation of projects.

2.6 *PROJECT PERMITTING: CURRENT STATUS*

As mentioned in *Section 1.2.4*, an initial Project Report was prepared by KPLC in February 2010 (1). Following receipt of the Project Report, NEMA deemed it necessary that an EIA be completed.

A Kenyan consultancy, Enviroplan, was commissioned by TPL to undertake the Project EIA to meet the requirements of Kenyan legislation. Enviroplan's draft final EIA report was issued in December 2010 (2) and submitted to NEMA in February 2011. NEMA issued the EIA licence for construction of the plant in July 2011.

TPL will at the appropriate time apply for and seek to obtain all necessary licences, permits and approvals from the relevant departments in relation to Project activities.

The Project received an 'Authorisation to Construct Works for the Use of Water' from the Water Resources Management Authority (WRMA), issued by WRMA in April 2011. This authorisation allows TPL to drill the on-site borehole to carry out the necessary testing to confirm the yields predicted by TPL's water resources consultants (3). The authorisation stipulates a number of

(1)Environmental Impact Assessment Project Report 80MW Thika Road MSD Power Project L.R. No 8380/2, KPLC, February 2010
(2)Environmental Impact Assessment Study for the Proposed 80MW Thermal Power Plant at Thika; Enviroplan & Management Consultants; December 2010
(3)Hydrogeological and Geophysical Investigations on Land reference No 8380/4, South West of Thika Municipality County of Kiambu. Geo Con Limited., December 2010

conditions with which TPL must comply; for example, the borehole should be equipped with a master meter to monitor groundwater abstraction.

3 OVERALL ESIA APPROACH AND METHODOLOGY

3.1 INTRODUCTION

The purpose of an ESIA is to examine how a proposed project will lead to a measurable difference in the quality of the environment and the quality of life of impacted individuals and communities. Over the past decades, environmental impact assessments have expanded to include social impact as well as public consultation/stakeholder engagement. These environmental, social, and consultation elements are integrated into the planning and decision-making process to avoid, reduce, or mitigate adverse impacts and to maximise the benefits of a proposed project. More recently still, the emphasis has moved to the ESIA producing robust environmental and social management plans (ESMPs) which can effectively implement the recommended mitigation measures identified in the ESIA, during the life of the project and culminating with an effective decommissioning plan.

The key elements of an ESIA are:

- scoping;
- stakeholder engagement;
- baseline data collection;
- project description;
- assessment of impacts and identification of mitigation measures;
- integrated management system and plans; and
- reporting and disclosure.

The following sections provide further detail on the scoping, stakeholder engagement, baseline data collection and impact assessment phases of work undertaken as part this ESIA process.

3.2 ESIA PROCESS

Figure 3.1 below illustrates an overview of the typical ESIA process stages. This is, however, not a linear process, but one where several stages are carried out in parallel and where the assumptions and conclusions are revisited and modified as the ESIA progresses.

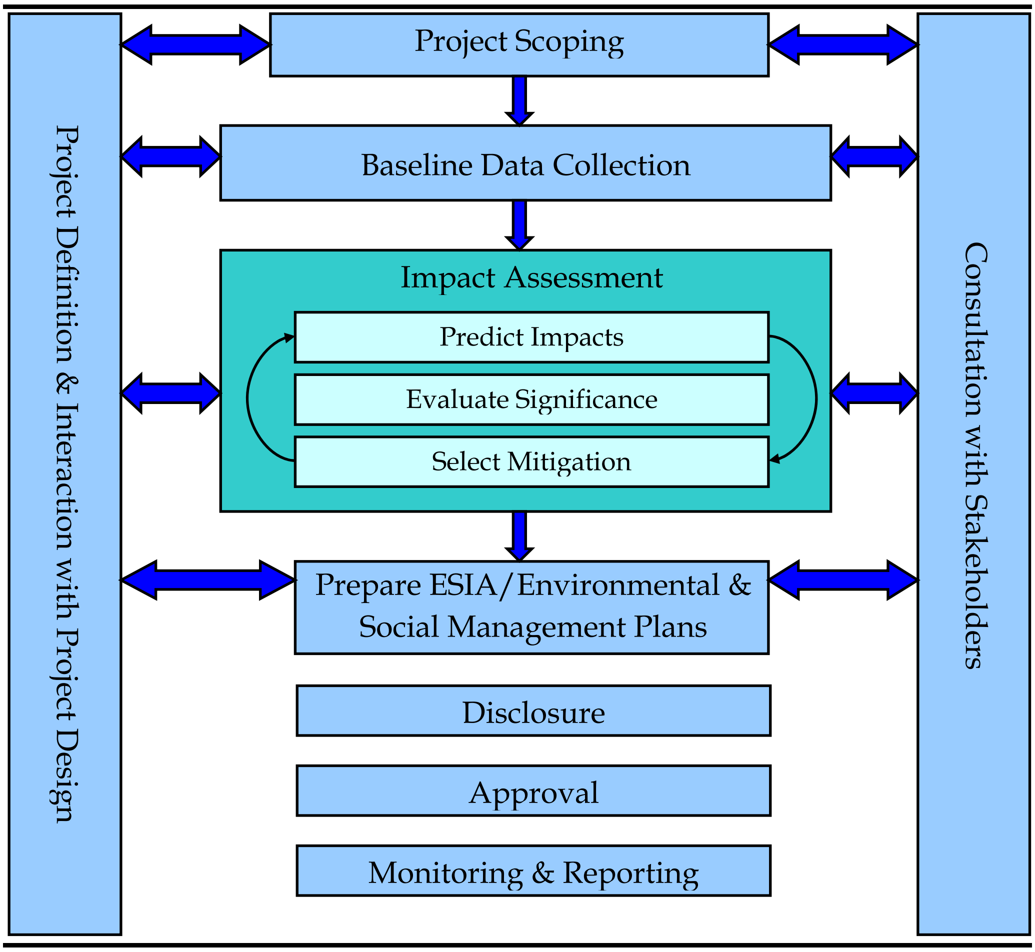
This assessment considers all phases of the Project lifecycle, including:

- site preparation and earthworks (i.e. land clearance, infrastructure creation etc);

- construction;

- comissioning and operation; and
- decomissioning.

Figure 3.1 *ESIA Process Overview*



3.3 *THE KENYAN EIA PROCESS*

The national EIA process is overseen by NEMA and is determined by Kenyan legislation (for further information see *Chapter 2*). In summary, every project is required to prepare a Project Report for submission to NEMA. Following a review of this document, NEMA will determined what sort of further assessment is required e.g. a full EIA.

If required, an EIA is then submitted to NEMA who will engage with other relevant authorities on certain potential aspects of the project e.g. the WRMA on projects where water impacts are likely to occur, in order to get their input. NEMA will provide overall approval for a project with or without certain conditions however, permits and licenses must then be obtained from the relevant authorities on particular issues i.e. for water abstraction and discharge licenses.

TPL has addressed the requirements of the Kenyan EIA process via the work commissioned from Enviroplan (see *Section 2.6*), and as noted previously is awaiting formal EIA approval from NEMA (expected April 2011).

3.4 SCOPING

ERM undertook a scoping site visit in early November 2010 which included meetings with TPL, Enviroplan and with key stakeholders, and a site visit. These identified the key environmental and socio-economic issues relating to the Project. Following this visit, and in parallel with further work being undertaken for the ESIA itself, a Scoping Report was prepared and submitted to the lenders for comment in February 2011.

In summary, the Scoping Report identified that at a "headline" level, two Performance Standards were deemed not applicable and these were as follows:

- *Performance Standard 7: Indigenous Peoples.* There is no indication that indigenous peoples are present within the region of the Project.

- *Performance Standard 8: Cultural Heritage*. The Project site has been part of a coffee farm for decades. The surface and sub-surface were seriously disturbed during clearance, and have been further disturbed during cultivation and replanting. There is no indication that the Project site might have any archaeological significance, nor any suggestion during consultations that it might be of cultural or religious importance for neighbouring communities: there is no evidence at the site of any graves, rocks, trees or other features that might have religious or cultural value.

Two other Performance Standards are considered to have, at most, limited applicability.

- *Performance Standard 5: Land Acquisition and Involuntary Resettlement*. The land was purchased by KPLC from Agro Tropical, on a "willing seller, willing buyer" basis, in compliance with all relevant Kenyan legislation. The area was entirely covered by coffee trees and contained no dwellings or plots of land used for purposes such as grazing or vegetable cultivation.

- *Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management*. The Project site has been disturbed over a period of several decades and maintained as monoculture during this time, as can be observed in the adjacent plots which are still under coffee cultivation. The surrounding areas also demonstrate a long history of human disturbance and degradation of natural habitats; there is no indication that species of unique or special biodiversity value occur at the site or in its environs. The Project site is therefore deemed to have very limited biodiversity value.

The other four Performance Standards are entirely applicable, and have been used to guide the impact assessment.

The Scoping Report contained a "scoping matrix" for the Project which identified the relationship between potential sources of impact from the Project, and environmental and social sensitivities potentially affected by the Project. These areas of intersection between sources of impacts and sensitivities then informed and determined the focus of this ESIA.

3.5 *STAKEHOLDER ENGAGEMENT*

A detailed SEP has been developed as part of this assessment (for further detail see *Annex G*). The SEP is a 'living' document which should be continually updated throughout the lifecycle of the Project as new stakeholders emerge and consultation activities are undertaken.

Stakeholder engagement has been undertaken as part of the ESIA process. Participating stakeholders have included affected households and villages, traditional leadership, civic organisations, local authorities and Non-Governmental Organisations (NGO). All engagement activities have been minuted and details are available in the SEP.

3.6 *BASELINE DATA COLLECTION METHODOLOGY*

This section provides an overview of the process for baseline data collection under each of the key topic areas.

3.6.1 *Air Quality*

Five years of hourly sequential meteorological data, recorded at Nairobi Airport, were obtained through *Trinity Consultants,* for the years 2005-2009. Nairobi airport is the closest meteorological station to the Project which records meteorological data suitable for conducting dispersion modelling. This provided information to allow the characterisation of the Project area in terms of climate and weather, and also provided the necessary data for input into the air dispersion model.

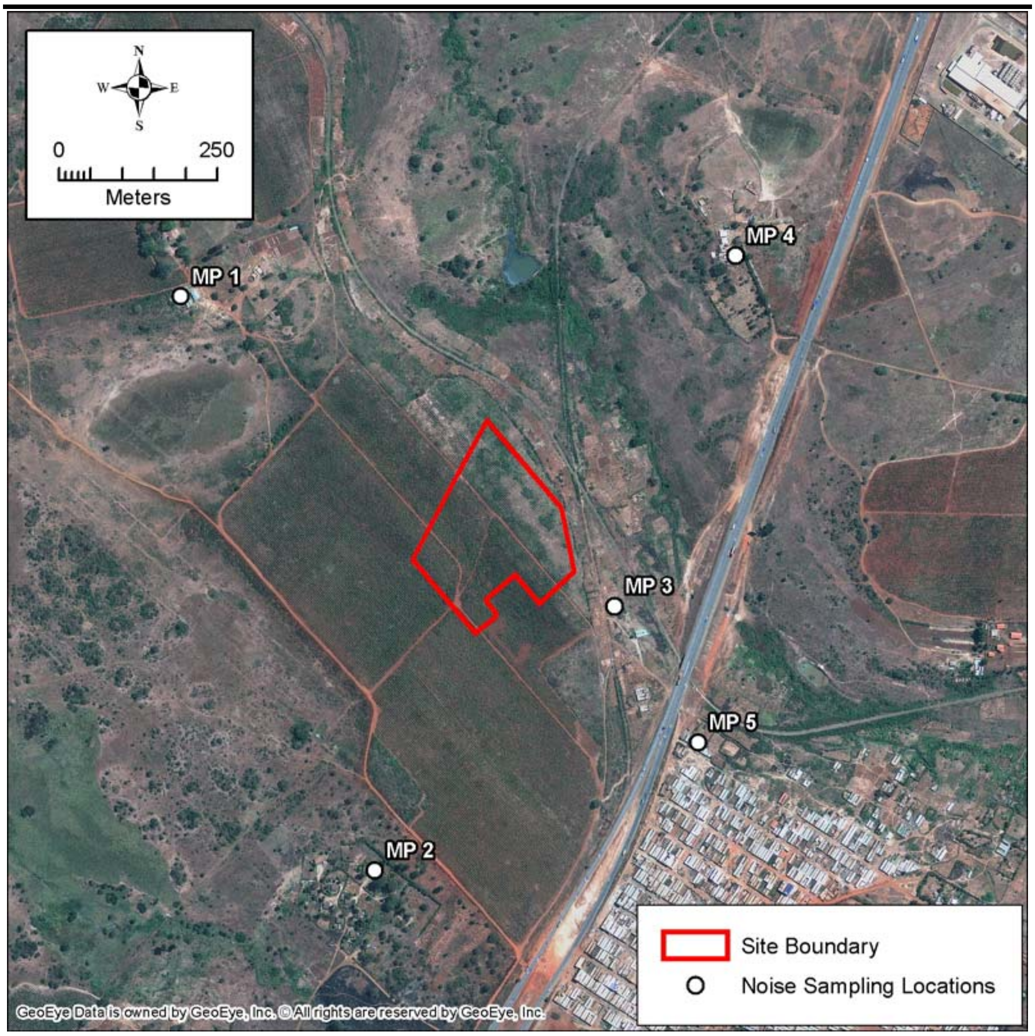
Data was collected by the Institute Of Nuclear Science and Technology at the University Of Nairobi, as part of the Project EIA which was prepared by Enviroplan. The report produced by the Institute (1) included data from a limited 'spot check' survey which resulted in significant limitations on the data collected.

(1) Report on the Assessment of Air Pollution and Noise Monitoring at the Proposed Site for MSD Thermal Power Plant at Thika, October 2010

3.6.2 *Noise*

Primary data collection was undertaken through survey work(1) conducted by SGS Kenya Ltd on 8-9th February 2011, with a return visit to the Project area to collect supplementary data on 18th March 2011. Noise samples were taken at five key receptor locations as identified below in *Figure 3.2*.

Figure 3.2 Noise Sampling Locations



Impacts at other potentially noise sensitive receptors, further from the site than those identified above, are not expected to be significant due to physical distance from the site and therefore no baseline data were collected for other locations.

3.6.3 *Water Resources*

Data were collected for the Hydro-geological and Geophysical Feasibility Study Report prepared by Geo Con Limited in November 2010 (2) as part of the Project EIA prepared by Enviroplan. This study provided information on

(1) Environmental Noise Assessment Report Proposed Thika Power Plant, SGS Kenya Limited, February 2011
(2)Hydro-geological and Geophysical Feasibility Study Report, Geo Con Limited, November 2010

water resources in the Project area and considered the feasibility of the Project utilising water from three potential sources: river water, piped water and groundwater.

3.6.4 *Traffic and Transport*

A traffic survey was carried out on the Nairobi - Thika highway in the vicinity of the Project site, both southbound towards Nairobi and northbound towards Thika, during July 2010 on behalf of the Ministry of Roads. The traffic count data was provided by TPL. The data provided daily traffic numbers as well as minimum and maximum record numbers.

Information was also derived from the first phase of a routing study (1) undertaken by Terms Kenya Limited and Union Logistics Limited in January 2011. The study was undertaken to identify the numbers, types, spans and conditions of the existing bridges/structures along feasible routes from Mombasa to Thika to deliver the large plant and equipment.

3.6.5 *Waste*

Limited baseline data on the existing waste infrastructure in the Thika District was collected primarily through discussions with TPL, consultation with local stakeholders and observations made during site visits as well as through a review of available secondary documentation.

3.6.6 *Landscape and Visual*

Primary data was collected in the form of visual observations and photographs which were taken during the site visits conducted by ERM. Several series of photographs were taken and compiled into panoramic views, from view points identified in *Figure 3.3.*

Information regarding potential land use changes in Thika District was obtained primarily from consultation with stakeholders and through a review of available secondary documentation.

3.6.7 *Social Data Collection*

The purpose of collecting baseline data and preparing a baseline description of the socio-economic environment are:

- to identify the social and socio-economic conditions in areas potentially affected by the Project and highlight those that may be vulnerable to aspects of the Project;

(1) Bridges along Various Routes Mombasa to Thika. Inception Report, Terms Kenya Limited and Union Logistics Limited., January 2011.

- to describe, and where possible, quantify their characteristics (nature, condition, quality, extent, *etc*) now and in the future in the absence of the Project;

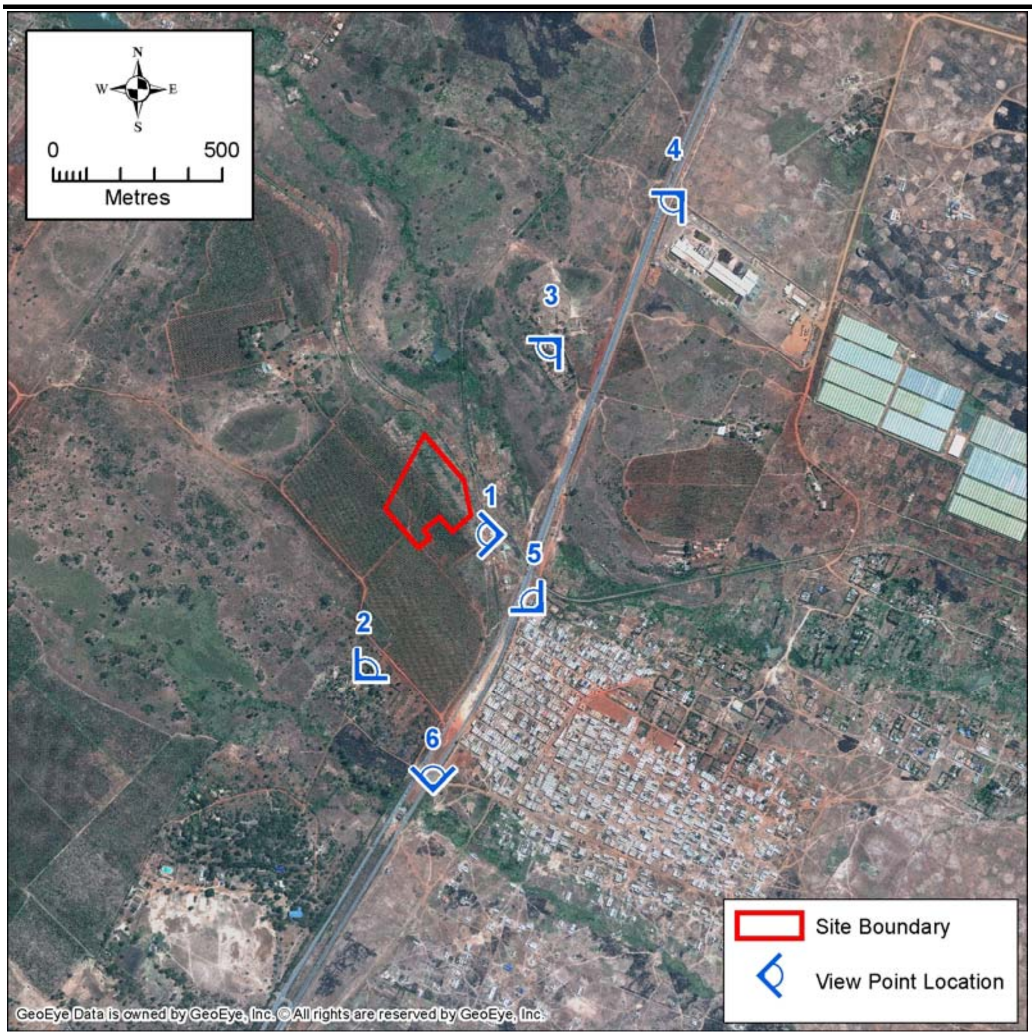
- to identify any liabilities, if present, that may be inherited from past activities;

- to identify gaps in knowledge and identify areas for further study that cannot be addressed in the ESIA timeframe; and

- to provide data to aid the prediction and evaluation of possible impacts, and the development of appropriate mitigation and enhancement measures that may be required.

To achieve the above-mentioned objectives, data were collected using a range of both primary and secondary sources of information.

Figure 3.3 View Point Locations



Primary Data

A number of data collection methods were used by the social assessment team. *Table 3.1* provides an overview of the methods used and the stakeholders targeted. Specific meetings and focus groups undertaken are detailed in the SEP (*Annex G)*.

A meeting schedule was prepared and meetings were arranged with the selected respondents ahead of time.

Table 3.1 Overview of Primary Data Collection Methods Used

Method	Overview	Stakeholders
Focus Group Discussion	Small group meeting in which members of a particular/ defined group came together in an interactive forum to share and provide in-depth information about a particular topic and to discuss key issues. The participants of the focus group discussion were selected by the local sub consultant, local leaders and the coffee farm manager who ensured that the group of 7- 10 people was broadly representative of the relevant population.	For example, women and youth.
Personal interviews	One-to-one meetings with stakeholders to gain information on concerns and perspectives. These semi-structured interviews included open-ended questions.	Government officials, local leaders, school principals, business owners/managers, NGOs.
Household Survey	A sample survey of households based on a structured questionnaire that was completed with the head of each household surveyed. Households were selected from different locations within the village.	62 households were surveyed: • 18 households of road side settlement. (100% sample • 21 households from the Witeithe estate (21 out of 1200 households) • 23 household of Ngoingwa estate.
Public Meeting	Meetings held in a public location open to all members of the local community. The community was informed in advance and invited to attend through information disseminated by local leaders. Note: information used in this ESIA was gathered both via meetings convened by ERM, and by Enviroplan.	Meetings were open to all local community members, as well as the communities in the road side settlement and the coffee plantation.
Observation	During the fieldwork, the social team observed people, infrastructure and all other aspects of the social environment.	All groups.

The topics of information gathered included:

- demographic profile;
- livelihood, subsistence and expenditure;
- land use and planning;
- access and quality of social infrastructure and services;
- education profile; and
- health profile.

A broad range of stakeholders were interviewed (interviews lasting up to two hours) about the same topics, and information was cross-checked and verified. The interview results are also supported by the secondary data sources.

Secondary Data

A range of secondary data sources were used during the drafting of this ESIA. They primarily provided background information required for the baseline description. Documents and information were sourced from government authorities (e.g. Thika District Development Plan and Vision 2030), and from sources such as previous EIAs and other relevant reports.

Limitations

Key limitations for the social baseline data collection process included the following:

- A sample survey approach, based on the structure questionnaire, was taken in relation to quantitative data gathering exercises. A sample size of approximately 20 households was selected as a representative example of villages surveyed. Although the sample survey method maximises the representation of the communities, it is possible that using this approach could potentially result in groups that are not represented in the final data.

- Time and resource constraints meant that it was not possible to undertake extensive data gathering exercises in every local community around the Project area; the focus was therefore on the nearest communities (within 1-2 km).

- It was not possible to engage or consult with the local farmers cultivating the areas directly down slope of the Project site. At the time of the site visits, the agricultural plots appeared to have been cultivated and replanted relatively recently, but the land was not being worked during any of the periods that ERM was on site. Indirect information was therefore collected from informants in the course of consultation and data collection.

3.7 ASSESSMENT OF IMPACTS & MITIGATION: OVERALL APPROACH

This section describes the overall approach used for the assessment of impacts and the identification of mitigation options. Topic-specific methodologies are described in the introductory part of each section of the impact assessment (*see Chapter 6*).

3.7.1 *Defining Impacts*

There are a number of ways that impacts may be described and quantified. The definitions adopted for this ESIA are described in *Box 3.1* below.

Box 3.1 Definitions of Impacts

1. Nature of Impact:

An impact is essentially any change to a resource or receptor brought about by the presence of a project component or by the execution of a project related activity.

Negative – an impact that is considered to represent an adverse change from the baseline, or to introduce a new undesirable factor.

Positive – an impact that is considered to represent an improvement to the baseline or to introduce a new desirable factor.

2. Type of Impact:

Direct (or primary) – impacts that result from the direct interaction between a planned project activity and the receiving environment (e.g. between stack emissions and the ambient air quality).

Secondary – impacts that result from the primary interaction between the Project and its environment as a result of subsequent interactions within the environment.

Indirect – impacts that result from other activities that are encouraged to happen as a consequence of the Project.

3. Duration of Impact:

Temporary - impacts are predicted to be of short duration and intermittent/occasional in nature.

Short-term - impacts that are predicted to last only for a limited period (e.g. during construction) but will cease on completion of the activity, or as a result of mitigation measures and natural recovery (e.g. non local construction workforce-local community interactions).

Long-term - impacts that will continue over an extended period, but cease when the Project stops operating. These will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period.

Permanent - impacts that occur during the development of the Project and cause a permanent change in the affected receptor or resource that endures substantially beyond the Project lifetime.

4 Scale of Impact:

Local - impacts that affect locally important environmental resources or are restricted to a single (local) administrative area or a single community.

Regional - impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries.

National - impacts that affect nationally important environmental resources, affect an area that is nationally important/protected or have macro-economic consequences.

International - impacts that affect internationally important resources such as areas protected by International Conventions.

Trans-boundary - impacts that are experienced in one country as a result of activities in another.

In addition to predicted impacts, those impacts that could result in the event of an accident or unplanned event within the Project (e.g. HFO release, traffic accident, fire) are required to be taken into account. In these cases the probability of the event occurring needs to be considered.

3.7.2 *Assessing Significance*

There is no statutory definition of '*significance*' and its determination is therefore necessarily partially subjective. For the purposes of this ESIA, the following definition of significance has been adopted:

> *"An impact is significant if, in isolation or in combination with other impacts, it should, in the judgment of the ESIA team, be taken into account in the decision-making process, including the identification of mitigation measures (by the Project) and consenting conditions (from Regulators and Stakeholders)."*

Criteria for assessing the significance of impacts stem from the following key elements:

- Status of compliance with relevant Kenyan legislation, policies and plans and any relevant Kenyan or industry policies, standards or guidelines;
- The magnitude (including nature, scale and duration) of the change to the natural or socio-economic environment (e.g. an increase in noise, an increase in employment opportunities), expressed, wherever practicable, in quantitative terms. The magnitude of all impacts is viewed from the perspective of those affected by taking into account the likely perceived importance as understood through stakeholder engagement;
- The nature of the impact receptor (physical, biological, or human). Where the receptor is physical (e.g. the air shed) its quality, sensitivity to change and importance are considered. For a human receptor, the sensitivity of the household, community or wider societal group is considered along with their ability to adapt to and manage the effects of the impact; [(1)] and

(1) Although not directly relevant to this assessment, in cases where the receptors were biological, its importance (e.g. its local, regional, national or international importance) and its sensitivity to the impact would have been considered.

- The likelihood (probability) that the identified impact will occur. This is estimated based upon experience and/or evidence that such an outcome has previously occurred.

For this assessment, significance has been defined based on five levels described in *Box 3.2*, and application of the latter three is shown in *Table 3.1* for environmental impacts.

Box 3.2 *Categories of Significance*

Positive impacts provide resources or receptors, most often people, with positive benefits. It is noted that concepts of equity need to be considered in assessing the overall positive nature of some impacts such as economic benefits, or opportunities for employment.
Negligible impacts (or Insignificant impacts) are where a resource or receptor (including people) will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
An impact of minor significance **(a 'Minor impact')** is one where an effect will be experienced, but the impact magnitude is sufficiently small (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
An impact of moderate significance **(a 'Moderate impact')** is one within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'Moderate' impacts have to be reduced to 'Minor' impacts, but that moderate impacts are being managed effectively and efficiently.
An impact of major significance **(a 'Major impact')** is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of ESIA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones such as employment, in coming to a decision on the Project.

Table 3.2 Overall Significance Criteria for Environmental Impacts in the ESIA

	Low Magnitude Impact	**Moderate Magnitude Impact**	**High Magnitude Impact**
Low value / low sensitivity receptor or resource, within standards	**Minor**	**Minor**	**Moderate**
Moderate value / sensitivity receptor or resource, within standards	**Minor**	**Moderate**	**Major**
High value / sensitivity receptor or resource, exceeding standards	**Moderate**	**Major**	**Major**

3.7.3 *Mitigation*

In developing mitigation measures, the first focus is on measures that will prevent or minimise impacts through the design and management of the Project rather than on reinstatement and compensation measures. A 'hierarchy' of mitigation measures for planned activities and unplanned events is outlined in *Box 3.3* and *Box 3.4.*

Box 3.3 Mitigation Hierarchy for Planned Activities

Avoid at Source; Reduce at Source: avoiding or reducing at source through the design of the Project (e.g. avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).

Abate on Site: add something to the design to abate the impact (e.g. pollution control equipment).

Abate at Receptor: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g. traffic measures).

Repair or Remedy*:* some impacts involve unavoidable damage to a resource (e.g. material storage areas) and these impacts require repair, restoration and reinstatement measures.

Compensate in Kind; Compensate Through Other Means where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g. financial compensation for degrading agricultural land and impacting crop yields). It is emphasised that compensation to individuals with residual impacts to livelihood or quality of life will generally be non financial and will have a focus on restoring livelihoods.

Box 3.4 Mitigation Hierarchy for Unplanned Events

Control: this aims to prevent an incident happening or reduce the risk of it happening to *as low as reasonably practicable* (ALARP) through reducing the likelihood of the event (e.g. preventative maintenance regimes, traffic calming and speed limits, community road safety awareness training); Reducing the consequence (e.g. bunds to contain hazardous substance spills i.e. HFO); and A combination of both of these.
Recovery/Remediation: this includes contingency plans and response, e.g. Emergency Response Plans and Procedures.

3.7.4 Residual Impacts

Complete mitigation of an impact cannot always be achieved. A residual impact is the impact that is predicted to remain once mitigation measures have been designed into the intended activity.

The residual impacts are described in terms of their significance in accordance with the categories identified in *Box 3.2* above.

3.7.5 Development of the Environmental and Social Management Plan

Throughout the ESIA process options for mitigation and management of adverse environmental and social impacts and for provision of benefits have been identified where possible. An ESMP has been prepared (see *Chapter 7* and relevant *Annexes*) to set out how the Project will deliver on commitments, by identifying the necessary actions required along with detail on timelines, responsible parties, etc. Templates for component sub-plans are provided as Annexes to the ESMP, to provide the structure of the Environmental and Social Management System (ESMS) for the TPL Project. Where appropriate, these templates have been populated with the detail necessary for TPL staff (and others who are responsible for ESMP components) to start to implement them. In other cases, the templates will provide the framework for TPL's Environmental and Social Manager(s) to develop the detailed ESMP actions, as the Project develops. Further detail on how the ESMP will be implemented is provided in *Chapter 7*.

3.8 Reporting & Disclosure

3.8.1 Consultation in Kenya

A Project Information Document (PID) was prepared early in 2011, and copies printed in both Swahili and English (see *Annex J*). Copies have been distributed widely at District level, and further copies left at key locations such as the Witeithie Assistant Administration Chief's office; poster versions were placed at key locations including Witeithie and Mang'u High School prior to the public meeting held in early March (see below). Copies were also passed to national level stakeholders. The PID includes contact details (telephone, email, post, and – when construction starts – a 'drop-box' to allow stakeholders to provide comments or express grievances throughout the life of the Project, as set out in the SEP (see *Annex G*).

Following the public meeting held in Witeithie by Enviroplan in October 2010, (which can also be considered part of the scoping process for this ESIA), a second meeting was held in Witeithie on 9th March 2011 (for further detail see *Annex G - SEP*). The meeting was convened and chaired by the Administration Chief, with ERM and TPL in attendance, and provided a forum for:

- TPL and ERM to disclose key findings from the ESIA; and
- TPL to outline its overall polices and approach with respect to issues such as employment opportunities and local procurement.

Comments and concerns were raised during the public meeting, which lasted over three hours and was attended by approximately 100 people. These comments have been have been incorporated and addressed in the finalisation of the ESIA. At the end of the meeting the Administrative Chief asked the audience to confirm their satisfaction with the nature of the discussion held, and to signal their support for the Project. This indication of support was given by the audience.

3.8.2 Review and Disclosure by Lenders

The April 2011 draft ESIA was reviewed by the lenders (IFC, World Bank, African Development Bank, and ABSA) and the lenders' independent engineers and comments forwarded to TPL during June and July 2011.

TPL and ERM responded to these comments in writing, and these were discussed further in a telephone conference call involving all parties on 10 August 2011 (see conference call minutes in *Annex K;* the comments and responses are also included in this annex).

Additional email comments were subsequently received from AfDB, endorsing the request by other lenders that the ESMP should include costs, and additionally requesting a description of organisational arrangements and a mitigation programme. All these elements have been incorporated into the revised ESMP chapter in this Final ESIA (see *Chapter 7*).

4 ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

This chapter describes the natural and human environment within which the Project will be constructed and operated. *Figure 4.1* provides an overview of the key environmental and social features in the Project area. The features are then discussed further in this chapter. Photographs of the Project site and surrounding area are provided in *Figure 4.2* and *Figure 4.3*.

4.1 THE NATURAL ENVIRONMENT

4.1.1 Topography and Geomorphology

Topography

Thika District lies between latitudes 3°53′ and 1° 45′ south of the Equator and longitudes 36° 35′ and 37° 25′ east and covers an area of 1,960.2 km^2. It borders Nairobi City to the south, Kiambu District to the west, Maragua District to the north and Machakos District to the east.

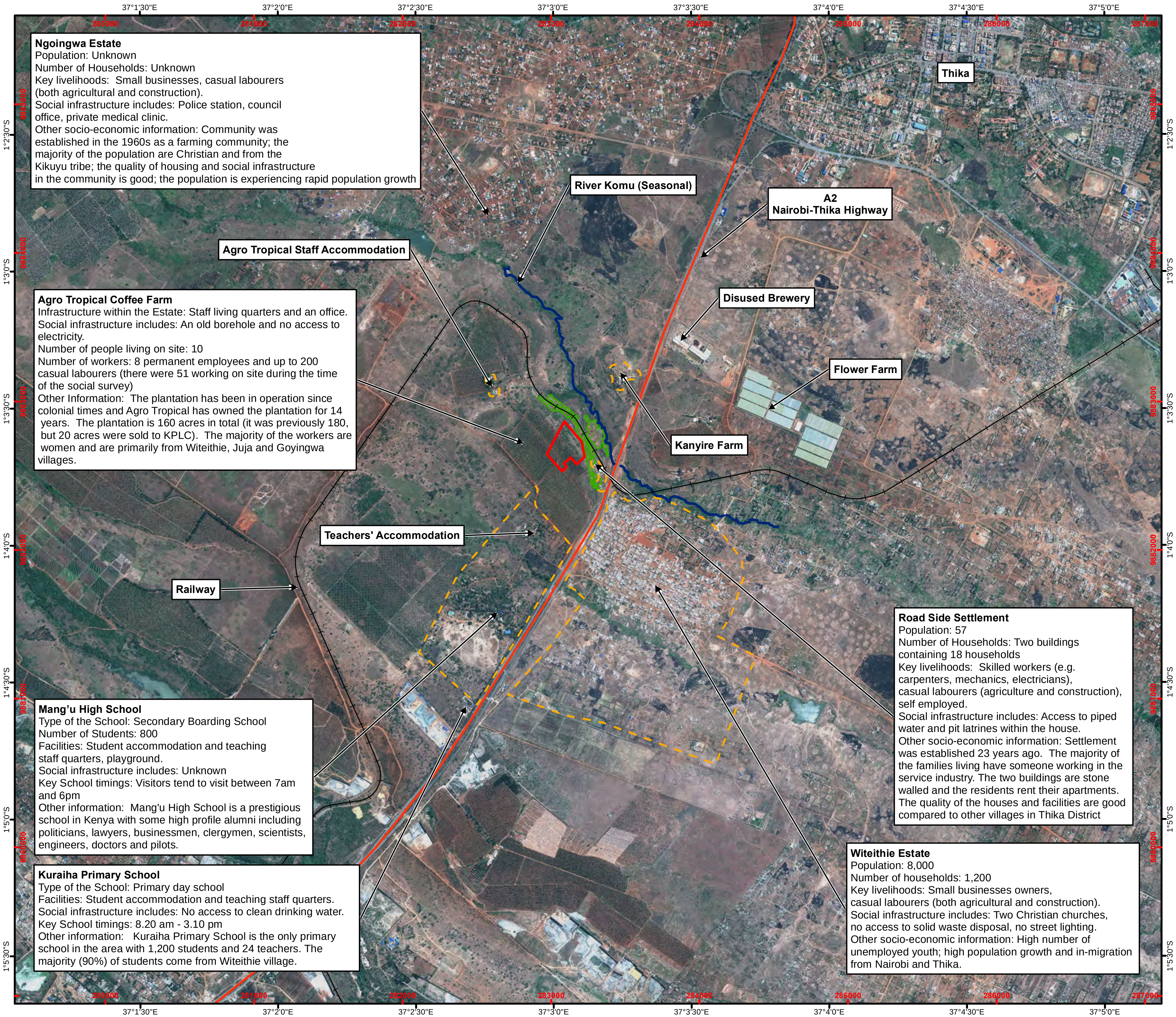
The landscape around Thika is typically flat, generally at an elevation above 1,500 m, with a few ridges and depressions in wetland areas. Further to the west, the area is characterised by escarpments and a series of hills, rising up to the highest, Ol Doinyo Sabuk, which is 2,144 m above sea level. These western highlands form the catchment areas for most of the rivers flowing into the south-eastern parts of the District (e.g. the rivers in the area near Thika municipality and the power plant site).

The proposed Project site is on the north-facing, gently-sloping, valley side of a seasonal watercourse, between 1,508 m and 1,528 m a.s.l.

Geology

The geology of Thika District mostly comprises volcanic rock from the Tertiary to Pleistocene, underlain by ancient (i.e. Pre-Cambrian) Basement rocks that are mainly gneisses and which break through to form some of the more prominent hills. The volcanic rocks are important for construction material in the region.

The key geological features at the Project site are the Tertiary volcanic rocks, i.e. pyroclastics, a thin basalt flow and Kapiti phonolite.



KEY:

- Site Boundary
- Key Features
- Agricultural Plots
- Main Road
- Railway
- River Komu (Seasonal)

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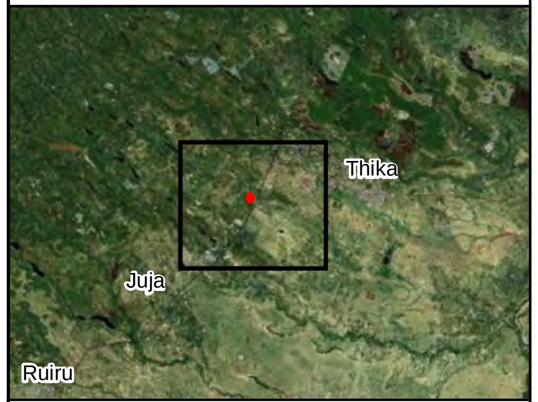
Metres



TITLE:

Figure 4.1
Key Features within the Project Vicinity

CLIENT: Thika Power Ltd.		SIZE: A3
DATE: 13/04/2011	CHECKED: PH	PROJECT: 0124250
DRAWN: AK	APPROVED:	SCALE: As Scale Bar
DRAWING: KeyFeatures_Thika.mxd		REV: 0

ERM
Eaton House
Wallbrook Court
North Hinksey Lane
Oxford, OX2 0QS
Tel: 01865 384800
Fax: 01865 384848

ERM

SOURCE: GeoEye Data is owned by GeoEye, Inc. © All rights are reserved by GeoEye, Inc. (c) 2010 Microsoft Corporation and its data suppliers
PROJECTION: WGS 1984 UTM Zone 37S

File: 0124250_ThikaMapping\mxd\March2011\KeyFeatures_Thika.mxd

Figure 4.2   View to North-East Towards Project Site from Access Road

Figure 4.3   View from Eastern Edge of KPLC Land, Looking East Towards Nairobi-Thika Highway (in Middle Ground)

Soils

The soils in the area are stable and rich in organic matter. Black-cotton soils develop in poorly drained areas while sandy soils and murrams form in well-drained areas. Soils in the highland areas tend to be moderate to high fertility, whereas soils in the lowland areas tend to be sandy and less fertile, but are suitable for cattle rearing. There are also red soils in the Thika area, suitable for agriculture and for brick making.

At the Project site, the soils are generally lateritic, with some small outcrops of underlying rock.

4.1.2 Climate

Kenya's climate varies across the country with tropical humidity on the coast, dry heat in the savannah and semi-arid areas, and a cooler climate in the highlands.

Temperature

The Thika District has semi-arid conditions with average daily temperatures varying throughout the year, and with altitude (see *Table 4.1*).

Table 4.1 Average Daily Temperatures in Thika

Month	Mean Maximum (°C)	Mean Minimum (°C)	Mean Range (°C)
January	26.8	13.1	13.7
February	28.0	13.4	14.6
March	27.4	14.4	13.0
April	24.6	14.3	10.3
May	24.1	14.2	9.9
June	23.1	12.6	10.5
July	22.3	11.5	10.8
August	22.7	11.8	10.9
September	25.3	12.2	13.1
October	26.2	13.7	12.5
November	23.6	14.4	9.2
December	25.1	13.8	11.6
Year	24.9	13.3	11.6

Source: Quoted in Nyatwang'a *et al.*, 2010

The Thika region has an average of 10 hours sunshine per day, with the most insolation generally being around the months of the two equinoxes, when the sun is directly overhead.

Humidity

Humidity levels in Thika District are high (see *Table 4.2*), and they tend to be highest at the beginning of the day (09:00 hrs) decreasing as the day progresses. It has been known for relative humidity levels to decrease to as low as 10-20% between January and April.

Table 4.2 Mean Relative Humidity Values (%) in Thika District

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
09:00	79	74	82	86	85	85	83	85	82	80	36	83
15:00	45	37	43	53	55	59	53	53	50	47	57	54

Source: Quoted in Nyatwang'a *et al.*, 2010

Rainfall

Rainfall in Thika District can be unreliable and highly variable but typically ranges between 500 to 1,500 mm per year, averaging 900 mm per year based upon average rainfall records over the past 50 years (see *Table 4.3*). Precipitation falls during two distinct rainy seasons, formed by the passage of the Inter-Tropical Convergence Zone. The 'long rains' are driven by the south-easterly monsoon, usually between March and May, and the 'short rains' are driven by the north-easterly winds that predominate towards the end of the northern monsoon, and typically last from October through to December.

Table 4.3 Mean Monthly Rainfall (mm) in Thika, Based on 50 Years of Records

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
48	48	115	195	137	42	15	21	24	52	114	77

Source: Quoted in Nyatwang'a *et al.*, 2010

In terms of potential future climate change, the Intergovernmental Panel on Climate Change's (IPCC's) Third Assessment Report (AR3, 2001) predicts a likely net increase in precipitation for equatorial East Africa in future years, and more specifically predicts a 5-20% increase in rainfall in the months December to February; and a 5-10% decrease from June to August by 2050[1].

Wind

Wind in the Thika region is predominantly north-easterly throughout the year. Wind speeds throughout the year are approximately 10-15 miles per hour, increasing to a maximum of 20 to 25 miles per hour just prior to the 'long rains'; winds tend to decrease during the night. Further information on wind characteristics is provided to support the air quality baseline section (see (see *Section 4.1.5*).

4.1.3 Hydrology and Hydrogeology

Hydrology

Most of the rivers in the Thika region flow from the highlands in the west towards the lowlands in the southeast of the District, where they join the River Tana and form parts of the Tana and Athi river drainage system. The nearest permanent watercourse to the proposed project site is the Ndarugo River,

(1) [1] IPCC Third Assessment Report, Climate Change 2001: Impacts, Adaptation and Vulnerability (Chapter 10-Africa).

located 3.5 km from the site, which originates in the Aberdare Mountains to the west.

As noted above, the Project site is in the valley of a seasonal water course, the River Komu, which at its closest is c. 250-300 m distant. This was flowing at the time of ERM's site visits in November and December 2010 (i.e. towards the end of the 'short' rainy season); the course of the stream is also marked by pools in which standing water will persist for some time after the rains have finished.

Hydrogeology

The hydrogeological feasibility study[1] reported that the main groundwater resource in the area occurs as shallow aquifers at the contact zones between the Tertiary volcanic sediments and the Basement rocks, with deeper aquifers possibly occurring along fault or fracture zones. The groundwater potential and chemical quality varies considerably across the wider area, but the inferred potential at the Project site itself is medium to average (subject to further drilling investigations). The recharge rate is also variable across the area, but is unlikely to be a limiting factor in a decision as to whether to utilise groundwater to meet the power plant's requirements.

There are a large number of boreholes in the surrounding area: Geo Con catalogued eight boreholes within a 5 km radius, with yields of between 0.4 and 27 m^3/hr; all of these boreholes are over 1 km from the Project site.

4.1.4 *Habitats and Vegetation*

Vegetation types in Kenya correspond to the climatic conditions in each area. The Thika region is characterised by woodland and shrub grassland, comprised of semi-evergreen and deciduous bush lands. However, as this falls within a semi-humid agro-climatic zone, with relatively high agro-ecological potential, the habitats of Project area and its surroundings have been highly disturbed and modified. Indeed, the power plant site itself has been excised from a long-established coffee farm, and thus from an area of monoculture that could be expected to have had relatively low biodiversity over many years.

The nearest National Park or other major protected area (e.g. National Reserve) is Ol Doinyo Sabuk National Park, more than 20 km to the east of the Project site.

No evidence gathered to date has indicated the presence of rare or protected plant or animal species within, or close to, the Project site.

(2) [1] Hydrogeological and Geophysical Investigations on Land reference No 8380/4, South West of Thika Municipality County of Kiambu; Geo Con Limited. December 2010.

Figure 4.3 View to West of Agro Tropical Coffee Farm from West Corner of Project Site

4.1.5 Air Quality

The environs of the Project site are generally agricultural-rural and there are no significant industrial or commercial enterprises within a radius of several kilometres, with the exception of the neighbouring Agro Tropical coffee farm and a large flower farm approximately 1.5 km to the north-east.

The major localised source of air pollution in the vicinity of the Project site is likely to be the Nairobi-Thika highway running 200-300 m to the north and east of the Project site.

A review of the available baseline air quality was undertaken, and this identified that the baseline data were limited in scope and quality. A limited 'spot check' survey was undertaken in the vicinity of the Project as part of Enviroplan's EIA prepared for submission under the Kenyan EIA procedures. The sampling consisted of two one hour samples obtained every day for approximately one month[1], and sampled for SO_2, NO_2, NO_x and PM_{10} (see *Table 4.4*). The results are reported by Enviroplan as indicative of a relatively clean airshed, with all values well within international (WHO and US EPA) and Kenyan guidelines.

(3) [1] Proposed Site for MSD Thermal Power Plant at Thika Institute Of Nuclear Science & Technology University Of Nairobi October, 2010 Reported In Environmental Impact Assessment Study For The Proposed 80mw Thermal Power Plant At Thika Enviroplan & Management Consultants, December 2010

Table 4.4 Results of Air Quality Spot Sampling Assessment

	Average concentration	Maximum concentration
PM_{10} ($\mu g/m^3$)	64.9	-
SO^2 (ppb)	76	200
NO (ppb)	1318	3300
NO^2 (ppb)	35	400
CO (ppb)	104	3500

Source: EIA for the proposed Enviroplan & Management Consultants, 2010 (as per ref 2, Chapter 2, page 13)

However, these data are considered unreliable, and of little use for the type of air quality modelling assessment presented in *Section 6.2*, for the following reasons:

- there is no representation of long term mean;
- short term variations have not been captured;
- no consideration of spatial distribution has been made; and
- two eight-hour sampling periods are not adequate for quantifying diurnal variations, which are heavily influenced by local sources, such as traffic.

These significant limitations in the data mean that they are not suitable to use in assessing long term trends or short term peaks and troughs in pollutants. In addition, limited baseline monitoring data had previously been undertaken in Nairobi itself[1 2 3 4], however this baseline is also considered to be highly unreliable as it utilises 'spot checks' and is focussed primarily on roadside locations which are not representative of the area as a whole.

Given the above limitations, ERM considers that the baseline data identified are too unreliable to be usefully considered in this assessment. Therefore, based on our understanding and knowledge of the Project context, general assumptions have been made regarding baseline conditions in the study area, as follows.

- Particulate matter (PM_{10}, $PM_{2.5}$ and TSP) – it is likely that the baseline concentrations of particulate matter will be elevated compared to the Kenyan and EU air quality standards. This is very much associated with natural sources, as the area surrounding Thika is semi-arid and therefore is likely to generate elevated emissions from sources such as fields and open land as a result. Emissions arising from traffic using the nearby highway will also contribute to the baseline, particularly within 100m of the roadside, albeit at concentrations likely to be substantially lower than those arising from natural sources.

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(4) [1] Mulaku and Kariuki (2001) Mapping And Analysis Of Air Pollution In Nairobi, Kenya International Conference on Spatial Information for Sustainable Development Nairobi, Kenya 2–5 October 2001

(5) [2] Vliet and Kinney (2007) Impacts of roadway emissions on urban particulate matter concentrations in sub-Saharan frica: new evidence fromNairobi, Kenya Environmental Research Letters 2

(6) [3] Maina (2004) Air Pollution Studies: Issues, trends and challenges in Kenya: The Role of Nuclear Analytical Techniques in Monitoring Air Pollution Vienna, Austria 7-11 June 2004

(7) [4] Odhiambo, Kinyua, Gatebe and Awange (2010) Motor vehicles air pollution in Nairobi, Kenya Research Journal of Environmental and Earth Sciences 2(4)

- Sulphur dioxide – there are likely to be only low concentrations of SO_2 in the ambient air. The major sources of SO_2 would be industrial, and to a lesser extent road vehicles. In the case of the Thika area, there are few significant industrial sources (none within 4-5 km of the Project site), and whilst there is a major highway adjacent to the Project site there are very few other traffic sources.

- Nitrogen dioxide and oxides of nitrogen – there are likely to be low concentrations of NO_x and NO_2 in the ambient air, apart from in the immediate vicinity of the highway where concentrations would be expected to be somewhat higher. The primary source of nitrogen oxides is vehicles, and to a lesser extent industrial sources. In the case of the Project site and surrounding area, it is a adjacent to major highway but has few other traffic sources; and so, whilst NO_x/NO_2 concentrations would be expected to be somewhat elevated within 100-200m of the highway, concentrations would fall rapidly with increasing distance from the road. As there are few industrial sources in the vicinity of the proposed Project these would not be expected to significantly contribute to ambient concentrations of NO_x/NO_2.

- Carbon monoxide – there is likely to be only low concentrations of CO in the ambient air. Away from a limited number of specific types of industrial sources (such as some types of sugar processing), ambient CO is unlikely to be elevated and whilst road traffic will contribute to ambient concentrations these are considered unlikely to be substantial.

4.1.6 *Ambient Noise*

Baseline Methodology

During the noise surveys conducted as part of this assessment, the main underlying source of noise was the Nairobi - Thika highway, although other natural sounds such as farm activities and crickets were noted. Survey measurements were made at a minimum of 3.5 m from the façade of the nearest building and represent free-field noise measurements, which can be compared directly with the predicted free-field noise levels from the plant. The potential noise sensitive receptors in the Project area are considered to be those shown in *Figure 4.4* below.

The first survey was undertaken between 8th and 9th of February 2011 at the points shown in *Figure 3.2* which mirror the potential noise sensitive receptor location identified in *Figure 4.4*. Traffic flows on the highway were noted to be significant during the day with approximately 35 to 42 vehicles per minute. At night the traffic mostly consisted of light vehicles as heavier traffic (trucks, etc.) is prohibited from using the road[1]. The measurement survey covered 10 minute daytime samples between 17.15 hours and 22.00 hours, and night-time measurements from 22.20 hours to 06.53 hours. A single measurement was made in the morning between 07.13 and 07.23 hours. These figures were

(8) [1] SGS (K) Limited, Nairobi: personal communication to ERM.

analysed carefully, and those samples which could not be used due to high maximum noise levels (that could suggest extraneous events) were excluded.

Figure 4.4 Potential Noise Sensitive Receptors

Since the highway traffic was variable at night and is the main noise source at most locations, there was some variation in noise level between the 10-minute samples that were taken. In order to confirm the night-time levels a second survey was conducted between 18th and 19th March 2011, at two locations which are affected by noise from the road (Receptor 3 and Receptor 5) over one hour periods.

The adopted baseline noise levels from the two surveys are shown in *Table 4.5*.

Noise from crickets was noted at Receptor 4, and although the underlying traffic noise reduced at night, the L_{Aeq} was consistently higher - which was compatible with the fact that crickets make more noise at night. Since this is a regular feature of the baseline environment at this location, the measured noise levels have been used directly.

Table 4.5 *Summary of Adopted Baseline Noise Samples from Surveys on 8th to 9th of February and 2011 and 18th to 19th of March 2011 - dB $L_{Aeq, period}$*

Receptor	**Date**	**Lowest Measured Noise Level Based on 10 Minute Sample**	
		Day	Night
Receptor 1	8th /9th February	42	40
Receptor 2	18th /19th March	47	35
Receptor 3	8th /9th February	61	49
Receptor 4	8th /9th February	51	52
Receptor 5	18th /19th March	67	61

The difference between daytime and night-time noise measurements at Receptor 2 was greater than at other locations affected by road noise. Domestic activities affected noise during the day which may have increased the daytime noise levels, but not those at night. Alternatively, the traffic flow may have been unusually low during the lowest 10 minute night-time sample which is shown in *Table 4.5*.

This would be consistent with the lower maximum noise level recorded during this period compared to other night-time measurements at this location. In either case this measurement is a conservative value for baseline noise. It is also noted that excluding this measurement would have no effect on the overall IFC assessment criterion since 45 dB(A) is used in cases where existing noise is below 45 dB(A), and two out of three of the other night-time samples were also below 45 dB(A).

The noise measurements during the second survey were undertaken following a period of intermittent light rain. The roads were at most damp (i.e. with no significant surface water). Although this may have slightly increased noise levels this was offset by the fact that speed restrictions occurred due to construction of the widening of the highway having advanced to a point which was in the region of the noise sensitive receptors.

The measurements at Receptor 3 corresponded to the front side of the building that faces south west and contains a double door and windows, and faces the plant boundary. Measurements were also made over a 10 minute period at the north eastern façade (the rear façade) which was also contains windows, to establish the difference in noise levels between the facades of Receptor 3. The results showed a daytime $L_{Aeq, 10 minute}$ of 62 dB. This value has been used in the assessment of noise at this point. Since this value is 1 dB higher than the value recorded at the south western façade, the night-time value has also been assumed to be 1 dB higher than was recorded at south western side.

Receptor 3 is the closest of a small group of four buildings. The discussion above relates to the house which is nearest to the site (Receptor 3 - Building 1), and which is shown in *Figure 4.4*. In order to estimate the noise levels at the next nearest receptor to the site (Receptor 3A - Building 2), the distances between the major noise source (the highway) and the two properties have been compared, and the likely difference in traffic noise levels has been calculated. This has then been used to estimate the baseline noise at the next nearest house to the site (Receptor 3A – Building 2). The other two buildings (Building 3 and 4) are not expected to be as affected by noise from the site as they are close to the highway and further from the site.

It has also been necessary to consider noise levels along the northern side of Witeithie Estate, along which the properties are further from the proposed plant, but at which lower baseline road noise levels are expected. Noise measurements were taken at Receptor 5 as noted above, and an additional receptor (5A) has been placed on the northern side of this settlement. Baseline noise levels at Receptor 5A have been estimated by setting a simplified model of the highway and calculating the difference in traffic noise at Receptors 5 and 5A.

Baseline Results

Based on the above discussions, the following baseline noise levels in *Table 4.6* have been adopted for the noise impact assessment presented in *Section 6.3*. These are representative of 1 hour values although some measurements are based on 10 minute samples.

Table 4.6 Adopted Baseline Noise Levels (Free-field)

Noise Sensitive Receptor Number	**Baseline Noise Level dB $L_{Aeq, 1\ hour}$**	
	Day	Night
1 – Agro Tropical Staff Accommodation	42	40
2 – Mang'u High School Teacher Accommodation	47	35
3 - Nearest Houses to Site – Building 1 (NE Facade)	62	50
3 - Nearest Houses to Site – Building 1 (SW Façade)	61	49
3A - Second Nearest House to Site – Building 2	63	51
4 - Kanyire Farm	51	52
5 - Witeithie Estate	67	61
5A - Witeithie Estate Further From Road	47	41

4.1.7 Traffic and Transport

The Nairobi - Thika A2 highway is a 49km long dual carriageway trunk road connecting the capital to other major international points. It connects:

- Nairobi to Ethiopia;
- the A2 to the A3 road, which links to Somalia;
- Nairobi to densely populated residential estates in the suburbs and to Thika Town, a major regional centre;

- Nairobi with central province and parts of the eastern and north eastern provinces, which supply Nairobi with important agricultural commodities.

The highway was originally constructed in the late 1970s with a design life of approximately 20 years. Until the current upgrading programme, no major enhancement or refurbishment has been carried out on the highway, apart from some re-paving activities following deterioration of the surface of the road. There are a number of major institutions located along the highway (see *Box 4.1*) and these contribute to the high traffic volumes.

Box 4.1 ***Examples of Major Institutions along the Nairobi-Thika Highway***

- Universities (Kenyatta University, Jomo Kenyatta University of Agriculture and Technology, KCA University, Kiriri Womens University, United States International University Africa, Agha Khan University, Inoorero University);
- Colleges (Utalii College, Kenya School of Monetary Studies, Augustana College, Nairobi Institute of Business Studies, Ruaraka KPLC Training School, NYS school of Engineering, IAT Campus);
- Hospitals (Guru Nanak Hospital, Agha Khan Hospital, Mathari Hospital, Ruiru Hospital, Avenue Hospital);
- Sports Facilities (Kasarani International Sports Complex, Ruaraka Sports Ground,Muthaiga Golf Club, Ruiru Sports Club, Thika Golf Club, Nairobi Gymkhana Club);
- Schools (Mang'u High School, Arya Primary and Secondary School, Pangani Girls High School, Ngara High School, Jamhuri High School);
- Industries (East African Breweries Ltd, Baba dogo Industries, Clay Works Ltd);
- Hotels (Safari Park Hotel, Utalii Hotel, Sports View Hotel); and
- Government Institutions (General Service Unit, Kenya National Museums, Kahawa Sukari Barracks, Muthaiga Police Station, Pangani Police Station, Juja).

Anecdotal evidence from 2006 indicates that close to Nairobi, the highway has an average daily traffic volume of approximately 70,000 vehicles. This is the highest traffic volume in the East African region, and has led to significant occurrences of congestion and delays estimated to cost the economy very significant amounts.

Traffic counts were carried out on the Nairobi - Thika highway in the vicinity of the development site during July 2010. *Table 4.7* and *Table 4.8* below show daily traffic numbers from Nairobi to Thika and the reverse, Thika to Nairobi.

An evaluation has also been made of the theoretical capacity of the Nairobi - Thika highway in this location, based on the specifications provided in the UK Design Manual for Roads and Bridges (DMRB)[1]. Given the variable

(9) [1] Design Manual for Roads and Bridges, TA 79/99 Amendment No 1: Traffic Capacity of Urban Roads, Tables 1 and 2, Highways Agency. 1999

specification and condition of the road the theoretical maximum one-way hourly flow capacity in each direction is 2,500[1] vehicles.

Table 4.7 *Summary of Daily Traffic Flows on Nairobi – Thika Highway, Travelling from Nairobi to Thika*

Date	Peak Hourly Flow of Cars	Peak Hourly Flow of Matatus, Busses & Trucks	Peak Hourly Flow of All Vehicles	Hourly Average of All Vehicles	Daily Total of All Vehicles
6th July	-	-	4,100	1,925	25,029
7th July	-	-	2,470	1,859	24,168
8th July	2,156	1,581	3,737	2,235	29,061
9th July	1,500	1,053	2,548	1,924	25,018
10th July	1,318	1,084	2,268	1,854	24,097
13th July	1,556	1,327	2,883	1,804	23,452
14th July	1,598	1,144	2,520	1,737	22,585
15th July	1,406	1,501	2,458	1,773	23,051
16th July	1,550	1,200	2,672	1,758	22,856
17th July	1,531	1,625	2,620	1,864	24,230
Daily 12 Hour Averages	1,577	1,314	2,828	1,873	24,355

Source: provided to ERM by TPL; undertaken by consultants on behalf of Ministry of Roads

Table 4.7 shows that the maximum peak hourly traffic flow from Nairobi to Thika was 4,100 traffic movements and the average peak hourly traffic flow was 2,828 traffic movements. These movements represent 164% and 113% respectively of the theoretical hourly capacity of the road, which shows that the road is currently operating at saturated traffic conditions (i.e. the actual traffic flow has exceeded the design flow).

Table 4.8 shows that the maximum peak hourly traffic flow from Thika to Nairobi was 3,124 traffic movements, and the average peak hourly traffic flow was 2,290 traffic movements. These movements represent 124% and 91% respectively of the theoretical hourly capacity of the road, which shows that the road is currently operating at or close to saturated traffic conditions (i.e. the actual traffic flow has exceeded the design flow).

The government of has initiated the ongoing improvement programme for the highway, by constructing extra lanes on each carriageway and rehabilitating the existing carriageways. In addition, the improvement project involves construction of flyovers and traffic interchanges at major junctions, to ease congestion by facilitating an unhindered through passage of vehicles.

(10) [1] Based on an average carriageway width of 6 metres, an HGV content of 50-55%. and classification 'Urban All Purpose 2'

Table 4.8 *Summary of Daily Traffic Flows on Nairobi - Thika Highway, Travelling from Thika to Nairobi*

Date	Peak Hourly Flow of Cars	Peak Hourly Flow of Matatus, Busses & Trucks	Peak Hourly Flow of All Vehicles	Hourly Average of All Vehicles	Daily Total of All Vehicles
6th July	-	-	2,108	1,723	22,397
7th July	-	-	3,124	2,106	27,378
8th July	1,095	1,108	2,203	1,801	23,408
9th July	1,700	1,128	2,828	1,876	24,391
10th July	-	-	2,456	1,815	23,590
13th July	957	1,216	2,173	1,765	22,945
14th July	408	1,512	1,920	1,699	22,082
15th July	464	1,368	1,832	1,671	21,722
16th July	952	1,280	2,232	1,820	23,655
17th July	899	1,121	2,020	1,751	22,763
Daily 12 Hour Average	925	1,248	2,290	1,803	23,433

Near the Project site, traffic has been reported to be an issue primarily for the approximately 1,200 pupils attending the Kuraiha Primary School: over 90% of pupils have to cross the highway to reach school, and five serious traffic incidents involving Kuraiha pupils, some fatal, were reported in 2010[1].

4.1.8 Waste

In common with many African countries, the waste management infrastructure in Kenya is very basic and standards of waste disposal are generally quite poor. No formalised waste collection systems are in place within local villages such as Witeithie and, in general, households commonly disposes of their own waste by burning it within the area of its own property.

Figure 4.5 *Example of Domestic Waste Disposal Practices*

(11) [1] Source: ERM Social Survey

The Thika District Development Plan (see *Figure 4.5*) states that there are three solid waste management sites located in the Thika District although no further information was available on these. As Nairobi is the largest urban centre in Kenya and the capital, it is expected that the waste infrastructure serving the city is more developed than in any other part of Kenya. There are exiting and committed power generation projects in Kenya which generate similar waste streams as those expected to arise from the Project, and TPL has been in discussions with licensed waste contractors in the area who currently collect and dispose of waste from these other similar facilities.

4.1.9 Landscape and Visual

The proposed Project site and the surrounding areas located within the Thika District do not have any designations with respect to planning or landscape and visual impacts. The Thika District Development Plan (see *Figure 4.5*), only provides high-level and strategic information on potential development in the District. There are currently no defined land use plans in place for the surrounding areas.

Landscape Character and Resources - Site Area and Immediate Surroundings Profile

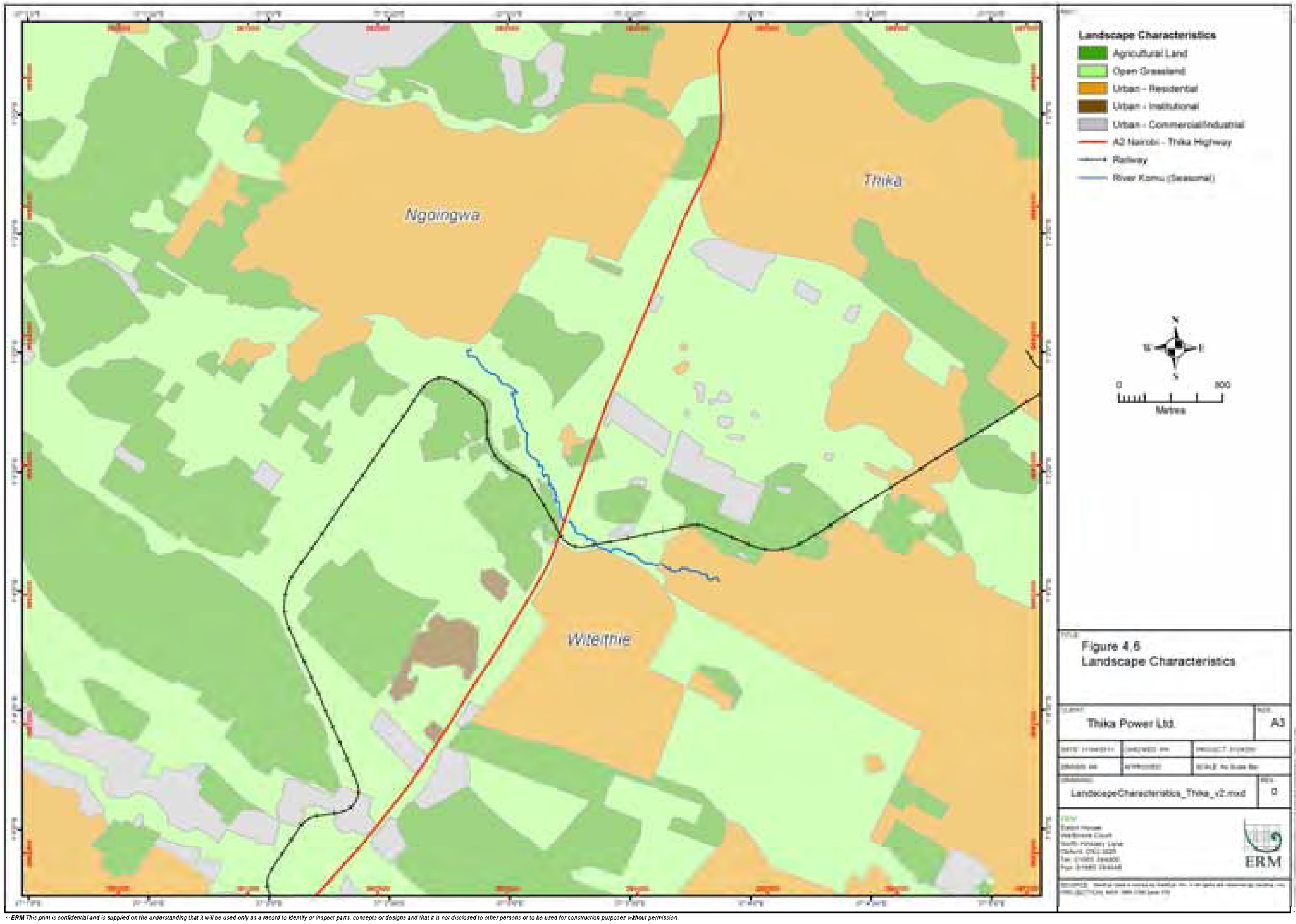
The site has been cleared of coffee, and is (via KPLC) currently being reclassified for industrial use to allow construction of the power plant. Construction activities have already commenced for the KPLC sub-station located adjacent to the Project site.

The immediate surroundings of the site are:

- subsistence agricultural plots, the railway line and the seasonal River Komu, to the north and east,
- the Agro Tropical coffee farm and Mang'u High School grounds to the south and south west;
- a small group of houses, the Nairobi - Thika highway and Witeithie Estate to the east and south east; and
- Agro Tropical coffee farm and open grassland to the west.

In essence, the area's sense of place is derived mainly from its 'rural setting'. However, there are existing developments in the surrounding areas, e.g. the highway upgrade which continue to change the rural character of the existing landscape in the area. The landscape characteristics within the Project area have been illustrated in *Figure 4.6* and are briefly described below.

Figure 4.6 Overview of Landscape Characteristics in Project Area



- *Agricultural lands* - Land surrounding the site and around Thika has been significantly fragmented due to agricultural activities. The open grasslands have been cleared for agricultural purposes with most areas being cultivated for coffee plantations. There is an area covering approximately 4.3 hectares immediately downslope of the Project site that extends along the railway line route, which is used by local community members for subsistence agricultural cultivation purposes. *Figure 4.7* provides an overview of the approximate area covered by agricultural plots in relation to the site.

- *River* – the River Komu is a seasonal watercourse located to the north of site and draining to the east. It does not flow consistently in the dry season, and pools form, interspersed with dry riverbed. The river does not provide domestic water supply, water for irrigation or for agro–industrial and industrial activities.

- *Open grasslands* - these are open savannah grasslands with few scattered houses in the areas surrounding the site.

- *Urban built forms* - which are in the form of organised residential/commercial/industrial/institutional built up areas including infrastructure elements (e.g. railway lines, highways, power lines, minor roads etc) and ad hoc settlements.

Due to the gently rolling landform in the immediate area around the site and the proposed height and scale of project components (particularly the stack, main plant buildings and HFO storage tanks), the Project is likely to be visible from the nearby residential areas, within the premises of Mang'u High School, from the highway and some areas of the Witeithie Estate, as well as in the wider area.

The built characteristics of settlements in the surrounding areas (including small group of houses close to the site and within the Witeithie Estate) are basic, purely functional and of low-average build quality. The residential /commercial buildings are of variable built quality resulting from progressive organic growth (natural development in absence of a coordinated development plan).

Existing Views and Visual Environment

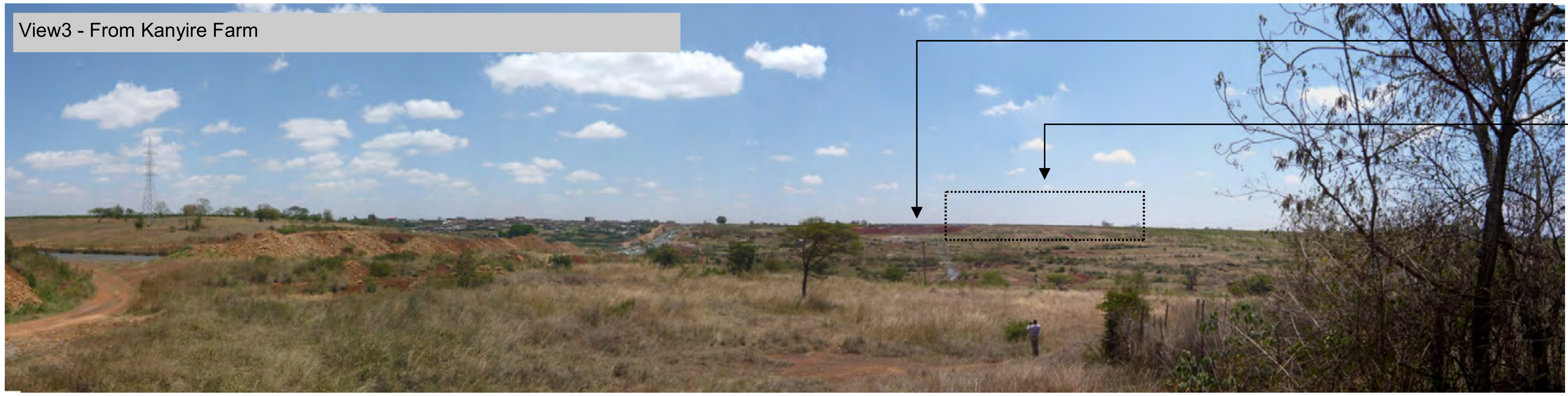
There are no designated views or views of international/national/local importance within the site boundary or in the immediate areas.
With the use of surveys and aerial photo data, viewpoints across the study area have been selected to represent the range of views and types of viewer likely to be affected by the Project. *Figure 4.9* and *Figure 4.10* illustrate some of the views from the site and surrounding areas.

Figure 4.7 Approximate Area Covered by Agricultural Plots

Figure 4.8 Examples of Witeithie Estate Built Characteristics

View1 - From Road Side Settlement (Closest House)

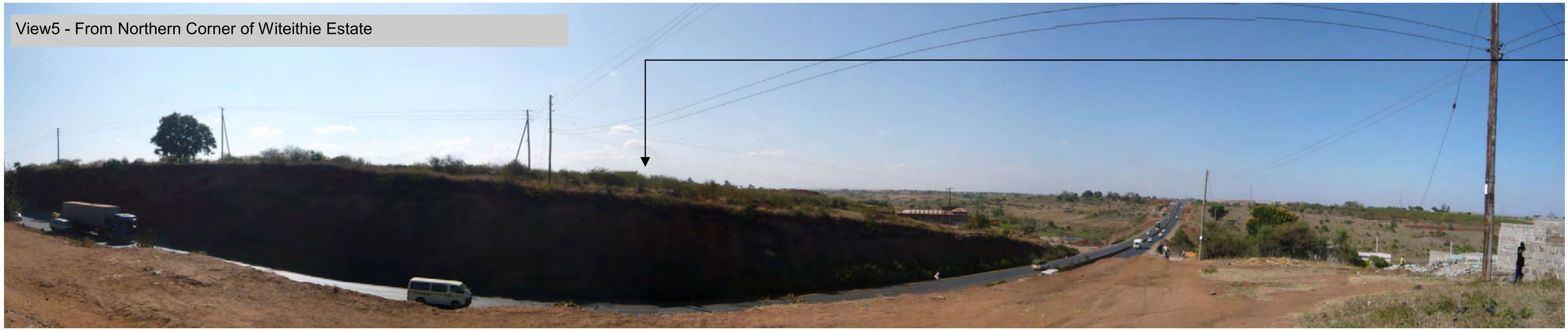
View2 - From Teachers Accommodation, Mang'u High School



View3 - From Kanyire Farm

CLIENT: Thika Power Plant	SIZE: A3	DRAWING NUMBER AND TITLE: Figure 4.9: Views from Surrounding Areas	
ERM Eaton House Wallbrook Court North Hinksey Lane Oxford OX2 0QS Tel: 01865 38 4800 Fax: 01865 384848		DATE: 16/03/2011 | CHECKED: JF | PROJECT: 0124250	
		DRAWN: NT | APPROVED: EB | SCALE:: As Shown	
© ERM This print is confidential and is supplied on the understanding that it will be used only as a record to identify or inspect parts, concepts or designs and that it is not disclosed to other persons or to be used for construction purposes without permission.	DRAWING:	STATUS:	Project Thika Power Plant

View4 - From Disused Brewery



View5 - From Northern Corner of Witeithie Estate

View6 - From Road Crossing to Witeithie Estate

CLIENT: Thika Power Plant	SIZE: A3	DRAWING NUMBER AND TITLE: Figure 4.10: Views from Surrounding Areas	
ERM Eaton House Wallbrook Court North Hinksey Lane Oxford OX2 0QS Tel: 01865 38 4800 Fax: 01865 384848		DATE: 16/03/2011	CHECKED: JF
		DRAWN: NT	APPROVED: EB
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PROJECT: 0124250

SCALE:: As Shown

4.2 *SOCIAL AND SOCIO-ECONOMIC BASELINE*

4.2.1 *Introduction*

This section provides information on the social and socio-economic baseline conditions in the proposed Project area. The baseline provides a critical contextual component for identifying and assessing potential impacts of the proposed development.

The information presented has been obtained during a desktop study and three site visits between October 2010 and March 2011 that included a site walkover, a household survey and stakeholder consultations, as reported in the Stakeholder Engagement Plan (see *Annex G* for further detail).

The Study Area

The area that is going to be primarily affected by the proposed Project includes the Witeithie Estate, Ngoingwa Estate, Mang'u High School and Kuraiha Primary School, two small clusters of houses close to the Project site and a coffee farm, which are all indicated on *Figure 4.1*. There are expected to be relatively small social impacts at the district level, and national benefits will result from the power generated by the proposed plant.

Historical Context

Thika District was created in 1995 out of the larger Kiambu and Murang'a Districts. The District covers an area of 1,479.1 km^2 and borders Nairobi North District to the south; Gatundu District to the west; Murang'a South District to the north; and Kangundo and Yatta Districts to the east.

Historically, Thika District was one of the industrial centres of Kenya, principally light industry. However, the focus for industrial development has now shifted to Athi River, east of Nairobi in Eastern Province. Agriculture is now an important economic activity across the district at both a small and large scale, with activities including horticulture (with exports mainly to Europe) and the coffee industry (with exports mainly to the USA and Europe). Other economic activities include some textiles (cotton), food processing (pineapples macadamia nuts and wheat), motor vehicle assembly and cigarette manufacture. In total, about one hundred small scale industries and about twenty major factories exist in and around Thika Town[1].

Social Baseline Structure

This baseline section provides information for Thika District[2] and the local communities in the vicinity of the Project. Commentary is also provided for the national level, as context. The remainder of the chapter is structured as follows:

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(12) [1] http://softkenya.com/kenya-city-town/thika-kenya.html

(13) [2] The 2010 constitutional reforms have resulted in Thika District being sub-divided into five smaller administrative units: Thika Municipality, Gatanga, Githurai, Kakuzi, and Ruiru Divisions. As these will not be functional until 2012, Thika District has been used as the wider baseline for the purposes of this ESIA report.

- key socio-economic indicators;
- demographic profile;
- gender profile;
- economic profile;
- land use;
- social infrastructure;
- education profile; and
- health profile.

Note: to the extent necessary, the legislative and institutional framework has been described in *Section 2.2*.

4.2.2 *Key Socio-Economic Indicators*

Table 4.9 summarises key socio-economic indicators at the national level to provide context to the social and socio-economic baseline for the proposed Project.

4.2.3 *Demographic Profile*

National Level

The Kenyan population has been growing steadily since 1960 to a current population of approximately 38.9 million[1]. This represents a growth rate of between 2.4% and 2.9% in the preceding ten years for which data were available (1999-2008).

Christianity is the dominant religion in Kenya (78%), with Islam being the other major religion (12%). About 10% of the population practice indigenous religions, which often combine Christianity with traditional religious belief systems[2].

The age distribution of Kenya's population has remained fairly constant since 1960. The percentage of children (aged 0-14 years) has remained between 42% and 50% of the population, with a peak during the early eighties which is now reflected by the number of people aged 15-64. Women make up approximately 50% of the population[3].

Although the fertility rate has fallen consistently since the 1960s (when it was approximately eight births per women), the current fertility rate of approximately five births per woman is relatively high, but fairly typical of a lower income, agrarian economy.

(14) [1] http://databank.worldbank.org/ddp/home.do?Step=2&id=4&DisplayAggregation=N&SdmxSupported=Y&CNO=2 ; (World Bank Group Development Indicators & Global Development Finance databank)

(15) [2] Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009

(16) [3] http://databank.worldbank.org/ddp/home.do?Step=2&id=4&DisplayAggregation=N&SdmxSupported=Y&CNO=2 ; (World Bank Group Development Indicators & Global Development Finance databank)

Table 4.9 Key Socio Economic Indicators

Socio-Economic Indicator	National Level	Source
Population (m)	38.8 million	World Development Indicators Database, 2009
Population growth rate (% per annum)	Between 2.4% and 2.9%, from 1999 to 2008	World Development Indicators Database, 2009
Life Expectancy (years)	Men 53.2; Women 54	Kenya National Bureau of Statistics, 2009
HDI index Value*	128	UNDP HDI, 2010
Gender Inequality Index**	0.738	UNDP HDI, 2010
Religion	Protestant 45%, Roman Catholic 33%, Muslim 12%, indigenous beliefs 10%	Foreign and Commonwealth Office, Country Profiles
GDP per capita (US$)	1,622	UNDP HDI, 2008
Inflation rate (%)	26.2 (2008)	UNDP Report, 2009
Employment Rate (both sexes) (%)	73	Human Development Report, UNDP, 2010
School enrolment, primary (% net)	59.6	Human Development Report, UNDP, 2010
Literacy rate (%)	73.6	Human Development Report, UNDP, 2010
Proportion of Total population served with Piped Water (%)	19	WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, 2010
Hospital Beds (per 10,000 population)	14 per 10,000	Human Development Report, UNDP, 2010
Proportion of total population served with Electricity (%)	18%	ESIA Study Report – Kilimbogo (July 2010)
Estimated adult rate (15-49) of people living with HIV/AIDS (%)	6.3%	Kenya Demographic and Health Survey, 2008-09

** The Human Development Index (HDI) is a summary measure of human development. It measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. The HDI is the geometric mean of normalized indices measuring achievements in each dimension. 1 shows high human development whilst 0 shows low human development.*

*** The Gender Inequality Index (GII) reflects women's disadvantage in three dimensions—reproductive health, empowerment and the labour market—for as any countries as data of reasonable quality allow. The index shows the loss in human development due to inequality between female and male achievements in these dimensions. It ranges from 0, which indicates that women and men fare equally, to 1, which indicates that women fare as poorly as possible in all measured dimensions*

Regional Demographic Profile

According to the District Development Plan report, population projections (dating from the 1999 census) estimate the total population of Thika District at 472,344 people in 2010.

The District is densely populated overall, although population density varies considerably across divisions. Thika Municipality, Gatanga, and parts of Ruiru are the most densely populated divisions, with between 400 and 500 people per km^2; Thika Municipality and parts of Ruiru are situated along the Nairobi-Nyeri highway and have rapid population growth. Thika, Ruiru[1] and Juja are the main urban centres in the District, and they have been growing rapidly due to rural-urban migration[2].

Approximately 50% of the population in Thika is of working age (15-64), with 31% of people falling into the 15-30 age brackets. Women make up approximately 50% of the population in Thika District[3], which is the same as the male: female ratio nationally[4].

The main languages spoken within the Thika District are English and Swahili. The average household size in Thika District is approximately four people which is less than the national average of seven.

Local Level Demographic Profile

The social survey for the proposed scheme identified that the majority (80%) of households interviewed within the Witeithie Estate, Ngoingwa Estate and the two small clusters of houses near the Project site had lived there for less than 10 years. These communities have experienced a significant amount of in-migration, most likely due to their location near a major transport route to Nairobi and the growth of a number of industrial and commercial operations in the area. Roughly 22% of household heads surveyed had moved into the community in the past year, and only 7% of household heads surveyed had lived in the area for more than 30 years[5].

During the village level consultation it was established that there is a population of about 8,000 living in the Witeithie Estate (see description in *Section 4.1.9* and photographs in *Figure 4.8* for an overview of the estate). The estate has approximately 1,200 households, i.e. around 6-7 people per household. The cluster of houses immediately east of the Project site (closer to the highway) house approximately 60 people, and the Agro Tropical coffee farm has 10 people permanently living on site. No population data were available for the more distant Ngoingwa Estate, to the west of the Project site.

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(17) [1] Ruiru is an important commercial and industrial area

(18) [2] Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009.

(19) [3] Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009

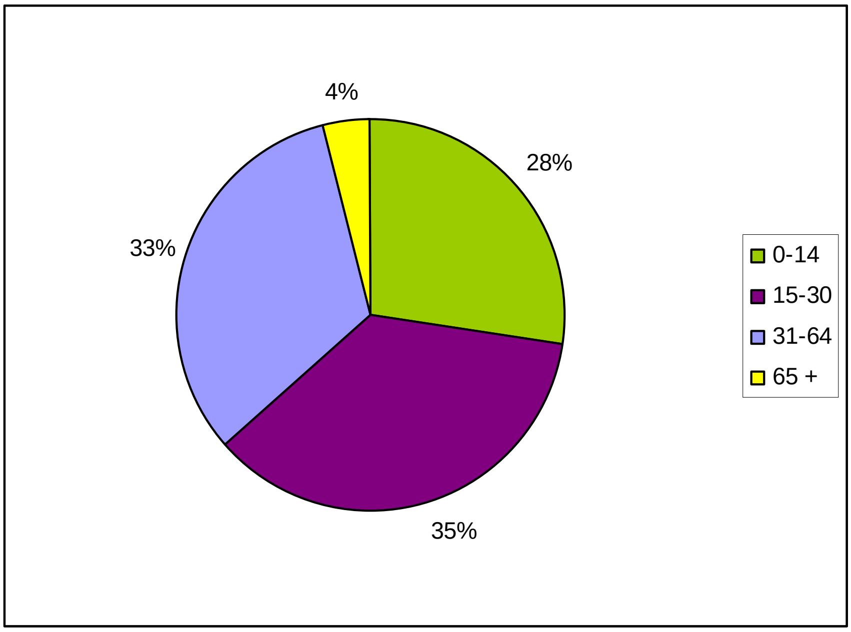
(20) [4] http://databank.worldbank.org/ddp/home.do?Step=2&id=4&DisplayAggregation=N&SdmxSupported=Y&CNO=2 ; (World Bank Group Development Indicators & Global Development Finance databank)

(21) [5] ERM Household Survey 2010

According to the household survey results, 68% of people in the local communities are of working age (between 15 and 64) (see *Figure 4.11*). This is a larger percentage than in Thika District overall or at the national level, suggesting significant in-migration of workers.

ERM's social survey identified that the majority of families living in the local communities practice Christianity, and originate from a range of tribes. People have been attracted to the area due to job prospects and so have a range of backgrounds, but it is understood that the majority of the population come from the Kikuya[1] and Lohya[2] tribes.

Figure 4.11 ***Age Distribution, Communities in the Study Area***



Source: ERM Household Survey 2010

4.2.4 *Gender Profile*

National Level

At a national level, the Kenyan Human Rights Commission reports that gender and sexual inequality remains widespread. Religious and cultural traditions in large parts of Kenyan society continue to create social conditions in which discrimination according to ethnicity; gender, religion, sexual orientation and health status are common.

Women are predominantly engaged in domestic unpaid work, and within the subsistence agriculture sector. Within the formal sector women tend to be engaged in low-skilled manufacturing jobs and agricultural activities, which tend to be poorly paid. A UNDP analysis of gender differences in economic

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(22) [1]The Kikuyu tribe, also spelled as Gikuyu, is the largest ethnic group in Kenya, making up about 22% of the countries total population. http://www.kenya-advisor.com/luhya-tribe.html
(23) [2]The Luhya tribe represents about 14% of Kenya's population, or around 5.3 million people. They are the second largest distinct ethnic group after the Kikuyu. http://www.kenya-advisor.com/luhya-tribe.html

achievement estimated that female-earned income is US$1,213 per annum[1]; this equates to approximately US$3.32 per day (which is just above the UNDP poverty threshold and lower than estimates for male-earned income, which are US$ 1,874 per annum (i.e. US$ 5.13 per day)).

Thika District

In Thika District, there is recognition that lack of ownership and control of productive assets by women is an important barrier to gender equality and economic development more widely[2]. Women often lack access to credit facilities, in part due to the lack of collateral as they do not own land. Other gender disparities identified in the District Development Plan include:

- educational attainment;
- lack of participation in development; and
- the traditionally low status of women as a result of socio-cultural practices.

In the District, women play a particularly important role in the rural economy. Currently, 70% of farm labourers are women, which make them crucial to rural and economic development in the region.

Community Level

Approximately 65% of working-age women included in the household survey was currently in employment. However, women are less likely to be trained or work in technical, managerial or construction jobs. Discussions with women living in the communities around the proposed Project identified that there are gender disparities in education, with most girls dropping out of school by class eight (fourteen years old) and not going to secondary school due to the cost implications. They also identified that casual work in agriculture is mainly the domain of women, with the majority of the women in the area engaged in this activity.

4.2.5 Economic Profile

National Level Economic Profile

Table 4.9 showed some key socio-economic indicators for Kenya. With a Gross National Income (GNI) per capita of US$ 1,550, Kenya is classified by the World Bank as a lower middle income country[3]. In 2008, the annual GDP growth rate was 1.8%. The major industries operating in Kenya are small scale producers of consumer goods, agricultural products, agricultural processing and tourism. Kenya is one of the most industrialised countries in East Africa, yet industry still represents only 10% of GDP. By comparison, agriculture employs 80% of the population and accounts for 50% of all exports

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(24) [1]According to the theory of purchasing power parity. Because of the lack of gender-disaggregated income data, female and male earned income are crudely estimated on the basis of data on the ratio of the female non-agricultural wage to the male non-agricultural wage, the female and male shares of the economically active population, the total female and male population and GDP per capita in PPP US$. The wage ratios used in this calculation are based on data for the most recent year available between 1999 and 2007.
(25) [2]Thika District Strategic Plan 2005 – 2010
(26) [3]Thika District Strategic Plan 2005 – 2010

and 25% of GDP. The Kenyan economy remains dependant on agriculture and periodic drought often threatens GDP growth[1].

Inflation increased by approximately 12% annually between 2006 and 2008, GDP growth decreased, and GDP per capita stayed relatively stable. Formal employment has increased by approximately two percent per annum and informal by six percent. The productive labour force of Kenya (people aged between 15 and 64) is approximately 54.6% of the population and based on a population of approximately 38.8 million this equates to approximately 21.2 million people[2].

The UNDP indicates that 20% of the population in Kenya lives below the income level of $1.25 per day, while 40% lives below $2 per day and 52% of the population falls below the national poverty line[3]. This indicates that Kenya suffers from high levels of poverty despite estimates that approximately 73% of the population has formal or informal employment, implying that average income levels are low.

District Level Economic Profile

Approximately 43% of households in Thika District rely on agriculture, growing both food and cash crops. The sector employs an estimated 189,072 people directly or indirectly, 70% of them women. The main cash crops are coffee, tea, pineapples and macadamia nuts; coffee and pineapples are grown on a large-scale for international distribution. The main food crops are maize, beans, potatoes and peas. Animal husbandry is also practiced throughout the district, including dairy cattle and goats, poultry and bee keeping. Co-operatives play a central role in marketing agricultural products, and providing access to credit and farm inputs. Fish farming is also an important activity in the District, employing an estimated 67,700 people and producing 65.5 m tonnes of fish per year[4].

The trade and industrial sectors also provide an important source of employment and income in Thika District. According to the Thika District Development Plan, a total of 31 agro-based industries, 16 chemical and 15 engineering industries are operating in the district, while commercial trading employs roughly 3,000 people. The private sector as a whole is estimated to employ roughly 16,232 people, with another 12,564 people counted as wage labourers. The total productive labour force in Thika District is approximately 267,000 people or 56% of the population[5].

The Thika District Development Plan estimates that 37% of the district population, or roughly 170,000 people, live in absolute poverty[6]. Poverty rates

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(27) [1]http://databank.worldbank.org/ddp/home.do?Step=2&id=4&DisplayAggregation=N&SdmxSupported=Y&CNO=2 ; (World Bank Group Development Indicators & Global Development Finance databank)
(28) [2]Human Development Report 2009 & 2010; United Nations Development Programme..
(29) [3]http://databank.worldbank.org/ddp/home.do?Step=2&id=4&DisplayAggregation=N&SdmxSupported=Y&CNO=2 ; (World Bank Group Development Indicators & Global Development Finance databank)
(30) [4]Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009
(31) [5]Thika District Strategic Plan 2005-2010.
(32) [6]Although not explicitly defined within the Strategic Plan, absolute poverty is commonly referred to within the context of the World Bank definition as living on less than US$1.25 per day.

have been on the rise due to declines in both agriculture and industry, as well as the rise in HIV/AIDS rates[1].

Local Level Economic Profile

The majority of households surveyed around the proposed Project site rely on waged labour in the commercial (48%) and service industries (30%), or in industry (16%). Very few households (three percent of those surveyed) rely on agriculture as their primary or secondary source of income (see *Figure 4.12*).

A large number of households have more than one working adult, with 66% of people 15 years and older responding that they are currently employed. Among women of a working age included in the survey, 65% were currently working, while 25% identified themselves as housewives. When asked to describe the primary occupation of all employed members of the household, the responses were divided nearly equally across professional, technical, trade, administrative, services, and workers (see *Figure 4.13)*, suggesting a highly diversified economy and wide range of skills among community members[2]. Women were most likely to be working in the services, administrative and trade sectors. Of the small number of people working in agriculture, most of these were women.

According to the social survey, the majority of wage earners (59%) earn between 10,000 and 55,000 KHS (US$ 120 to $ 650) per month, while 17% earn more than 55,000 KHS per month. Approximately 26% of people earn less than 10,000 KHS per month, a sum equal to roughly $3.90 per day. Because more than one person per household may be working, this does not necessarily equate to household income. This suggests that relatively few households are living below the US$1 or $2 per day poverty line, but income data from surveys should always be treated with caution as it can be biased. However, as an increasingly urban area and with little subsistence farming practiced, the cost of living in this area is also higher than other parts of the country.

The Agro Tropical coffee farm is likely to be one of the more significant agricultural employers in the immediate area (see *Box 4.2*).

4.2.6 *Vulnerable Groups*

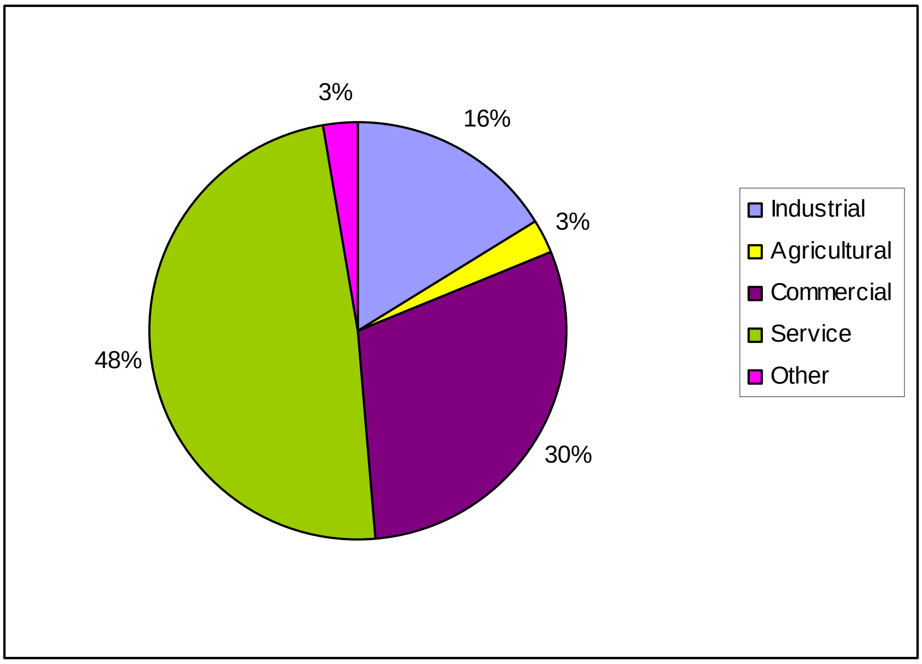
Vulnerable groups include people who, by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage or social status may be more diversely affected by project than others and who may be limited in their ability to claim or take advantage of other development benefits. Groups of people identified during this assessment as being potentially vulnerable include:

- those living below the poverty line;

(33) [1]Thika District Strategic Plan 2005-2010
(34) [2]ERM 2010 Household Survey.

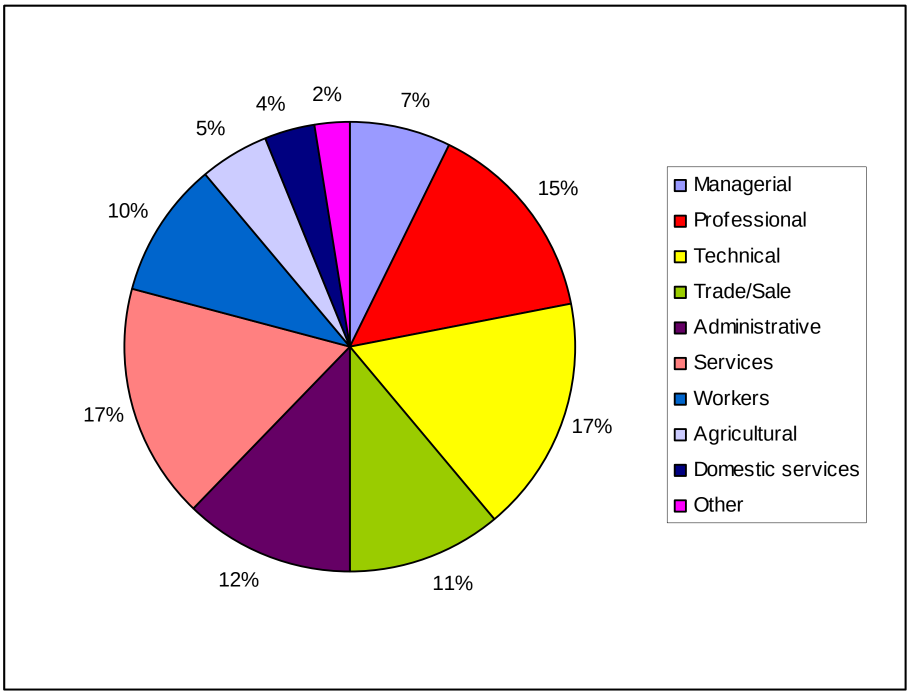
- the unemployed;
- those with low education levels or are unskilled;
- female headed households;
- the elderly; and
- those who do not own the land that they use or live on.

Figure 4.12 Primary Economic Activity of Household Heads at Local Level



Source: ERM 2010 Household Survey

Figure 4.13 Primary Occupation Types at Local Level



Source: ERM 2010 Household Survey

Box 4.2 *Agro Tropical Coffee Farm: Key Facts*

Agro Tropical Coffee Farm

The coffee farm has been in operation since colonial times and Agro Tropical has owned the farm for 14 years. The farm is now approximately 66 hectares in total, after the sale of 8 hectares to KPLC. The majority of workers are from Witeithie, Juja and Goyingwa with casual workers mostly being required in November/ December for harvesting. The millers for the coffee are based in Thika and the farm produces approximately 100 tonnes of coffee per year.

The average manpower needed during each stage of the coffee production cycle is as follows:

Jan-March	Weeding Stage	100 labourers
Jan-March	Pruning	180 labourers
March–June	Irrigation	50 labourers
April-August	Picking	400 labourers
August- October	Weeding and Pruning	200 labourers
October –December	Crop picking	400 labourers

4.2.7 *Land Use*

National Level Land Use

Croplands and agro-ecosystems account for about 19% of the land cover in Kenya, with human populations concentrated in areas of high agricultural productivity. Agriculture accounts for 63.9% of water use in Kenya, while industry only for 6.3%.
All land ownership in Kenya ultimately resides with the State. Under the Government Lands Act, the Commissioner of Lands grants leases of town plots for terms up to 99 years and agricultural land for terms up to 999 years in duration. The power of the State to extinguish property rights in the public interest is embodied in Section 75 of the Constitution, subject to due process (including prompt and adequate compensation)[1].

District Level Land Use

Thika District covers an area of 1,479 km^2. Historically, although as reported above Thika District has been one of the leading industrial areas in Kenya, it also supports both large- and small-scale agriculture. The northern and western parts of the District receive the highest amount of rainfall, and tea, coffee and dairy farming are common. Some irrigated farming is also undertaken in the drier eastern areas of the district[2]. Thika Municipality is one of the most densely populated divisions of Thika District, with over 400

(35) [1] Environmental Impact Assessment Study for the Proposed 80MW Thermal Power Plant at Thika, Enviroplan & Management Consultants, December 2010.
(36) [2]Thika District Development Plan 2008-2012

people per km². It consists of the urban area of Thika Town, surrounded by a mix of industrial, commercial and agricultural land-use[1].

Land Use and Land Acquisition in the Project Area

As noted previously, the proposed 4 hectare Project site was formerly part the Agro Tropical coffee farm. The site was purchased from Agro Tropical by KPLC, in a "willing seller, willing buyer" transaction that was fully compliant with all Kenyan legal provisions relating to sale and transfer of ownership of land. In September 2010 KPLC obtained a 'Change of land use' from "agricultural" to "electrical substation", from the Thika City Council (1) and ERM understands that an application from KPLC is in process to further alter the classification to "substation and power station". KPLC and TPL are negotiating a 20-year lease for the area required for the power plant.

The plot of land acquired by KPLC (including that portion upon which the power plant will be sited) is vacant and unoccupied. As shown in *Figure 4.1* there are a number of dwellings within 200-300 m of the Project site, and there are also areas of cultivated land immediately down slope to the north east of the site on which local people grow crops of maize and beans (i.e. vegetable gardens – see *Figure 4.14*). It is understood that the people cultivating these areas have no title to the land.

4.2.8 Social Infrastructure

National Infrastructure Profile

At a national level, the Kenyan government has recognized the energy sector as intimately linked to economic and social development, and made it a priority area for investment. Energy costs in Kenya are high, and approximately 85% of the population in Kenya has no access to electricity[2].

Total water availability in Kenya is roughly 937 m³ per capita, which reflects the fact that much of the country is classified as arid or semi-arid, and falls far below the average for Africa (approximately 4,500 m³ per capita)[3]. Approximately 59% of the population is estimated to have access to an improved water source; this figure drops slightly to 52% of people in rural areas[4]. As of 2008, only 31% of the population had access to improved sanitation facilities (including both protected pit latrines and flush toilet facilities)[5].

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(37) [1]Thika District Development Plan 2008-2012

(38) [2]Human Development Report 2009 & 2010; United Nations Development Programme.

(39) [3] http://safaricom.co.ke/foundation/fileadmin/template/main/downloads/Kenya_VISION_2030-final_report-October_2007.pdf ; (Kenya Vision 2030.)

(40) [4]http://databank.worldbank.org/ddp/home.do?Step=2&id=4&DisplayAggregation=N&SdmxSupported=Y&CNO=2 ; (World Bank Group Development Indicators & Global Development Finance databank). Access to an improved water source refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection.

(41) [5]http://databank.worldbank.org/ddp/home.do?Step=2&id=4&DisplayAggregation=N&SdmxSupported=Y&CNO=2 ;(World Bank Group Development Indicators & Global Development Finance databank).

Figure 4.14 Agricultural Plots Close to the Proposed Project Site

Source: ERM Social Survey

4.2.9 District Level Infrastructure

Infrastructure in Thika District is relatively poor. The district does have railway coverage, with 51 km of railway line helping to boost connectivity to Nairobi for transport of goods. Road coverage is considered fairly low, with 1,339 km of classified and 123 km of earth roads for the entire District. Poor access to road networks in the interior of the district makes it difficult for farmers to bring products to market, and contributes to higher poverty levels in these areas[1]. One of the major transport routes is the Nairobi – Thika highway passing within a few hundred metres of the Project site, which as has been described is currently being upgraded.

As of 2008, approximately 14,000 households (12%) in the district had access to piped water, and another 11,500 (10%) had access to potable water. Approximately 83% of households have latrines, with pit latrines in the majority of households (75%), the remainder being uncovered pit latrines. At the district level, electricity accounts for 21% of energy use, while kerosene accounts for 75.6% of use. The District Development Plan recognises the importance of electricity to promote economic development; the Rural Electrification Programme aims to increase electricity coverage to 30% of households by 2012[2].

(42) [1]Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009

(43) [2]Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009

4.2.10 *Local Level Infrastructure*

The majority of people in communities neighbouring the proposed Project site live in stone-walled houses; most of the remaining homes are brick-built.

According to the household survey results, all households have access to piped water; 60% have access to water outside their dwelling and 40% inside their homes. Approximately 66% of households have access to a pit latrine, while 32% of households (most of them in Ngoingwa estate) have toilet facilities located inside the house. Waste disposal services are also well covered in the area, with 79% of households responding that their household waste is collected and only 15% of households responded that they burn or dump their own waste[1]. However, it is important to note that results of the household survey are skewed in that Ngoingwa has good service provision, whereas the respondents from Witeithie stated that the overall quality of facilities and services were poor with residents only having access to water at centralised points (see *Figure 4.15*), having no domestic waste collection and no street lighting.

Approximately 72% of households use electricity as a source of lighting, while 19% use kerosene and 9% use gas. Electricity use is less common for cooking with 45% of households cooking with kerosene, 40% with electricity and 15% with gas.

Nearly 100% of households have access to a mobile phone. However, very few households own private cars, motorcycles or bicycles, suggesting that travel on foot and by public transport is common.

4.2.11 *Education Profile*

National Level Education and Literacy

The primary school net enrolment ratio (NER) in Kenya increased dramatically in recent years, rising from 83.5% in 2006 to 92.5% in 2008, with enrolment of girls rising at roughly the same rate. The rate of transition from primary to secondary school also increased in the 2000s, from 41.7% in 2002 to 60% in 2005[2].

As of 2008, approximately 74% of adults over the age of 24 were literate, rising to 80% of young people (between 15-23 years of age). *Figure 4.16* illustrates the literacy levels of men and women nationally as adults (24 and above) and as youths (15-23 years), using available data for the years 2000 and 2008. This shows that adult men are on average more literate than women, with literacy rates for both genders rising between 2000 and 2008. Literacy rates for young people are marginally higher than those for adults, with little difference between young women and young men.

(44) [1]ERM household survey 2010
(45) [2] http://safaricom.co.ke/foundation/fileadmin/template/main/downloads/Kenya_VISION_2030-final_report-October_2007.pdf ; (Kenya Vision 2030.).

The rise in literacy from 2000 to 2008 for both groups possibly reflects improvements in education facilities and services throughout Kenya. Similar literacy rates for young women and young men in both 2000 and 2008 potentially indicate the reduction in the gender bias in access to primary education. However, there is still relatively poor representation of women in secondary education.

Figure 4.15 ***Water Access in Witeithie Estate via Stand Pipe***

Source: ERM Social Survey

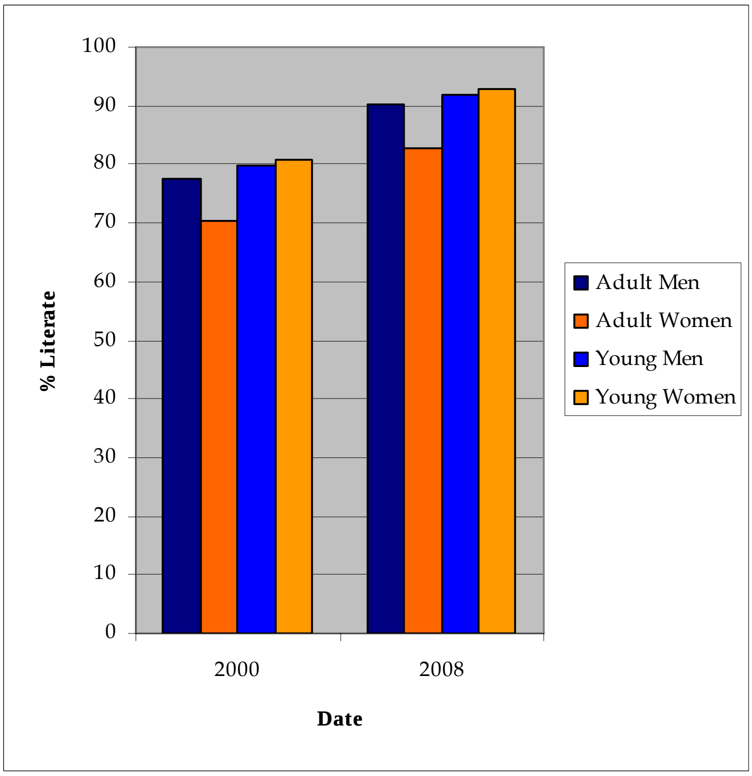
District Level Education and Literacy

Thika District has 317 primary schools, with a net primary school enrolment rate of 80% for both boys and girls. The teacher to pupil ratio is 61:1, suggesting that there is a pressing need for investment in schooling and teachers in the District. Enrolment in secondary schooling in the District drops off sharply to approximately 44%[1].

Literacy rates in Thika District are quite high, with 83% of the population able to read and write. This is a reflection of the high primary enrolment rates, which may also be supported by some of the national provisions such as minimal tuition fees and the mid-day meal programme. Adult literacy centres are also a resource for people who lack primary education, particularly women, who represent 75% of the 950 per year in the District who enrol in adult education[2].

(46) [1]Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009
(47) [2] Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009

Figure 4.16 National Literacy Levels



Source: World Bank Group Development Indicators & Global Development Finance databank 2009)

Community Level Education and Literacy

According to the household survey results, educational attainment levels for women and men in the communities close to the proposed Project site are relatively equal, with 30% of women and 36% of men attending only primary or preparatory school and 33% of women and 28% of men attending secondary school. A large percentage of both women and men covered by the survey attended university (19% and 23% respectively), and only 5-6 % of respondents were illiterate (see *Figure 4.17)*.

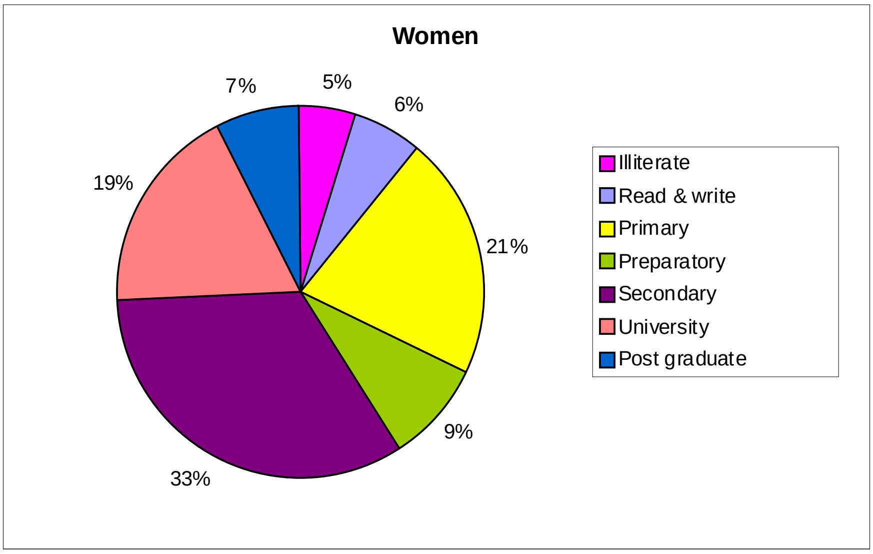
These figures present a relatively positive picture of education in the local area, but do not take into account failure to complete a level of education; many people who make it to secondary school drop out before completing their studies. Approximately 28% of women and 31% of men included in the survey did not complete their studies, and another 24% and 22%, respectively, are still in education. Of those who did drop out, roughly half did so at the secondary level, 43% did not complete primary/preparatory school, and the remainder dropped out at one of the higher levels of education[1].

In addition to the formal education system, 76% of household heads responded that they had received professional training of some kind. The most common types of training received include driving, computer skills, administration, hair styling and tailoring (see *Figure 4.18*). Thika Technical

(48) [1] ERM Household Survey 2010

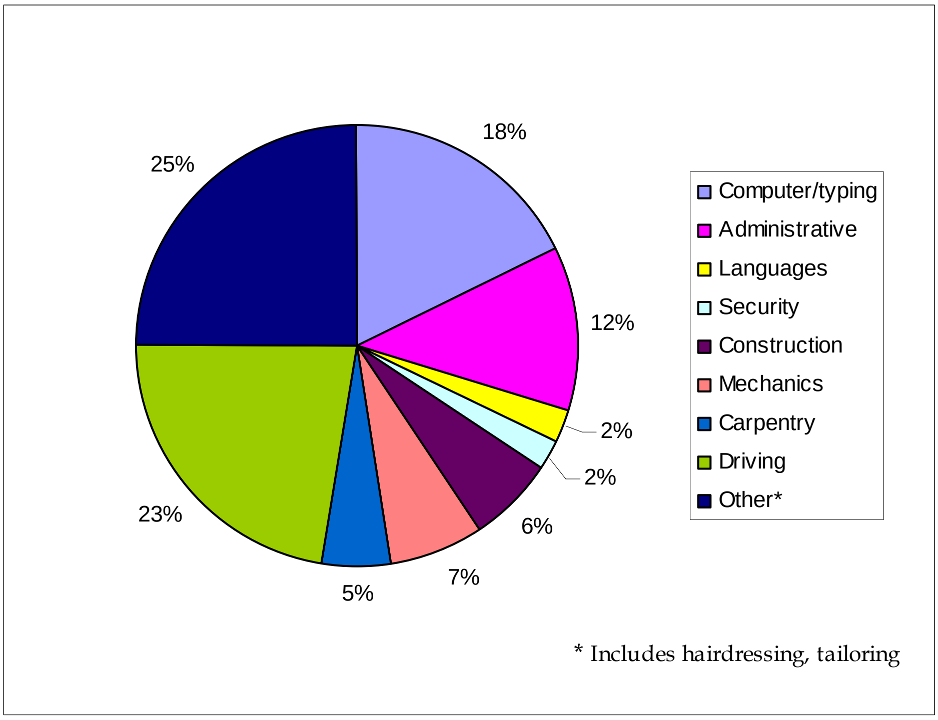
Institute, located in Thika Town, representing another source of technical training for the local population.

Figure 4.17 Level of Formal Education, Women and Men



Source: ERM Social Survey 2010

Figure 4.18 Type of Professional Training Received, Community Level



Source: ERM Social Survey 2010

Sensitive Educational Receptors

There are two educational establishments close to the proposed Project site that have been identified as sensitive receptors: Mang'u High School and Kuraiha Primary School (see *Figure 4.1*).

Mang'u High School is a public secondary boarding school south of the proposed Project site (see *Figure 4.19*). The main school entrance is from the highway, a little over one kilometre from the Project site, and the majority of the school buildings (e.g. classroom and dormitory blocks) are between approximately 700 m and 1.2 km of the Project site. There are also some teachers' quarters that are closer, approximately 300-400 m south of the Project site (see *Figure 4.20*).

Kuraiha Primary School is located immediately south of Mang'u High School on the highway, a little under two kilometres from the proposed Project site. It is one of the biggest public primary schools in Thika District, with over 1,200 pupils (generally from low or middle income families, many from Witeithie) and 26 teachers. Compared to Mang'u High School, it has a very small, compact campus.

A large proportion of Kuraiha's pupils walk to school from Witeithie, which as noted in *Section 4.1.7* has resulted in a number of traffic incidents involving children in recent years (some fatal).

Figure 4.19 Mang'u High School: Administrative Offices

Source: ERM Social Survey 2010

Figure 4.20 Mang'u High School Teachers Accommodation

Source: ERM Social Survey 2010

4.2.12 Health Profile

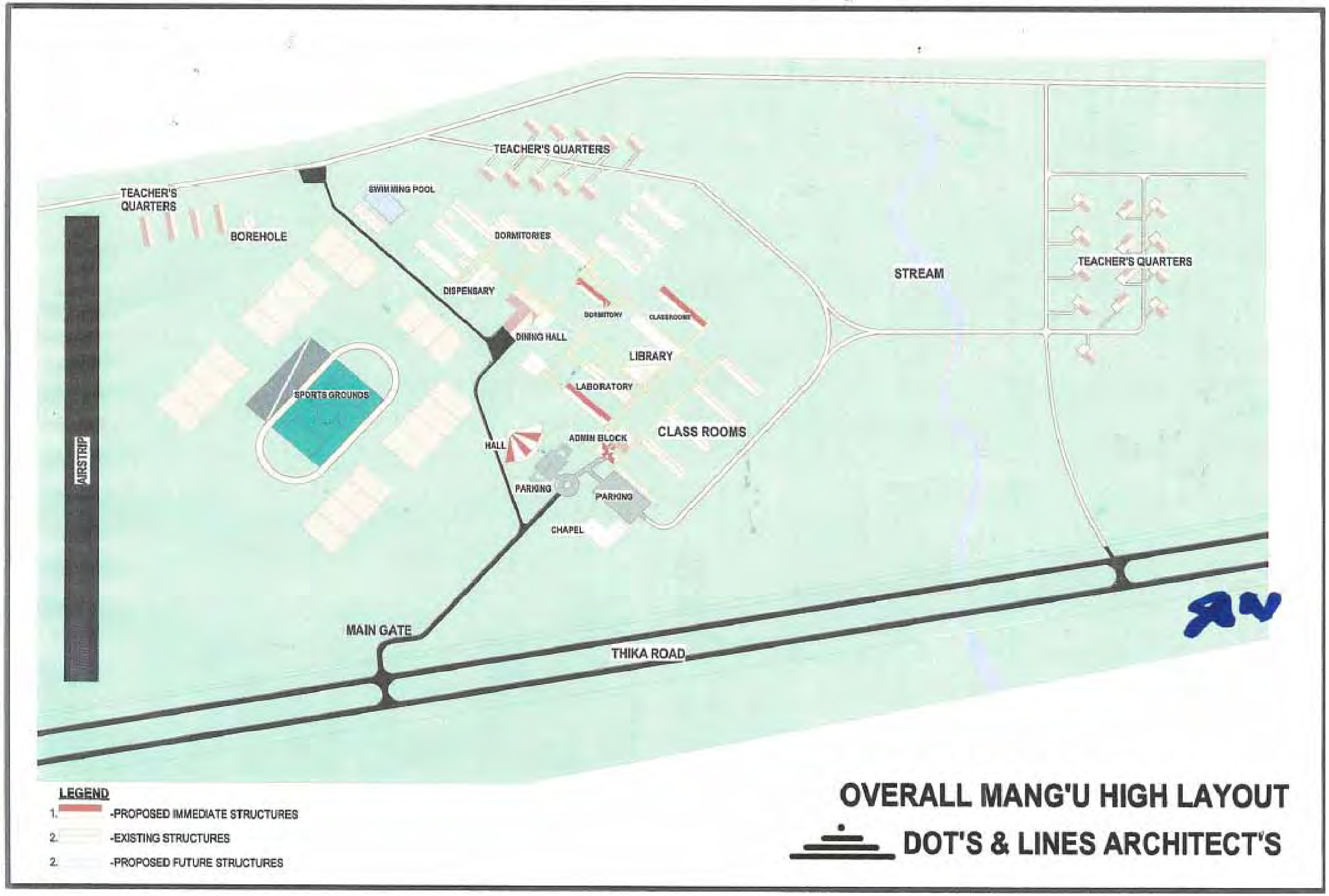
National Health Profile

According to the World Bank Group Development Indicators and Global Development Finance databank, life expectancy at birth in Kenya in 2007 was 53.6 years, with expectancy rates for men and women being 53.2 and 54 years respectively. Other key statistics from the World Bank indicate that in the period 2000-2006, 50% of children were underweight for their age, while government expenditure on health care per capita was US$51, or 6.1% of total government expenditure.

Access to, and quality of, health care facilities in Kenya are relatively poor. National level statistics indicate that there are approximately 19 hospital beds and 203 medical personnel per 100,000 people in Kenya[12]. Immunization levels have remained fairly constant at 71-73% of children under one year of age.

(49) [1] http://www.knbs.or.ke; Kenya National Bureau of Statistics.. A breakdown of medical personnel was not provided; this figure includes nurses, aides, etc.
(50) [2]http://www.knbs.or.ke/index.html?SQMSESSID=101561fb04e4511cde553e35a3da421e ;Kenya Ministry of Health; Health Statistics 2003.

Figure 4.21 Mang'u High School Layout



Source: Dots and Lines Architects (Provided by Mang'u High School Management)

Under Kenya's Medical Termination of Pregnancy (MTP) there are targets to reduce:

- mortality under five years from 120 to 33 per 1,000;
- maternal mortality from 410 to 147 per 100,000 live births;
- cases of TB from 888 to 444 per 100,000 persons;
- the proportion of in-patient malaria fatality to three per cent; and
- the HIV prevalence rate to less than 2% per cent.

4.2.13 District Level Health Profile

Most of the population of Thika District has relatively poor access to health facilities. According to the Thika District Development Plan there are 105 health facilities in the District, with a doctor: patient ratio of approximately 1:11,620. Only one of these health facilities in the District is a hospital, and the average patient has to travel 5 km to reach a health facility.

Table 4.10 summarises basic health indicators for Thika District. The most prevalent diseases are malaria, HIV/AIDS and broncho-pneumonia. Common diseases among children include anaemia, marasmus[1], eye infections, pneumonia, and malaria. Life expectancy is slightly above the national average (more so for women than men).

In recent decades, HIV/AIDS has been a major problem in the area. As of 2002, HIV/AIDS prevalence in the District averaged 34% of the population, while 60% of hospital beds were occupied by patients with HIV/AIDS related diseases[2]. The age group most affected by the disease is between 15-49 years, with significant implications for the productive labour force. However, by 2008 the data show a dramatic drop to a prevalence rate of only 3.7 percent of people in the District[3]. It is unclear what led to this marked drop.

Table 4.10 General Health Indicators, Thika District

Indicator	Value
Crude birth rate (CBR)	35/1,000
Life expectancy - men	53
Life expectancy - women	58
Crude death rate (CDR)	12.7/1,000
Infant mortality rate (IMR)	42/1,000
Neo-natal mortality rate	18/1,000
Under 5 mortality rate	35/1,000
Doctor/population ratio	1: 11,620

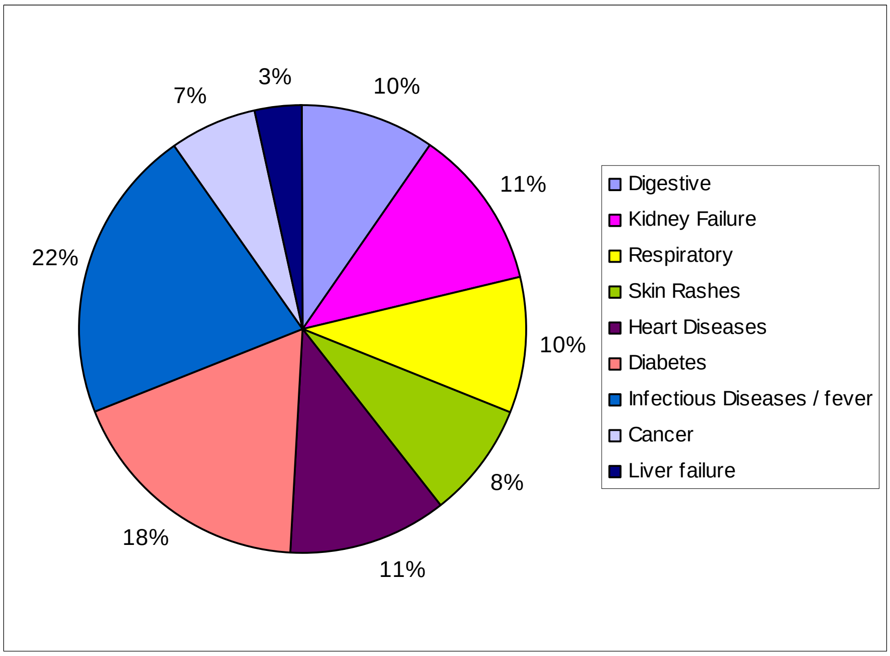
Source: Thika District Development Plan 2008-2012

(51) [1] Marasmus is a form of severe protein-energy malnutrition
(52) [2]Thika District Strategic Plan 2005-2010 for implementation of the national population policy for sustainable development.
(53) [3]Thika District Development Plan 2008-2012, Republic of Kenya, Office of the Prime Minister, Ministry of State for Planning, National Development and Vision 2030, June 2009

Local Health Profile

Only 12% of the households surveyed reported having an ill family member in the past two months. Of those people who were sick, 39% had a cold or influenza, 28% had diarrhoea and 22% suffered from a fever. Roughly a third of households visited a pharmacy for medical consultation, a third visited a private clinic, and 23% visited a Public Health Unit. Only 8% of households reported using traditional medicine[1]. Infectious diseases and diabetes were cited as the most common diseases in the community (see *Figure 4.22)* [2]with alcohol and drug abuse also cited as issues leading to illness in the area.

Figure 4.22 Common Diseases in Communities Close to the Project Site



Source: ERM Household Survey 2010

(54) [1] ERM Household Survey 2010
(55) [2] HIV/AIDS was not explicitly included in the survey.

5 *PROJECT DESCRIPTION*

A Project overview has been provided in *Chapter 1*, along with a summary of the key Project objectives and drivers, and an overview of the site selection process and a description of the proposed site to be developed for the Project.

This Chapter provides a description of the key Project components and details regarding activities throughout the life of the Project.

5.1 *POWER PLANT*

5.1.1 *General Overview*

The power plant is intended to be a reliable and cost effective supplement to the existing sources of energy for consumers in Kenya. It is designed to deliver up to 660 Gigawatt hours per annum, of which 98% (647 GWh/annum) will be sold to KPLC (with the remaining 2% consumed by the power plant itself). The power plant will be fuelled by Heavy Fuel Oil (HFO) that will be purchased by TPL from a Kenyan supplier, according to a Fuel Supply Agreement (FSA) which will be finalised after signature of the Power Producer's Agreement (PPA). TPL will undertake a tender process to contract a fuel supplier, according to terms agreed with KPLC, and will (as per the PPA) stipulate that all HFO should contain up to, but not more than, 2% sulphur. The HFO will be delivered from Mombasa via trucks to storage facilities on site. A Diesel Combined-Cycle (DCC) system will recover heat from the exhaust gases from the engine systems to generate steam for the turbine. This recovery cycle system allows the plant to produce approximately 8% more energy whilst consuming the same quantity of fuel, compared to the engine production method only. Distillate Fuel Oil (DFO) will be used as secondary fuel for maintenance and auxiliary services. The plant is designed for continuous i.e. 24 hours per day, operation with a maximum total output capacity of 87 MW. However, it is expected that the plant will only operate at approximately 85% capacity for the majority of the time.

TPL currently has no plans to expand the Project or increase capacity in the future.

5.1.2 *Project Description*

Overview

The power plant will consist of a simple-cycle power block with five reciprocating MSD engine-generators sets and one steam turbine. The engines will be configured with a two-circuit cooling system, which uses treated groundwater or municipal water as a cooling medium. A DCC system will recover heat from the exhaust gases from the engine powered generator sets to generate steam for the turbine. Power generated will be transmitted to the KPLC substation via medium and high voltage switchgear, a step-up transformer (15kV/132kV) and an auxiliary transformer (15kV/0.4kV).

The primary equipment elements of the power plant will include:

- Engine-Generator Sets, comprising: five 18.9 MW MSD Model MAN 18V48/60 turbocharged diesel engines (delivering 16MW net each at site conditions), matching electric generators, radiators for engine cooling, intake air filters, exhaust silencers, waste heat recovery boilers and stacks, and control system; and

- DCC system comprising: one 7 MW 2-stage steam turbine manufactured by MAN, matching electric generator, air cooled condenser, waste heat recovery boilers (installed on diesel gensets – as per above) all with associated piping/accessories, and control system.

The power generated by the plant will be exported to the transmission network via the adjacent KPLC substation, which is being constructed as part of the transmission upgrade project for the Nairobi area as discussed in *Chapter 1*.

Project Components

The Project will include the following key components:

Table 5.1 Key Project Components

Key Component	Additional Information
Power House	Containing five 4-stroke MSD engines 18.9MW manufactured by MAN, and a steam turbine 7MW
Tank Farm	3 x 4700m3 HFO tank 1 x 560m3 DFO tank 1 x 560m3 HFO service tank 1 x 75m3 Sludge tank 1 x 75m3 Lubricant oil storage tank 1 x 50m3 Maintenance lubricant oil storage tank
Pump House & Water Treatment Plant	Including fire fighting and raw water tank (1096m3) and demineralised water tank (65m3)
Diesel Combined Cycle Heat Recovery System	Including 5 boilers, a condenser etc
Medium and High Voltage Switchgear	
Transformers	Step-up transformers (15kV/132kV) and 2 auxiliary transformers (15kV/0.4kV)
Ancillary Systems and Facilities	Including unloading area, fire protection system, administration buildings, workshop, store, laboratory etc

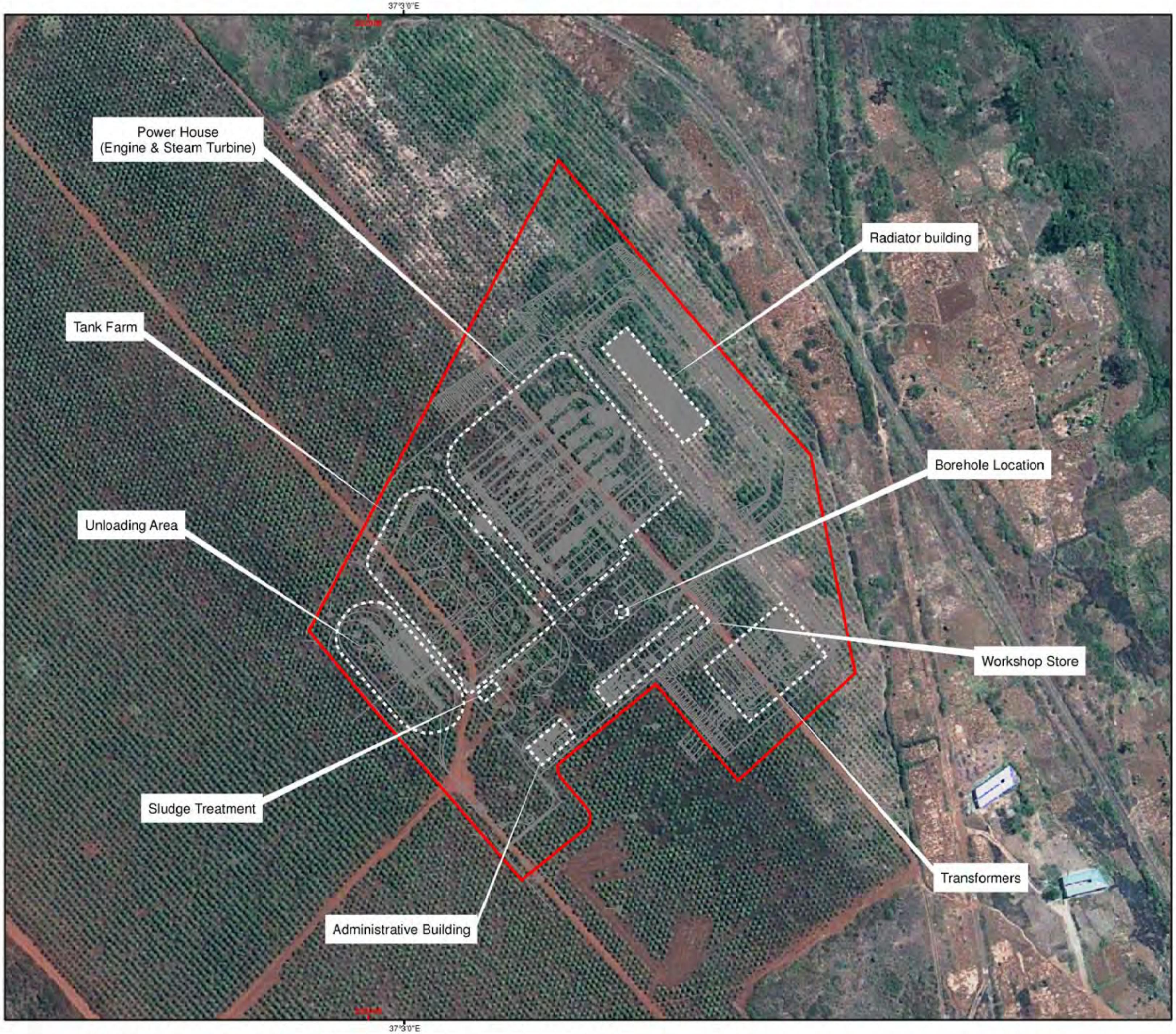
Additionally, during construction, the Project will require a temporary laydown area for equipment and materials and a batching plant for the mixing of cement on site. The laydown area, which will be fenced during the period of use, will be located on unused KPLC-owned land immediately to the east of the substation as shown in *Figure 5.1*. The location of the batching plant has not yet been determined; however, it is likely to be located either in the area designated for unloading during operation or towards the most northerly part of the site as shown in *Figure 5.1*.

Figure 5.1 Potential Location of Laydown Area and Batching Plant

5.1.3 *Power Plant Fuel Supply and Consumption*

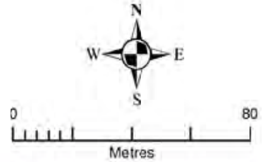
Fuel Supply

HFO (also known as CIMAC-E25) will be transported to the site in 30-tonne trucks from Mombasa. It is estimated that on average approximately 10 trucks per day will be required to maintain fuel supplies for the Project under 'normal' expected conditions i.e. the plant operates at approximately 85% capacity and that a maximum of 13 trucks per day maybe be required if the plant operates for extensive periods at 100% capacity.



KEY:

Site Boundary



TITLE:

Figure 5.2
Layout of the Thika Power Plant Site Showing Key Project Components

CLIENT: Thika Power Ltd.		SIZE: A3
DATE: 13/04/2011	CHECKED: PH	PROJECT: 0124250
DRAWN: AK	APPROVED:	SCALE: As Scale Bar
DRAWING: SiteLayout_A3.mxd		REV: 0

ERM
Eaton House
Wallbrook Court
North Hinksey Lane
Oxford, OX2 0QS
Tel: 01865 384800
Fax: 01865 384848

ERM

PROJECTION: WGS 1984 UTM Zone 37S

The delivery of fuel will occur 7 days per week and will only be during daytime hours i.e. no night-time deliveries. Once the trucks arrive on site, fuel will be transferred to one of three HFO above-ground bulk storage tanks located in the tank farm area. The truck unloading station will be designed such that trucks can drive in, unload fuel or lubricants, and drive out in a continuous loop to minimise the risk of accidents. The station design also includes hoses with quick-connect fittings, unloading pumps, filters, fuel meters, a rain roof to cover truck and equipment areas, and kerbs to direct any accidental spills and storm water to an oil/water separator.

The HFO used must meet one of the following International Council on Combustion Engines (CIMAC) standards: A10, B10, C10, D15, E25, F25, G35, H35, H45 and H55 under ISO 8217, DIN EN 590, ASTM D396 or ASTM D975.

Similarly, DFO is to be used as a secondary fuel and will be transported to the site in 30-tonne trucks from Nairobi. It is estimated that on average one delivery (i.e. one truckload) will be required every one to two months to maintain supplies for the Project under 'normal' expected conditions. DFO will be pumped out of the fuel-delivering trucks in the dedicated unloading area described above and stored on-site in an above-ground storage tank.

The HFO and DFO storage tanks will be co-located in a tank farm, where all tanks will be field-erected and will be constructed in line with the American Petroleum Institute (API) 650 standard. The tank farm will have a secondary containment retaining wall which will be designed to hold 110% capacity of the largest tank. All tanks will be fitted with filling alarms to prevent over filling and thus spillage from occurring.

Routing of fuel deliveries has not yet been confirmed, although the routing assessment undertaken by Terms Kenya Ltd (1) to consider the stability of bridges and potential routes for transportation of heavy units, four potential routes have been identified (shown in *Figure 5.4*). The routing option chosen will avoid travel into Nairobi. Project vehicle routing is discussed further in *Section 5.4.1*. All deliveries of fuel will be subject to the mitigation and management measures outlined in the Traffic Control Management Plan (*Annex B*) prepared as part of *Chapter 7*.

Fuel Consumption

The power plant is expected to use up to approximately 380m^3-470 m^3 per day of HFO, if operating at full capacity. The HFO will be pumped from the storage tanks in the tank farm, through a conditioning system, to the HFO service tank with a capacity of 560 m^3, which provides a buffer against minor upstream fuel supply interruptions. The total HFO storage capacity on-site is 14,100 m^3, which is sufficient for at least 30, and up to 35 days, under the anticipated operating conditions. The HFO tanks will be filled at commissioning, and continually topped up via the daily truck deliveries.

(1) Term Kenya Ltd, Inception Report for Bridges on Various Routes from Mombasa to Thika, January 2011

5.1.4 *Power Plant Water Supply and Consumption*

Water consumption at the site during the construction phase is expected to be primarily for the following purposes:

- drinking water for employees;
- batching plant activities; and
- dust mitigation and management measures i.e. vehicle wash down, dampening of areas etc.

Water required during the construction phase of the Project will initially be provided by water bowsers until such times as borehole abstraction commences as planned (further detail provided below) and water treatment can ensure water will be provided to the appropriate standard relative to need e.g. drinking water, water for batching plant activities etc.

Given that the batching plant is anticipated to produce approximately 6,000m^3 of cement in total, it is estimated that approximately 1,200m^3 of water will be required solely for this purpose. The exact quantities of water required for human consumption, dust management, or other uses cannot be accurately calculated at present.

During operation, the Project plans to abstract water from a groundwater aquifer using a borehole (estimated to be approximately 250m in depth) to be drilled on site. The planned location for the borehole is between the fire fighting and raw water tank, and the water treatment room located to the south of the site adjacent to the power house (see *Figure 5.2*). TPL applied to the Water Resources Management Authority (WRMA) in January 2011 for approval to sink a borehole onsite to supply Project water demands. Approval was sought to cover a maximum abstraction rate of 150m^3 per day (pending intrusive investigation and testing) with an agreement that once the borehole is confirmed as a feasible source, TPL will undertake monitoring in order to ensure that abstraction quantities are recorded to demonstrate compliance with the application, as well as recording a number of additional parameters. The contingency plan, should borehole abstraction not be feasible, is that TPL will enter into discussions with the municipal water supplier about connecting the site to the municipal water system.

During operation, water is required on site primarily for the following purposes:

- steam turbine system;
- fire fighting system;
- domestic /service water (i.e. toilets, kitchen etc);
- cleaning/equipment washing; and
- cooling water.

Approximately 60% of the daily water use will be for the steam turbine system whilst the remaining 40% will be sufficient for other on site requirements. Cooling water requirements will be minimal and will be in a closed loop system. Water will be distributed through underground piping to buildings and equipment.

5.1.5 *Fire Protection System*

The fire protection system on site will be in line with the requirements of the National Fire Protection Association (NFPA) 850 (1). Components of the system will include audible and visual alarms, smoke detection devices, a fire water storage tank and portable fire extinguishers appropriate to the nature of the potential fire i.e. dry powder, carbon dioxide etc.

The closest emergency fire station to the site is located in Thika. The capacity of this station to deal with industrial fires is currently unknown, and will be investigated further in fully developing the Emergency Response Plan (see *Annex D)* for further detail.

5.1.6 *Overview of Emissions and Wastes from the Power Plant*

Atmospheric Emissions

During construction, the primary emission to air is likely to be dust as a result of construction activities such as site clearance and preparation, batching plant activities associated with cement making and vehicle movements particularly on non sealed roads.

The power plant will to be operated on HFO and as a result, the emissions of note are considered to be:

- particulate matter (PM_{10}, $PM_{2.5}$, Total Suspended Particulates);
- sulphur dioxide (SO_2);
- oxides of nitrogen (expressed as both total oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2); and
- carbon monoxide (CO).

Chapter 6 provides further detail regarding the quantification of emissions to air from the plant which have been derived from data provided by TPL and MAN in relation to the design of the plant and used as air dispersion modelling inputs.

(1) National Fire Protection Association 850: recommended practice for fire protection for electric generating plants and high voltage direct current convertor stations, 2010

Noise Emissions

During construction, the primary noise emissions are likely to be as a result of construction activities involving heavy machinery and vehicle movements, as well as site clearance and preparation works.

Once commissioned and operational, the plant will operate on a continuous basis with power production 24 hours a day, with the exception of maintenance shut down periods. The primary noise sources are considered to relate to:

- radiator fans;
- engine room;
- ventilation outlets and venting units;
- air cooled condensers; and
- transformers.

Chapter 6 provides further detail regarding the quantification of noise emissions from the plant which have been derived from data provided by TPL and MAN in relation to the design of the plant and used as noise modelling inputs.

Liquid Effluents

The primary liquid effluents generated by the Project include:

- domestic effluent (during both construction and operation);

- stormwater run off (during both construction and operation); and

- wastewater generated from the Effluent Treatment Plant (ETP) (during operation).

Domestic effluent from temporary facilities during construction (e.g. toilets) and permanent facilities during operation (i.e. toilets, showers, kitchen, etc.) will be collected and contained in a septic tank on site: a temporary one during construction, which will be replaced by a permanent one for operation. The contents will be removed for disposal as and when necessary by a licensed contractor.

Options for managing **stormwater run off** during both the construction and operational phases of the Project are currently being discussed by TPL, which is examining a collective approach to coordinate stormwater management with the neighbouring KPLC substation site. During construction it is likely that temporary drainage channels will be created to channel and divert stormwater from the TPL site, away from the down slope agricultural plots. The KPLC contractor already has proposals for construction stormwater management, and TPL is discussing whether these can developed jointly and upgraded as necessary to combine construction stormwater management for the two adjacent sites.

Stormwater run off generated during the operational phase of the Project will be channelled and discharged to ground in an unused part of the TPL site, via a soakaway or reticulated drainage network. The siting of soakaway/ drainage areas, and their design, will take account of the risks of runoff affecting any sensitivities such as the railway line and agricultural plots downslope. Only external areas of the site without the potential to be contaminated will be handled in this way, whilst all areas where the potential exists for stormwater to become contaminated will be collected separately and sent to the ETP.

All **wastewater** on site that is considered to have the potential to become contaminated either because it is directly used as process/contact water, or because rainwater has collected in an area such as the tank farm where the presence of contaminants is possible, will be collected, channelled and processed through the ETP.

The primary ETP inputs are therefore expected to be from the following on site sources:

- oil separator, collecting run off from the unloading area;
- effluent from neutralisation plant (for oil/water separators);
- sump located in the workshop (includes wastewater from laboratory);
- sump located in the power house;
- sump located in the pump house;
- HFO separators (numerous);
- drain pit located in the tank farm; and
- leak oil sumps from all modules using oil.

Sampling of all wastewater will be undertaken before discharge from the ETP, and treatment will continue (via re-circulation for additional processing) until all applicable Kenyan and IFC discharge standards are met. It will then be discharged to ground in the same manner as stormwater (see above). The output capacity of the ETP is approximately 7m^3 per hour.

Solid Waste

The significant solid waste materials generated by the Project during construction will be:

- excavated top soil (to approximately 3m depth over large parts of the 4 hectare site);

- domestic waste;

- waste packaging from raw materials (e.g. cement bags, wooden crates etc); and

- hardcore material, e.g. excess concrete.

TPL is currently in discussion with a number of parties that may be interested in purchasing or taking some or all of the excavated top soil for beneficial use, in order to minimise the need for disposal. The management and disposal of solid waste generated by construction activities will be incorporated by the Contractor in a Construction HSE Management Plan: TPL will require that all waste be disposed of by licensed waste contractors.
The solid waste materials generated by the Project during operation will be:

- domestic waste;
- sludge generated from the ETP;
- hazardous waste i.e. spent lubricants and their containers, spent oil filters, used rags, spent solvents used for cleaning, waste materials from the laboratory etc; and
- waste material from the workshop areas.

For sludge disposal, TPL is currently in discussion with a licensed contractor that undertakes sludge disposal for another HFO power plant in Kenya. It is estimated that under 'normal' operations (i.e. at 85% capacity), sludge collection would be required approximately once per month.

TPL will evaluate the potential recycling, reuse and disposal options for waste generated as part of operations in light of available facilities and contractors in and around Nairobi. TPL will ensure that all waste is disposed of by licensed waste contractors.

5.2 *OVERVIEW OF UTILITIES AND ANCILLARY SERVICES*

5.2.1 *Workshop/Store Building*

The workshop/store building located between the power house and the KPLC substation (see *Figure 5.2)* comprises the following:

- domestic facilities i.e. male and female changing rooms, separate shower and toilet facilities;
- laboratory;
- storage areas for engine tools and spare parts;
- work areas with equipment, i.e. welding unit, lathe, grinder, drilling machine;
- electrical instrument workshop; and

- injector testing room.

5.2.2 *Administration Building*

The administration building located between the tank farm and the KPLC substation (see *Figure 5.2)* comprises office space, kitchen and toilet facilities.

5.2.3 *Access Road and Unloading Area*

KPLC will be responsible for surfacing the access road from the highway service road to the substation. TPL will then be responsible for surfacing the section of road from the substation boundary to the unloading area on site. It is understood that both of these sections of road will be surfaced with hardstanding tarmac material.

The unloading area will have three lanes/bays and will be one-way so that trucks and vehicles entering the site will leave by driving through the bay and turning in a semi circular designated area to face back onto the access road. There will be separate pumps for HFO, DFO and lubricating oil deliveries.

The road and unloading area are being designed to ensure that access to the Agro Tropical coffee farm will not be restricted by construction traffic or operations.

5.2.4 *Electrical System*

The primary purpose of the electrical systems is to export net electrical generation, distribute station power for internal loads when the plant is operational, and import station power during plant outages. An electrical system operating at 50 Hz will be provided, including:

- high voltage 132 kV substation;
- medium-voltage 15 kV system including generator and generator bus;
- low-voltage 0.4 kV system for plant auxiliary loads;
- convenience voltage 400/230 V system distribution for lighting and convenience outlets; and
- control voltage 24 V DC and 110 or 125 V DC.

5.2.5 *Compressed Air and Ventilation Systems*

The compressed air system compresses, stores and delivers medium pressure (30 bars) compressed air to start the diesel engines. The system includes:

- dual air compressors;
- compressed air storage tanks;

- air-start system for engines; and
- instrument and service air system.

The power house ventilation system aims to provide an environment that permits the machinery and equipment to function properly within their service life and to provide noise attenuation. It includes:

- two ventilation inlet modules: one for the generator side and another for the annex side, which include a filter section, silencer section and fan section, and is directly connected to the power house; and

- one ventilation outlet module to exhaust the combined generator and annex side ventilation inlet air volumes.

5.2.6 *Lube Oil System*

The purpose of the lube oil system is to deliver clean, cool lubricating oil to the engines at the proper pressure and temperature. This is accomplished by a series of pumps, coolers, tanks, and filters. Lube oil is circulated to the engine and back in a continuous loop, via an 80 m^3 lube oil circulating tank that serves as a central receiver.

5.2.7 *Communication and Controls Systems*

The power plant will include state-of-the-art communication and controls systems comprising:

- a complete plant monitoring and control system, to include a freestanding common plant control Programmable Logic Controller (PLC) panel, a measurement and protection unit located in the control room, and a plant desktop SCADA (Supervisory Control and Data Acquisition) system; and

- security camera supervision systems and internal communications systems.

5.3 *PROJECT SCHEDULE*

5.3.1 *Overview*

Subject to the necessary permitting approvals and financing sources delivering in accordance with the existing schedule, earthworks and site preparation for the Project are expected to commence in April 2011 whilst civil works are expected to commence in May/June 2011. Construction and commissioning activities are expected to take approximately 26 months in total with final performance testing due to be completed in May 2013 (1). Earthworks and civil works construction are expected to take 7-9 months. The

(1) Project Schedule dated 19th March 2011, provided by Thika Power Limited (*subject to further minor revisions*)

Project expects to start generating power in October 2012 following installation and commissioning of the engines.

5.3.2 *Milestones*

Key milestones in the construction process include:

- preparatory earthworks and civil works i.e. steel structures, the access road, site fencing, ancillary buildings etc to be completed by October 2011;
- engine erection and commissioning between December 2011 and October 2012; and
- steam turbine erection and commissioning between August 2012 and February 2013.

Figure 5.3 *Overview of Project Schedule*

ID	Task Name	Start	Finish
1	Earthworks and Site Preparation	01/04/2011	31/10/2011
2	Civil Works	02/05/2011	31/10/2011
3	Engine erection and commissioning	01/12/2011	31/10/2012
4	Steam turbine erection and commissioning	01/08/2012	28/02/2013
5	Final performance testing	01/05/2013	31/05/2013

5.4 CONSTRUCTION AND COMMISSIONING

5.4.1 *Sourcing of Equipment and Material*

It is anticipated that construction activities will require the following approximate quantities of the major raw materials:

- 500 tonnes of steel;
- 4,800m^3 of raw material for concrete (i.e. gravel, sand and cement); and
- 1,200m^3 of water for concrete, plus additional water for other purposes such as drinking water and dust suppression.

The majority of the raw materials (i.e. steel, cement etc.) and specialist materials (i.e. wall panels for noise abatement, etc.) will be sourced from Nairobi. The specialised equipment and units i.e. 5 x engines, 5 x boilers, 2 x auxiliary transformers, 1 x steam turbine etc. are being sourced from technical specialists, mostly from MAN in Europe and Matelec in Lebanon.

Delivery of raw materials, equipment and units, and staff movements to and from the site, are likely to result in vehicle movements approximately as outlined in *Table 5.2*. In total, up to a maximum of 85-90 vehicle movements per day are estimated at peak periods, although there will be significant periods during construction when the numbers will likely be much lower.

Table 5.2 Vehicle Movements during Construction

Delivery	Approximate Vehicle Movements (1)
Concrete materials - gravel, sand and cement	• average 2 movements per day over approximately 10 month period • maximum 6 to 10 movements per day during peak concreting activities
Mechanical and steel including pipe work	• average 4 movements per day over approximately 8 month period (would commence approximately 3 to 4 months after concreting period commences)
Specific equipment pieces	• 5 deliveries for engines • 5 deliveries for boilers • 1 delivery for steam turbine • 2 deliveries for transformers • 5 deliveries for tank material for assembly
Miscellaneous (deliveries, etc).	1 to 2 deliveries per week
Worker and supervisory staff transport	• average 16-20 movements per day for workers' buses • up to 30-50 car movements per day for manager and supervisory staff, and other contractors' vehicles

As outlined in *Section 5.1.3*, a routing assessment has been undertaken to consider the stability of bridges along routes and the conditions of potential routes themselves in relation to transporting heavy units during construction and four potential routes have been identified (see *Figure 5.4*). The routing option chosen will avoid any Project vehicles bringing materials from Mombasa needing to transit through Nairobi.

Construction activities and vehicle movements associated with delivery of materials and equipment will not take place during night-time hours and when possible, will be scheduled to avoid school start and end times i.e. not between 7am and 8am, or between approximately 4pm and 5pm.

5.4.2 *Construction Personnel and Logistics*

The construction phase will be undertaken primarily by an appointed Engineering, Procurement and Construction (EPC) contractor, and potentially a number of smaller specialist contractors, working alongside TPL staff. The key features of employment during construction can be summarised as follows:

(1) A vehicle travelling to the site is treated as one movement, and departing from the site as a second movement.

- a total of approximately 500 construction workers will be required over the period of construction, hired via contractor(s);

- at peak construction, there are expected to be up to 350 workers on site, the remaining 150 being specialist skills used for short periods, e.g. welders;

- there will be approximately 25 TPL employees during the construction phase;

- TPL will source employees from local communities where the skills base makes that possible, and will require its contractor(s) to follow a similar recruitment policy;

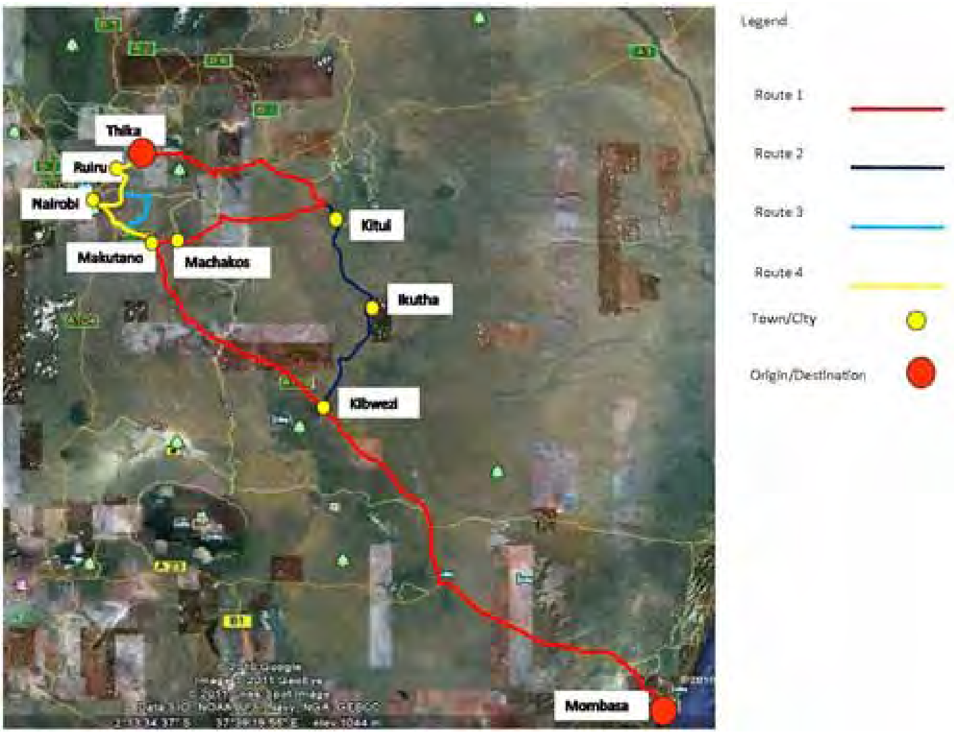
- the standard working day will likely start at 7 a.m., and end at around 5 p.m. so that construction worker vehicle movements do not coincide with school hours;

- the standard working day will be between 8 and 10 hours;

- the working day may on occasion be extended, and workers paid overtime, when tasks must be completed without interruption (e.g. concrete pouring); and

- except on a very limited number of occasions when such ongoing tasks must be completed, TPL will operate a six-day working week, Monday-Saturday.

Figure 5.4 Route Options for Equipment Deliveries from Mombasa



Source: Terms Kenya Limited, 2011

5.4.3 *Accommodation and Transportation of Construction Personnel*

No onsite accommodation for workers will be necessary.

It is expected that those workers who live locally will continue to reside in their current homes, and will travel to and from the site on a daily basis. This should eliminate the potential for the socially disruptive interactions between construction camp residents and nearby communities that can occur in similar circumstances. TPL will require contractors to offer bus transport for workers, to limit vehicle movements and to reduce the traffic-related risk to workers and the wider community (especially vulnerable groups such as school children). On this basis, workers from the nearby Witeithie Estate should be offered bus transport so they do not cross the Highway on foot.

Workers from further afield will mostly either be short-term specialist contractors, or supervisory and management staff who may reside in Thika, or as far away as Nairobi. These staff will mostly travel in light commercial vehicles or cars.

5.5 *OPERATIONAL WORKFORCE AND LOGISTICS*

5.5.1 *Operation Personnel and Logistics*

The plant will operate 24 hours per day for the majority of the year, and employees will work in three shifts. TPL will employ 40 to 50 permanent staff. These staff will be sourced from the local community where the skills base permits, mostly unskilled or semi-skilled positions (e.g. kitchen staff, security guards, cleaners); many of the remaining positions will require technical supervisory and managerial skills which are less likely to be available locally.

Occasionally, for large maintenance operations, temporary personnel may be active on site, and additional technical experts from MAN and from Matelec may be present to supervise maintenance programmes, performance testing, and similar activities.

5.5.2 *Accommodation and Transportation of Operation Personnel*

No on site accommodation for employees will be provided, and it is anticipated that operational staff will live in the immediate area, in Thika or other nearby towns, or in some cases as far afield as Nairobi.

Given that three shifts will operate, there will normally be between 6 and 10 managerial staff on site at any time (most during the day shift). Many of these will have their own cars. The 10 to 20 support employees per shift (security guards, cleaners, etc.) are likely to use public transport or travel by bicycle or on foot.

Thus it is likely that during the plant's operational phase a maximum of 40-70 staff vehicle movements per day would be expected, including both permanent staff and occasional visitors. As described in *Section 0*, there will be approximately 30 delivery vehicle movements a day, mostly fuel trucks.

5.6 *MITIGATION THROUGH DESIGN CHANGES*

During the design process, and through discussions with MAN, ERM and other Project consultants, TPL has made a number of design alterations and design decisions to develop the Project in the most environmentally and socially sustainable way. Key changes include:

- increasing the stack height to improve dispersion of emissions to air;
- onsite batching plant to avoid transporting large quantities of wet cement;
- routing all construction and operational traffic from Mombasa to avoid transit through Nairobi;
- restricting operational hours and delivery times to avoid school hours, and so improving community safety, especially for vulnerable groups such as schoolchildren;
- positive employment policy (for TPL and contractor(s)) favouring local employment for all positions where the skills base allows this; and
- channelling and drainage of stormwater and wastewater from the ETP to minimise/avoid impacts to down slope agricultural plots.

5.7 *DECOMMISSIONING*

The TPL Project is expected to have an operational life of approximately 25 years. This may well be extended for a longer period should the need for this type of power generation remain at that time. TPL do not foresee any significant environmental or social impacts arising from the eventual decommissioning of the Project infrastructure. Notwithstanding this view, the Project will be subject to the requirements of a Site Closure and Restoration Plan (SCRP), which will be developed prior to commencement of operation. The SCRP should ensure that TPL leaves the site in no worse environmental condition than when it was first occupied and thereby having no significant environmental impacts during decommissioning.

TPL will adopt appropriate initiatives during the operational life of the Project to ensure there will be no deterioration of the site. If any instances arise during the course of operation that impact the state of the site, TPL will record these instances, and any investigation or remediation work that is carried out. Various steps will be taken to minimise the potential for soil and groundwater contamination including the appropriate use and storage of chemicals, lubricants and fuel oil.

5.7.1 *Decommissioning Issues Incorporated into the Design*

The design of the power plant has been carried out in such a way as to ensure the continued safety and operation of the Project. All design work for the infrastructure has been carried out in accordance with current industry accepted best practice.

The design has taken into account and included a review of the following areas as a minimum:

- choice and use of materials;
- ease of replacement and/or dismantling;
- location of equipment;
- avoidance of potential build up of contamination, *e.g.* sumps;
- bunding of tanks and storage areas for consumables;
- ease of operation; and
- ease of cleaning.

Pipework containing hydrocarbons will be installed either above ground or in underground pipework with access arrangements or using double skinned pipe in accordance with international best practice to enable leaks to be detected.

5.7.2 *Decommissioning Issues Considered During Operation*

Incorporated Management of Materials and Spill Containment

TPL will adopt a range of appropriate measures during the operation of the Project to ensure that the requirements for site restoration, following decommissioning, are minimised.

In particular, the following measures [1] will be adopted during operation:

- appropriate containment and management of chemicals, lubricants and fuels, to ensure that the potential for accidental spills is minimised;

- the development and maintenance of an appropriate on-site drainage system to ensure that, in the unlikely event of a spill, material is contained and the potential for discharge to controlled waters is minimised;

- storage of spill kits at appropriate locations around the site and training of staff in their use;

(1) Measures have been adapted from ***IFC General EHS Guidelines: 4.0 Construction and Decommissioning***.

- supervision of contractors during the delivery of chemicals, fuels and lubricants and during the removal of wastes;
- review on a regular and on-going basis of measures for the storage, control and clean-up of chemicals, fuels and lubricants; and
- training of staff as appropriate.

The above measures will ensure that the potential for contamination during the operation of the Project is minimised.

5.7.3 Site Closure and Restoration Plan

An appropriate SCRP will be developed in consultation with KPLC and relevant authorities where necessary. Throughout the lifetime of the Project the Plan will be reviewed regularly and updated if any material changes occur (for example the method of fuel delivery from road to rail). The adoption of measures described in *Section 5.7.2* above will ensure that the potential for contamination, as a result of the operation of the installation, is minimised. The SCRP will include information on the following:

- removal or flushing out of pipelines and vessels where appropriate and their complete emptying of any potentially harmful contents;
- plans of all underground cables, pipes and vessels;
- the removal of potentially harmful materials unless agreed otherwise; and
- Site Protection and Monitoring Programme (SPMP) including testing of soils where necessary.

The contents of the SCRP will be as follows:

- summary of proposed site end use(s);
- summary of relevant environmental guidelines (Kenyan and international);
- description of acceptable standards/criteria for post-decommissioning conditions;
- preliminary closure concepts for project facilities;
- post-decommissioning monitoring and maintenance requirements;
- provisional timetable for decommissioning of construction facilities and for establishment and maintenance of future beneficial uses;
- responsibilities for decommissioning, establishment and maintenance; and

- maintenance and monitoring costs and financial allocations.

The SCRP will include the following supporting annexes as appropriate:

- general reclamation, restoration and remediation methods;
- control of erosion;
- establishment and maintenance of future beneficial uses; and
- pathways for disposal of waste materials removed from the site.

Once the SCRP has been implemented on closure of the site, a Site Closure Report will be written that will provide a statement of the condition of the site following cessation of operations and decommissioning.

Prior to decommissioning commencing, a method statement and risk assessment philosophy will be applied to the decommissioning of the Project. All documentary information relating to the Project will be drawn together including: as built drawings, CDM files and operating manuals. Risk Assessments will be produced addressing: activities, hazards, risks, required control measures, assessment of required actions. Typically these could address:

- consumables, chemicals, oils, lubricants, *etc*;
- noise exposure and control;
- personnel management;
- burning cutting;
- handling and storage;
- cleaning;
- handling and storage of flammable fuels;
- general structural demolition;
- dismantling and site clearance;
- assessment of suspected hazardous materials;
- accidents and near misses incidents;
- loading and unloading;
- disposal of materials;
- contaminated materials and soils; and
- health and safety.

Development of Method Statements for each activity will be drawn up prior to the demolition commencing, which will be based on the risk assessment.

Decommissioning will meet the best practice requirements at the time of cessation of operations, which may require the approval of the relevant authorities and KPLC as the land owners.

Decommissioning of the power plant and associated infrastructure could pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of solid, liquid or gaseous forms. During decommissioning the infrastructure at the TPL plant that will present the most likely hazards includes the following:

- fuel delivery and unloading area;
- sludge treatment area;
- HFO storage tanks;
- pumphouse sump;
- drain pit;
- sludges tank;
- HFO service tanks;
- new lube oil storage tank;
- maintenance lube oil storage tank;
- demineralised water tank;
- electric room;
- pipework;
- diesel engines; and
- flue stacks.

Exposure to hazardous materials during the decommissioning of the power plant must be prevented through the implementation of Project specific plans and other applicable management practices. These should include:

- use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated ground as a first step in decommissioning activities to allow for safe decommissioning;

- use of specially trained personnel to indentify and selectively remove potentially hazardous materials in structural elements prior to dismantling or demolition, for example, insulation or electrical components containing mercury;

- use of waste-specific personal protective equipment (PPE) based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection; and

- operation of a permit to work system, that deals with "hot works" and electrical isolation.

During the decommissioning a complete set of records, which details the full traceability of all materials, wastes and contaminants, will be produced in keeping with international best practice HSE requirements.

5.8 UNPLANNED EVENTS

There is the potential for unplanned events to occur during the construction, operation or decommissioning phase of the Project, and such events may include:

- environmental incidents;
- general natural disasters such as flooding, fire, explosion;
- individual emergencies such as injury, illness, fatality, drug reaction or medical emergencies; and
- civil disorders such as civil disturbances and strikes.

TPL will develop contingency procedures and an Emergency Response Plan (ERP) in case of such accidents. *Annex D*, provides further consideration of such events and detail on the potential management measures to be adopted, as well as providing guidance on the suggested content of the procedures and ERP.

5.9 ANALYSIS OF ALTERNATIVES

A brief overview of alternatives relating to particular aspects of the Project is presented below. This information has been elaborated from information provided in *Chapter 3: Analysis of Alternatives* in the Project EIA[1] undertaken for the Project, and from the Hydro-geological and Geophysical Feasibility Study Report[2], and further information and discussions during preparation of this ESIA.

5.9.1 No Project Scenario

If the Project was not constructed the site may potentially remain empty under the ownership of KPLC. Another potential option would be that the land allocated for the Project be sold back to Agro Tropical and returned to coffee farm land. As the Project was part of a successful bid on a tender by KPLC, it is almost certain that if TPL were not undertaking this Project, then another company would be. If the Project did not go ahead the wider benefits to the stability and availability of electricity and associated benefits to the national economy would not be realised. The rationale behind this Project is that demand currently outstrips supply in terms of power generation, that supplies can be unreliable and suffer interruptions, and that Kenya's economic development may therefore be hampered if the Project is not developed. The Ministry of Energy's fast-track approach to getting three 60-80MW power plants on-stream by 2013 is in line with Kenya's energy policy and strategy, and is the most cost-effective option to fill a widening energy gap; the no-Project scenario it is not considered a viable alternative.

(1) [1] Environmental Impact Assessment Study for the Proposed 80MW Thermal Power Plant at Thika, Enviroplan & Management Consultants, December 2010
(2) [2] Hydrogeological and Geophysical Investigations on Land reference No 8380/4, South West of Thika Municipality County of Kiambu; Geo Con Limited. December 2010

5.9.2 *Fuel Diversification Options*

Diversification of the sources of fuel used for electricity generation in Kenya could (in principle) include nuclear, geothermal, hydro, solar, wind, coal, oil, gas or some combination of the above. The current status of these fuel sources available in Kenya are outlined below to highlight and justify development of an HFO thermal power plant.

Nuclear Power

Nuclear power requires sophisticated infrastructure and cautious planning and investment over a 10 to 15 year period. At present, Kenya does not have the experience, materials, fuels, funding or infrastructure required to implement this option.

Geothermal Power

Geothermal resources are available in Kenya, mainly within the rift valley. Geothermal energy can be generated by tapping natural steam from volcanic-active zones. There are three plants in Olkaria, Kenya, which feed approximately 127MW into the national grid. Over the next 20 years this is expected to increase to 576 MW, versus an estimated potential for the country from more than 2000MW (when generated using conventional flash-steam condensing turbines) to more than 3000MW (if combined cycle and binary systems were used). Geothermal exploration and development projects are currently ongoing with KenGen conducting surface scientific studies in Suswa, Longonot, Eburru and Menengai. Further exploration is occurring in the Lake Baringo area. Such geothermal projects result in varying costs and benefits however, these are not achievable within the short to medium term.

Hydropower

Approximately 70% of all electricity output in Kenya is generated through hydropower. The total installed capacity of hydropower in Kenya is 677 MW versus a total estimated potential hydropower resource of 1100 MW. Kenya has a limited number of rivers which originate from the highland areas and flow into the Indian Ocean; these present the majority of the potential for hydropower. However, these rivers can also experience severe seasonal water fluctuations. Due to this variable hydrology, the level of risk associated with hydropower production is high, especially given that most of the power is generated within one catchment. Pilot projects for mini and micro hydropower projects are also being investigated to meet rural energy demand patterns. The potential for such projects is estimated to be 300 MW, however the viability of such systems and incentives for accelerated exploitation is still being explored. KPLC is exploring options for harnessing energy from rivers in western Kenya which may be less affected by variable hydrology. However, the impacts of climate change are not currently well-understood as a risk to further development of hydropower resource, and a significant increase generation in the short term is not an option.

Wind Power

Wind power offers significant potential for the generation of renewable power in Kenya. A 5 MW wind farm has been commissioned in the Ngong Hills near Nairobi and two other 300 MW wind farms are reportedly planned in the Turkana and Marsabit Districts. Challenges associated with wind generation relate to long roll out periods, large capital outlays and lack of transmission infrastructure linking projects with the national grid. Thus while wind generation offers huge potential for the medium to long term, it will be unable to meet increasing demands in the short term.

Solar Power

Solar power is suited to conditions throughout Kenya. The technology is sustainable and well proven especially for home or single building applications. However, production is limited to the daytime hours and production is expensive. Solar power may, therefore, only provide a limited short term power solution for Kenya.

Thermal Power

Coal, liquid fuels such as diesel and heavy fuel oil or natural gas can be used for thermal power generation. In Kenya, coal and natural gas are unavailable, however liquid fuels are imported either as crude oil (for refining at the Kenya Petroleum refineries in Mombasa) or imported as refined fuel. The disadvantages of thermal power include the production of greenhouse gases (CO_2), high levels of sulphur, and higher potentially higher operational costs than most other fuels. Conversely, thermal power generation can – as for this Project – be compact, reliable and can be installed within a short time frame; thermal power projects can also create suitable conditions for mobilisation of expertise and funding via IPP (as in the case of TPL). Thermal generation can therefore be a good option to meet short-term demand.

5.9.3 *Water Source Options for the Project*

The Hydro-geological and Geophysical Feasibility Study Report (1) assessed three possible sources of water for the Project; surface water from surrounding rivers, piped water from the local municipality, and groundwater from aquifers.

Surface Water

The nearest permanent surface water source to the site is the Ndarugo River, which originates from the Aberdares. The River feeds a water treatment plant downstream of the site, which supplies water to Juja Town. There is also a seasonal stream next to the site called the River Komu, that currently has significant water flow volumes due to the impact of downstream backfill

(1) Hydrogeological and Geophysical Investigations on Land reference No 8380/4, South West of Thika Municipality County of Kiambu; Geo Con Limited. December 2010.

deposits from road construction works on its flow path. The Ndarugo River flows throughout the year, although based on a review of water flow records, flows have been diminishing from 1948 to 1995.

The Ndarugo River could be a potential option for water supply for the Project. However, potential challenges exist relating to the existence of a road reserve through which piping would have to pass, substantial costs relating to the installation of piping and pumping, and diminishing flow volumes due to loss of head.

The River Komu, due to its seasonality cannot be considered to be a reliable water source for the Project all year round.

Piped Water

Piped water from the local municipality is sourced from Thika River. The authorities are currently tackling issues relating to low pressures in the pipe supply. Unforeseen interruptions in supply are also expected to increase due to ongoing expansion in population and industries in the region. These issues have the potential to have direct impacts on future supplies and are a considered to be a major restraint for this water supply option. The site is also not currently connected to the piped water supply and therefore construction of underground piping to link the site to mains pipes would be required.

Groundwater

Based on the feasibility study undertaken, Geo Con Limited recommended that groundwater abstraction from the aquifer directly beneath the site would be the preferable option for the Project water supply. The site is located in a hydrogeological zone with medium groundwater potential. The main productive aquifer is expected within the volcanic succession geological deposits at depths of more than 250 m below ground level. A shallow aquifer is expected to be present less than 20 m below ground level with another aquifer at depths of 100 to 150 m below ground level. The feasibility study recommends that the borehole is drilled to depths of at least 250m below ground level in order to prevent any potential impacts to shallower aquifer yields. Deeper aquifers with sufficient yields may be found below this (between 250m and 290m below ground level).

5.9.4 Site Location

As discussed in *Chapter 1*, the siting of the Project was stipulated in the RfP issued by KPLC for the power plant. Therefore TPL had no capacity to negotiate or influence the location of the Project site. The factors favouring a location on KPLC land adjacent to the already-programmed substation and transmission line is both efficient, and minimises social and environmental impact by eliminating any requirement for associated facilities to support the Project.

6 IMPACTS AND MITIGATION

6.1 INTRODUCTION

This Chapter outlines the specific methodologies used to assess impacts and discusses the potential impacts identified, discusses the significance of the impacts, defines mitigation measures, and describes residual impacts for each environmental and social topic area as relevant to the construction, operation and decommissioning phases of the Project.

6.2 AIR QUALITY

The assessment has been undertaken using detailed dispersion modelling and this section sets out the approach and methodology for the assessment, as well as the model inputs, assumptions and limitations. The limited information on the current air quality baseline has been presented in *Chapter 4.*

6.2.1 Methodology

Dispersion Model

The power plant will to be operated on HFO and as a result, the pollutants of concern will be:

- Particulate matter (as particulate matter of aerodynamic diameter ≤10µm (PM_{10}); as particulate matter of aerodynamic diameter ≤2.5µm ($PM_{2.5}$); and as total suspended particulates (TSP)).
- Sulphur dioxide (SO_2).
- Oxides of nitrogen (expressed as both total oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2).
- Carbon monoxide (CO).

These emissions have been derived from generic emission factors provided by the USEPA for combustion plants and set out in *AP-42, Compilation of Air Pollutant Emission Factors* (1).

The model used in the assessment is the USEPA AERMOD dispersion model, one of a number of 'new generation' models which are characterised by two main features:

(1)AP-42 Section 1.3; Compilation of Air Pollutant Emission Factors, United States Environmental Protection Agency, 2010

- The description of the boundary layer in terms of two parameters: the boundary layer depth and the Monin-Obhukov length.

- Dispersion under convective meteorological conditions uses a skewed Gaussian concentrations distribution.

AERMOD is considered to be appropriate for this type of assessment as the model is well recognised within the air quality and impact assessment practice by numerous organisations including the USEPA, the UK Environment Agency and the IFC.

In addition to the modelled Project emissions, some consideration is made of the baseline air quality conditions in the vicinity of the proposed Project as far as possible. However, as described in further detail below, baseline data for the area are particularly limited and as a result, a more qualitative assessment of the baseline has been undertaken.

Dust related to construction activities are considered qualitatively, on the basis of the potential for these emissions to primarily result in nuisance issues. This approach is used as modelling of these emissions is not appropriate, due to uncertainties in the model source term.

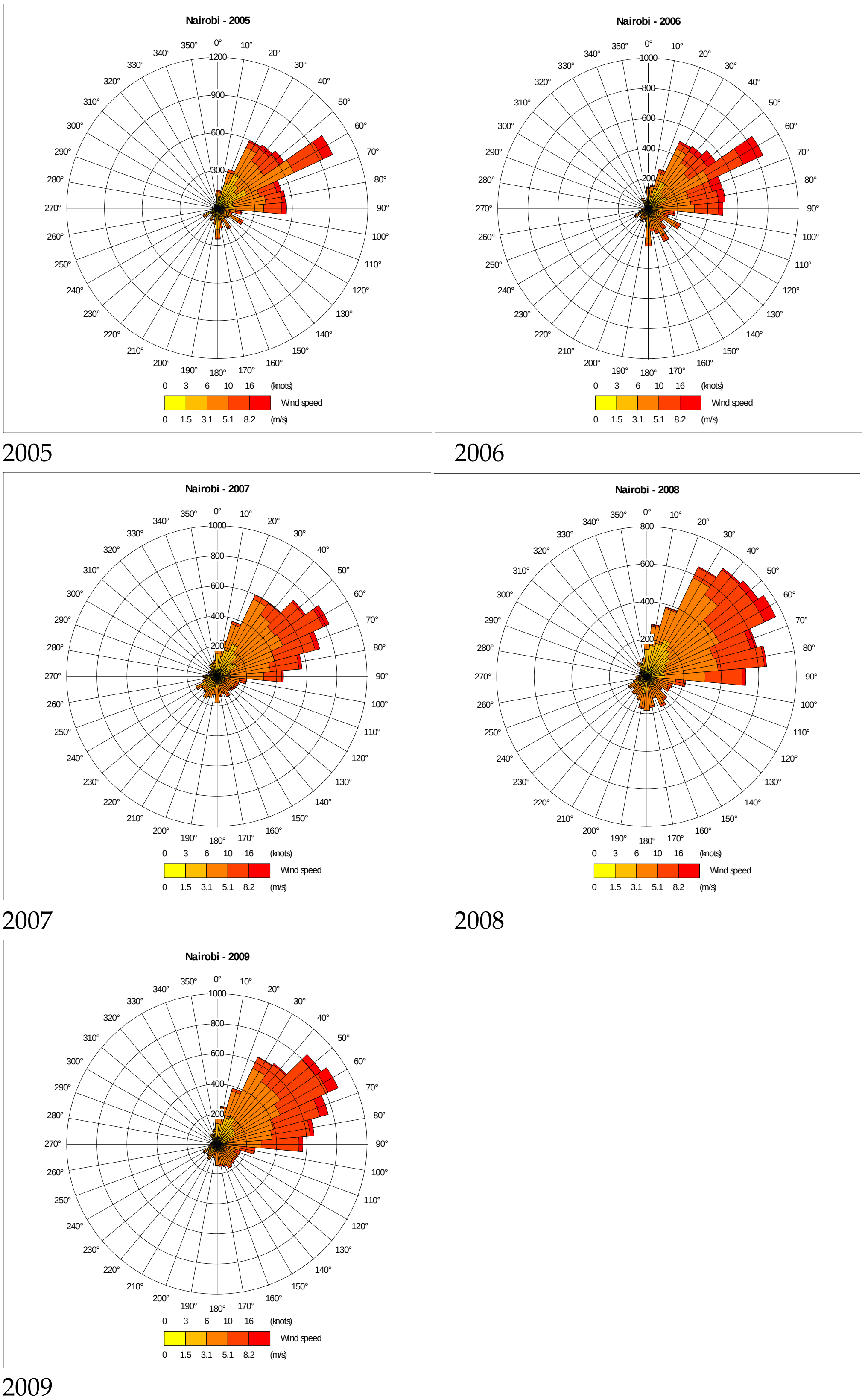
Vehicles running over open surfaces have the potential to generate dust. However, in this case, due to the small number of vehicles likely to be accessing the site (10 to 13 heavy goods vehicles per day during operation), the potential for generating dust is anticipated to be negligible. Given this relatively small number of vehicle movements, combustion emissions from these vehicles are also considered to be negligible: for context, the UK Highways Agency guidance document *Design Manual for Roads and Bridges* (DMRB) suggests that greater than 200 additional heavy vehicle movements per day are required in order to have a significant impact on air quality. In this case it is predicted that during operations there will be little over ten percent of this number. In addition, there are considered to be negligible impacts associated with odour, as there are no significant emission sources on site during the Project lifecycle.

The study area is primarily defined as an area within 2km of the proposed development location. This study area is defined as such as the maximum ground level concentration will be within this zone based, on the local terrain and exhaust height. As the air quality standards are applicable anywhere off-site, this is considered appropriate for the purposes of this assessment.

Meteorological Data

In line with best practice, five years of hourly sequential meteorological data recorded at Nairobi Airport were obtained and processed through the USEPA AERMET programme to generate files suitable for use in the air dispersion model. These data were for the years 2005-2009. Nairobi airport is the closest station which records meteorological data suitable for conducting dispersion modelling. The wind roses produced from this meteorological data set are presented below in *Figure 6.1*, identifying that the prevailing wind direction is predominantly from the northeast for all years assessed.

Figure 6.1 Wind Roses for Nairobi, 2005-2009



With the prevailing wind direction being almost exclusively from the northeast, air quality impacts from the Project will therefore be predominantly experienced to the southwest of the Project site for both short term and annual average concentrations.

Terrain Data

The topography of the surrounding Thika area is characterised by undulating hills and terrain is therefore considered to have the potential to influence the dispersion of emissions from the power plant. Therefore, topographical information has been included in the model calculations.

Surrounding Land Use

The pre-analysis of the meteorological and terrain data has reflected the land use in the vicinity of the Project which is characterised primarily by a mixture of generally degraded savannah, agricultural land and residential areas.

Percentage Oxidation of Nitric Oxide to Nitrogen Dioxide

During the combustion process, two nitrogen based pollutants are generated:

- Nitrogen dioxide (NO_2); and
- Nitric oxide (NO).

Together these comprise emissions of oxides of nitrogen. NO_2 is the pollutant of interest from a health perspective as this is considered the more toxic of the two, with NO being largely inert. The emissions from the combined stack will comprise, initially, primarily NO, but through various chemical reactions that will take place in the atmosphere, the NO will be converted to NO_2. Taking the worse case, the assumption is made that all of the NO is converted to NO_2 by the time the emissions reach ground level and therefore human receptors.

However, in reality this does not occur and only a proportion of the NO emitted will be converted to NO_2. This is due to the chemical reactions taking time to occur and also 'mopping up' other atmospheric chemicals such as ozone, a process which will limit the reaction rate and therefore limit the generation of NO_2. The conversion of NO to NO_2 is in part a function of the amount of ozone in the ambient air, and the travel time of the plume in the atmosphere (with time, more ozone is entrained into the plume and more conversion can therefore take place). It is expected that, in the area most impacted by the plume from the power plant, ozone concentrations will be low due to the absence of significant ozone precursor emissions upwind of the plant. Furthermore, this area is within 1 kilometre of the proposed power plant stack. At an average wind speed of 4 m/s, the plume travel time is about 250 seconds - very little time to entrain ozone and likely minimal NO to NO_2 conversion.

A number of international agencies have developed guidelines for including in assessments the conversion of NO to NO_2. A summary of the main guidelines are set out below in *Table 6.1*. The ratios set out in *Table 6.1* indicate that a wide range of ratios to convert NO to NO_2 are recommended by a variety of country agencies. On the basis of the recommended ratios, adopting a conservative approach and assuming that the suggested ratios are equally valid, it is recommended that for long term a conversion ratio of 75% is appropriate, and for short term a conversion ratio of 60% is appropriate. These conversion factors have been applied in the results interpretation.

Table 6.1 Recommended NO to NO_2 Conversion Ratio

Country	**Averaging period**	**Recommended conversion ratio NO to NO_2**
United States	24 hour	75%
	Annual	75%
Germany	24 hour	60%
	Annual	60%
United Kingdom	Short term (1 hour)	35%
	Annual	70%
Hong Kong	24 hour	20%
	Annual	20%
Ontario, Canada	24 hour	52%
	Annual	68%

Assumptions

The following assumptions have been made in relation to the air dispersion modelling undertaken as part of this assessment.

- Modelling has only been undertaken for emissions relating to the power plant i.e. not potential emissions relating to vehicles movements, construction activities, etc.

- The model assumes that the proposed plant operates using HFO with a sulphur content of 2%. This will be the maximum sulphur content percentage that TPL will use as stated in the PPA; therefore the plant may at some times operate using HFO with a sulphur content of less than 2%.

- The model assumes that the proposed plant will operate at 100% capacity on a continuous basis i.e. 24 hours per day; again this is a conservative approach as it is estimated that the plant will run at approximately 85% capacity for the majority of the time in order to be able to honour the PPA in terms of the power supplied.

Model Inputs

Table 6.2 sets out the model inputs used in this assessment.

Table 6.3 sets out the values used in the model relating to emissions arising from the plant based upon the use of HFO with a 2% sulphur content. This table also displays the emissions levels recommended in the IFC document "Environmental, Health, and Safety Guidelines for Thermal Power Plants", December 2008, Table 6 (A). It is noted that the NOx emissions from this plant are projected to be higher than the guideline level; however, consistent with the statements in the guidelines this level will achieve compliance with applicable air quality standards and impacts will be minimized by the use of a 65 meter stack.

Table 6.2 Model Inputs

Criteria					**Units**	**Value**
Building parameters						
ID	**Description**	**X** **M**	**Y** **m**	**Elevation** **M**	**Stack height** **m**	**Angle** **deg**
D	Cooling	283262	9882481	1505.17	8.2	-6
B1	SG 1	283215.4	9882529	1507.44	15.75	-6
B2	SG 2	283216.5	9882519	1507.84	15.75	-6
B3	SG 3	283217.4	9882509	1508.28	15.75	-6
B4	SG 4	283218.8	9882499	1508.68	15.75	-6
B5	SG 5	283219.7	9882490	1509.15	15.75	-6
A	GT's	283181	9882457	1514.62	12.6	-6
E		283222.3	9882464	1510.38	18.9	-6
Emission parameters – engines						
Source Location[1] (Stacks 1, 2, 3, 4 and 5)					m	283233.8, 9882510
Stack height					m	65
Stack diameter (effective)[1]					m	3.47

1: The six stacks are co-located adjacent to one another and modelled here as a single stack. This is reflected in model input values and the effective diameter is based upon 5 x 1.55m diameter stacks

Dust Impact Assessment

Emissions of dust will arise from the site during construction activities, primarily as a result of earth moving activities and the passage of vehicles over open ground. Emissions of dust are primarily associated with nuisance issues at nearby sensitive receptors, due to the deposition of dust on surfaces, such as window sills, washing, vehicles etc.

The generation of dust will depend upon the prevailing weather conditions:

- at wind speeds of <5.6 m/s dust is unlikely to be listed from surfaces and emissions will therefore be negligible(1);

- at all but the most extreme wind speeds, dust will typically travel a maximum of 200m from source before falling from the air column[1];

- at the highest wind speeds, dust is unlikely to travel more than 500m from source; and

- precipitation will effectively attenuate dust, with rainfall of >0.2mm/hour likely to effectively attenuate dust emissions(2).

The assessment of the potential for significant dust nuisance to arise is undertaken with due consideration of these weather factors; the proximity of receptors to dust sources; and the duration of dust generation activities. On the basis of these factors the risk matrix set out in *Table 6.4* has been developed.

Table 6.3 Power Plant Emissions Values (Based on HFO with 2% Sulphur Content)

Fuel type	Units	Value	IFC Guideline
Emission flow rate	Nm^3/s	124	
Emission flow rate	Am^3/s	237	
Emission temperature	Celsius	163	
SO_2	mg Nm^{-3}	1167	1170
CO	mg Nm^{-3}	105	n/a
NO_x	mg Nm^{-3}	2000	1850
PM_{10}	mg Nm^{-3}	50	50
SO_2	g/s	144	
CO	g/s	13.0	
NO_x	g/s	248	
PM_{10}	g/s	6.21	

Note: SO_2 emissions based upon 2.0% fuel sulphur content.

(1)AP-42 Section 13.2; United States Environmental Protection Agency 1995
(2) http://www.communities.gov.uk/documents/planningandbuilding/pdf/mps2annex1.pdf; (UK Office of the Deputy Prime Minister 2005)

Table 6.4 Dust Nuisance Assessment Matrix

Likely magnitude of impact	Conditions
Likely major significant impact	• Receptor within 200m of dust source • Dust generating activities for >12 months • Downwind for >10% of the year where wind and rainfall conditions promote dust generation
Likely moderate significant impact	• Receptor within 200m of dust source • Dust generating activities for <12 months • Downwind for >10% of the year where wind and rainfall conditions promote dust generation
Likely minor significant impact	• Receptor within 200m of dust source • Dust generating activities for <12 months • Downwind for 2-5% of the year where wind and rainfall conditions promote dust generation • Receptor within 500m of dust source • Dust generating activities for >12 months • Downwind for 2-5% of the year where wind and rainfall conditions promote dust generation
Insignificant impact	• Receptor > 500m of dust source • Receptor 200m – 500m from dust source • Downwind for <2 of the year where wind and rainfall conditions promote dust generation

6.2.2 *Air Quality Standards*

The IFC has been consulted regarding the appropriate standards to be used in the assessment and has agreed that the primary standards to be used are the European Union (EU) air quality standards. In addition, consideration will be made of the draft Kenyan air quality standards; however, it is acknowledged that these are in draft format and are not yet legally binding within Kenya. The Kenyan air quality standards include a consideration of the type of area within which a project is located, i.e. an industrial area, residential area or protected area. For the purposes of this assessment and for the purpose of taking a conservative approach, it is assumed that the residential standards apply. The EU standards make no such differentiation, and as such apply equally at all off-site locations.

On the basis of the above, *Table 6.5* sets out the Kenyan and EU air quality standards used in the assessment. Where Kenyan standards are set out in terms of parts per million, these have been converted to $\mu g/m^3$ for ease of comparison.

In the majority of cases, the Kenyan and EU air quality standards are relatively comparable; however, in some cases the Kenyan standards differ from the EU standards (i.e. PM_{10} 24 hour mean is less stringent in the Kenyan standards, whilst the CO standard is more so).

Table 6.5 Air Quality Standards used in the Assessment

Draft Kenyan Standards			EU Standards		
Pollutant	Averaging period	Criterion (μg/m³)	Pollutant	Averaging period	Criterion (μg/m³)
SO_2	annual average	50			
SO_2	24 hour 98 percentile	80	SO_2	24 hour 99.2 percentile	125
-	-	-	SO_2	1 hour mean 99.7 percentile	350
SO_2	10 min maximum	508	-	-	-
NO_x	annual average	60	-	-	-
NO_x	24 hour 98 percentile	80	-	-	-
NO_2	annual average	96	NO_2	annual mean	40
NO_2	monthly average	153	-	-	-
NO_2	24 hour maximum	100	-	-	-
NO_2	one hour maximum	383	NO_2	1 hour mean 99.8 percentile	200
NO_2	Instant peak maximum	957	-	-	-
TSP	annual average	100	-	-	-
TSP	24 hour maximum		-	-	-
TSP	24 hour 98 percentile	180	-	-	-
PM_{10}	annual average	50	PM_{10}	annual mean	40
PM_{10}	24 hour 98 percentile	100	PM_{10}	24 hour 90.4 percentile	40
$PM_{2.5}$	annual average	35	$PM_{2.5}$	annual mean	25
$PM_{2.5}$	24 hour maximum	75	-	-	-
CO	8 hour 98 percentile	2000	CO	8 hour rolling mean	10000
CO	1 hour maximum	4000			

6.2.3 *Significance Criteria*

Air Quality

The significance of the predicted impacts is considered in terms of:

- The Process Contribution (PC): this is the impact on air quality arising from the process emissions only; and

- The Predicted Environmental Concentration (PEC): this is the PC added to the existing baseline.

However, as described in more detail in *Chapter 4*, there is only poor baseline air quality information available, and therefore accurate determination of the PEC is not possible. On this basis, the significance criteria normally used for this type of process which makes reference to the PEC is not appropriate.

Within the IFC General EHS guidelines (1) the following criterion is recommended with regard to the PC only for assessing the potential for significant impacts:

> *"The PC can be considered insignificant where is accounts for <25% of the appropriate air quality standard."*

However, where an impact is >25% of the air quality standard this does not conclude that an impact is automatically significant. Instead, the implication is that more detailed consideration should be made of the existing airshed (i.e. baseline conditions), and the need to preserve the airshed in order to allow for any future developments that may also impact on air quality.

As described in *Section 1.2.4*, the baseline pollution concentrations are likely to be low. In addition, the area surrounding the Project site is currently classified by the District authorities for agricultural development, and there are no planned or committed proposals for industrial development in the vicinity. There is unlikely, therefore, to be elevated baseline pollution and no overriding reason to need to protect the airshed for the purposes of future development. On this basis, where:

- The PC <75% of the air quality standard, impacts are *insignificant*;

- The PC between 75% and 100% of the air quality standard, impacts are of *minor significance*; and

- The PC >100% of the air quality standard, impacts are of *major significance*.

Greenhouse Gas Emissions

In addition to the significance criteria set in relation to impacts on air quality, significance criteria have also been defined based upon IFC guidance for greenhouses gases (GHG), in this case carbon dioxide (CO_2). The GHG

(1) http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS_1-1/$FILE/1-1+Air+Emissions+and+Ambient+Air+Quality.pdf ; IFC (2007) Environmental, Health, and Safety Guidelines General EHS Guidelines: Environmental Air Emissions And Ambient Air Quality

assessment criteria are based on *IFC Performance Standard 3 for Pollution Prevention and Abatement*, which states that the significance threshold is:

"100 kilo tonnes CO_2-eq per year for a single project or development".

The total GHG emission forecast is presented as tonnes of CO_2 equivalent (CO_2-e).

6.2.4 Receptors

Within the model, two receptor grids have been defined in order to capture the maximum off-site locations. A fine grid was defined with a resolution of 50m and extents of 2,500m in each cardinal direction, and a Coarse grid was defined with a resolution of 100m and extents of 5000m in each cardinal direction. In addition, a number of individual receptors have also been defined on the basis of a review of the surrounding environment, upon mapping prepared for the ESIA, and upon information supplied TPL. These are set out in *Table 6.6*.

Figure 6.2 Air Quality Receptors

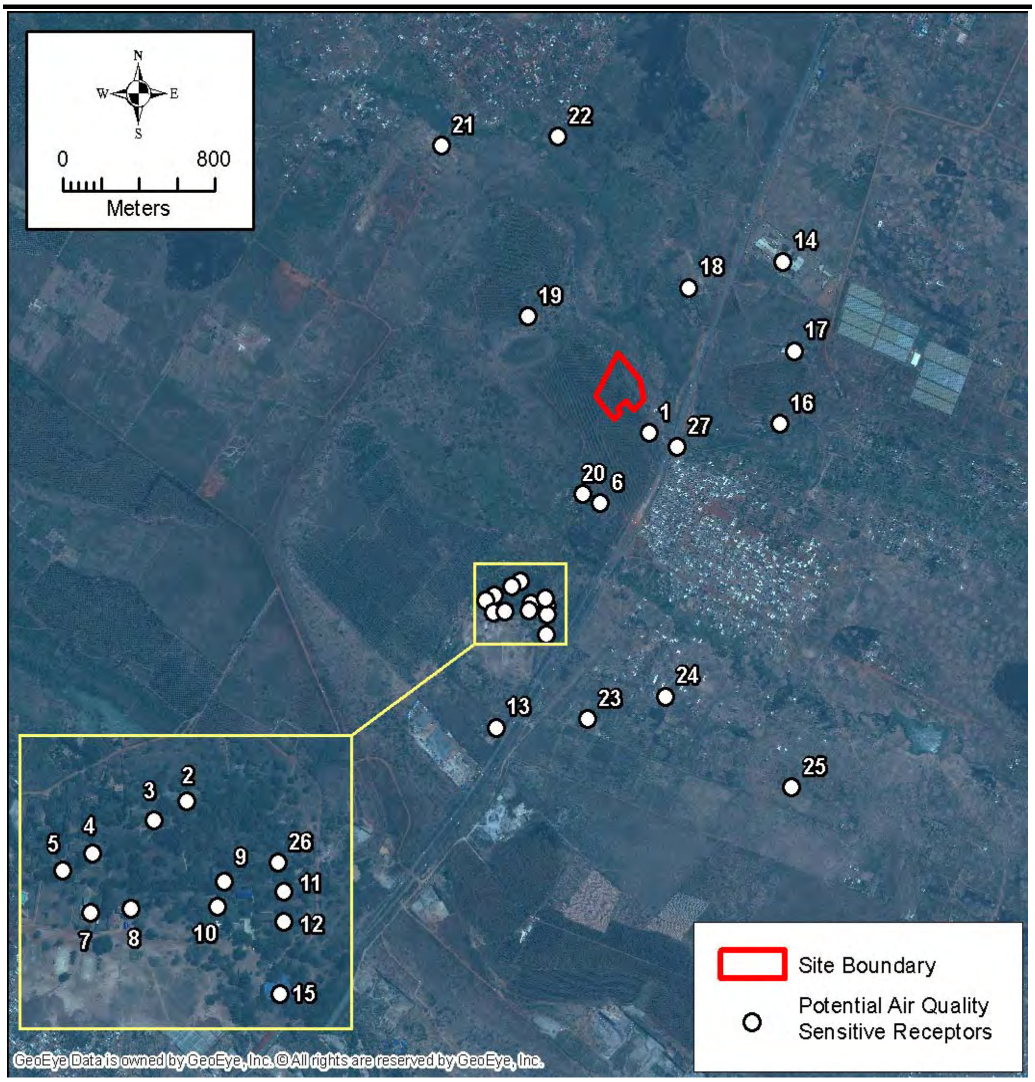


Table 6.6 Potential Sensitive Receptors

No.	Receptor	Easting (m)	Northing (m)	Distance from site (m) [1]
1	Nearest Residential Properties	283256	9882457	75
2	Hotel	282577	9881706	964
3	Hotel (2)	282529	9881680	1014
4	Kimathi Kenyatta House	282439	9881633	1109
5	Ronald Ngala Scheider House	282396	9881610	1155
6	Mang'u High School Staff Accommodation	283000	9882100	400
7	Mang'u High School Dispensary	282437	9881551	1172
8	Mang'u High School Mess	282496	9881556	1132
9	Mang'u High School Library	282632	9881595	1022
10	Mang'u High School Laboratory	282622	9881560	1057
11	Mang'u High School Middle Block	282719	9881580	991
12	Mang'u High School Junior Block	282719	9881539	1028
13	Kuraiha Primary School	282448	9880967	1661
14	Castle Breweries (disused)	283964	9883323	1167
15	Mang'u High School Chapel	282713	9881438	1121
16	Human Receptor 1	283948	9882502	768
17	Human Receptor 2	284023	9882871	938
18	Human Receptor 3	283468	9883191	788
19	Human Receptor 4	282616	9883045	815
20	Human Receptor 5	282906	9882146	415
21	Human Receptor 6	282158	9883911	1778
22	Human Receptor 7	282773	9883956	1554
23	Human Receptor 8	282932	9881009	1469
24	Human Receptor 9	283343	9881124	1343
25	Human Receptor 10	284011	9880664	1976
26	Mang'u High School Senior Block	282710	9881621	960
27	Witeithie Estate (closest point)	283405	9882385	235

Note: Distance calculated from stack location to nearest point of receptor

6.2.5 *Impact Description and Significance: Construction*

Positive Impacts

With regard to air quality, there are no specific positive impacts relating to the construction of the proposed Project.

Negative Impacts

The negative impacts identified due to air borne emissions at the Thika site are primarily related to emissions of dust arising from construction activities at the site.

A review of receptor locations identified that within 500m of the site boundary are areas of the Witeithie Estate (300m to the south east), properties on the Mang'u High School accommodation (400m south west), and two small outlying properties to the east of the site (approximately 75-100m to the south east).

As previously discussed, the potential for dust nuisance is unlikely at locations between 200m and 500m, except in the most extreme wind conditions. In addition, wind speeds of <5.6m/s are unlikely to lift dust and rainfall of >0.2mm/hour will effectively attenuate dust. The latter is particularly pertinent as the proposed construction programme is likely to occur in the rainy season.

Meteorological data for 2009 have been used to assess the dust conditions, the results of which are set out in *Table 6.7*. The table sets out the percentage of the year when the wind speed and precipitation are sufficient to generate dust, and the direction towards which the wind is blowing.

Table 6.7 ***Summary of Dust Generating Conditions and Migration, 2009***

Direction (wind blowing toward)	Percentage of the year
South	0.33%
Southwest	11%
West	12%
Northwest	0.63%
North	0.25%
Northeast	0.08%
East	0.02%
Southeast	0.03%
Weather conditions unlikely to result in dust being generated	*75.7%*

This analysis demonstrates that for >75% of the year significant dust generation on site is unlikely. For the reminder of the year, any generated dust will migrate towards the Witeithie Estate 0.36% of the year; towards the outlying properties for 0.03% of the year and towards Mang'u High School accommodation for 11% of the year. However, in the case of the Witeithie Estate and Mang'u High School, due to the distance between the site and the receptor, dust nuisance is unlikely.

Emissions arising from traffic associated with the construction activities are considered likely to be negligible. As previously discussed, DMRB states that impacts to air quality associated with HGV traffic are unlikely to be significant for less than 200 additional vehicles per day.

On the basis of the potential impacts identified for the construction phase, a dust mitigation component has been included in the Construction Management Plan (see *Annex A*) in order to ensure that the potential for dust generation is minimised.

6.2.6 *Impact Description and Significance: Operation - Plant Emissions*

Positive Impacts

With regard to air quality, there are no specific positive impacts relating to the operation of the proposed Project.

Negative Impacts

The negative impacts identified due to air borne emissions at the Thika site are impacts on human health from emissions of particulate matter (PM_{10}, $PM_{2.5}$ and total particulates), NO_x, NO_2, CO and SO_2 arising from the combustion of fuel in the power plant.

The process contributions (PC) from the operation of the power plant following sources have been modelled using the AERMOD air dispersion model, a summary of the results of which are set out in *Table 6.8*. This sets out the maximum off-site impacts. In addition, the maximum impacts on site at the main compound of the nearby Mang'u High School have been reported, as this contains the nearest sensitive receptor locations in the primary downwind direction.

In order to assess potential impacts, comparison has been made with EU and draft Kenyan air quality standards. As discussed in *Chapter 3*, as the available baseline data are too limited to be used in the air quality assessment only the PC, not the PEC, has been compared to the air quality criteria with respect of the significance criteria set out in *Section 0*.

The results of the assessment indicate that there are ***no significant impacts*** associated with the operation of the proposed process at any sensitive receptor locations. With regard to the maximum impact anywhere off-site, there are also no significant impacts associated with the operation of the proposed process, with the exception of 1 hour NO_2 when compared against the EU standard for which there is predicted to be a minor significant impact. However, it should be acknowledged that this only occurs as the assessment allows headroom for the existing baseline conditions, and it is unlikely that the baseline will be sufficient to result in the air quality standard being exceeded at this point, as the baseline is expected to be low in all locations except the immediate vicinity of the roadside.

Table 6.8 Summary of Impacts due to Process Emissions

Pollutant	Averaging Period	Basis of Assessment	Source	Criterion µg/m³	Maximum Impact µg/m³	Percent of Criterion %	Significance	Mang'u High School µg/m³	Percent of Criterion %	Significance	Mang'u High School Staff Accommodation µg/m³	Percent of Criterion %	Significance
SO_2	Annual	Maximum	Kenyan	50	14.5	29%	Insignificant	10.4	21%	Insignificant	7.86	16%	Insignificant
	24 hour	Not to be exceeded more than 3 times per year	Kenyan	80	36.9	46%	Insignificant	28.4	35%	Insignificant	25.9	32%	Insignificant
	24 hour	Not to be exceeded more than 3 times per year	EU	125	36.9	30%	Insignificant	28.4	23%	Insignificant	25.9	21%	Insignificant
	1 hour	Not to be exceeded more than 25 times per year	EU	350	119	34%	Insignificant	95.1	27%	Insignificant	115	33%	Insignificant
NO_2	Annual	Maximum	Kenyan	60	18.7	31%	Insignificant	13.4	22%	Insignificant	10.1	17%	Insignificant
	Month	Maximum	Kenyan	153	31.7	21%	Insignificant	26.3	17%	Insignificant	20.1	13%	Insignificant
	24 hour	Maximum	Kenyan	100	42.4	42%	Insignificant	32.2	32%	Insignificant	31.6	32%	Insignificant
	24 hour	Not to be exceeded more than 3 times per year	Kenyan	80	38.0	47%	Insignificant	29.2	36%	Insignificant	26.6	33%	Insignificant

Pollutant	Averaging Period	Basis of Assessment	Source	Criterion µg/m³	Maximum Impact µg/m³	Percent of Criterion %	Significance	Mang'u High School µg/m³	Percent of Criterion %	Significance	Mang'u High School Staff Accommodation µg/m³	Percent of Criterion %	Significance
	1 hour	Maximum	Kenyan	383	139	36%	Insignificant	111	29%	Insignificant	139	36%	Insignificant
	Annual	Maximum	EU	40	18.7	47%	Insignificant	13.4	34%	Insignificant	10.1	25%	Insignificant
	1 hour	Not to be exceeded more than 18 times per year	EU	200	124	62%	Insignificant	98.3	49%	Insignificant	119	60%	Insignificant
TSP	Annual	Maximum	Kenyan	100	0.623	0.62%	Insignificant	0.447	0.45%	Insignificant	0.337	0.34%	Insignificant
	24 hour	Not to be exceeded more than 3 times per year	Kenyan	180	1.76	1.0%	Insignificant	1.34	0.74%	Insignificant	1.32	0.73%	Insignificant
PM_{10}	Annual	Maximum	Kenyan	50	0.623	1.2%	Insignificant	0.447	0.89%	Insignificant	0.337	0.67%	Insignificant
	24 hour	Not to be exceeded more than 3 times per year	Kenyan	100	1.76	1.8%	Insignificant	1.34	1.3%	Insignificant	1.32	1.3%	Insignificant
	Annual	Maximum	EU	40	0.623	1.6%	Insignificant	0.447	1.1%	Insignificant	0.337	0.84%	Insignificant
	24 hour	Not to be exceeded more than 35 times per year	EU	50	1.76	3.5%	Insignificant	1.34	2.7%	Insignificant	1.32	2.6%	Insignificant
$PM_{2.5}$	Annual	Maximum	Kenyan	35	0.623	1.8%	Insignificant	0.447	1.3%	Insignificant	0.337	0.96%	Insignificant

Pollutant	Averaging Period	Basis of Assessment	Source	Criterion μg/m³	Maximum Impact μg/m³	Percent of Criterion %	Significance	Mang'u High School μg/m³	Percent of Criterion %	Significance	Mang'u High School Staff Accommodation μg/m³	Percent of Criterion %	Significance
	24 hour	Maximum	Kenyan	75	1.76	2.4%	Insignificant	1.34	1.8%	Insignificant	1.32	1.8%	Insignificant
	Annual	Maximum	EU	25	0.623	2.5%	Insignificant	0.447	1.8%	Insignificant	0.337	1.3%	Insignificant
CO	8 hour	Not to be exceeded more than 3 times per year	Kenyan	2000	12.1	0.60%	Insignificant	9.67	0.48%	Insignificant	12.1	0.60%	Insignificant
	1 hour	Maximum	Kenyan	4000	12.1	0.30%	Insignificant	9.67	0.24%	Insignificant	12.1	0.30%	Insignificant

6.2.7 *Impact Description and Significance: Operation - Emissions of Greenhouse Gases*

The proposed facility will contribute to greenhouses gases through the emission of fossil fuel derived carbon dioxide (CO_2) to the atmosphere. The main source of CO_2 emissions during operation being from the combustion of HFO to generate power. .

GHG emissions from the proposed facility have been calculated based upon the predicted emissions arising during nominal operations (i.e. 85% maximum capacity). The following calculation has been undertaken to quantify CO_2 emissions:

- total HFO usage: 470m^3/day;
- emissions of CO_2 from HFO combustion: 2596 kg/m^3 (cited in reference as 11.8kg CO_2/ gallon HFO) (1);
- total emissions of CO_2: 1220000 kg/day; or
- total emissions of CO_2: 445000 tonnes/year.

The total Project operational emissions are estimated as 445 kt eq CO_2/yr. This is above the 100 kt eq CO_2/yr significance criteria presented in *Section 0*, so the Project constitutes a ***significant impact to GHG emissions***.

6.2.8 *Impact Description and Significance: Operation - Other Impacts*

During operations there are unlikely to be any significant emissions of dust or odour and these have therefore not been assessed. In addition, there will be relatively few vehicle movements associated with the operation of the facility, and therefore impacts associated with road traffic have also not been assessed.

6.2.9 *Impact Description and Significance: Decommissioning*

Positive Impacts

With regard to air quality, there are no specific positive impacts relating to the decommissioning of the proposed Project.

Negative Impacts

The negative impacts identified due to air borne emissions at the Thika site are primarily related to emissions of dust arising from decommissioning, demolition and site clearance activities at the site.

(1) http://www.eia.doe.gov/oiaf/1605/coefficients.html; (US Energy Information Administration; 2011)

Emissions arising from traffic associated with the decommissioning activities are considered likely to be negligible, due to the relative small numbers of vehicles that will be accessing the site and present on site during construction.

Emissions arising from site draindown and removal of plant are also expected to be negligible, as there are anticipated to be minimal quantities of residual materials remaining on site at decommissioning.

On the basis of the potential impacts identified for the decommissioning phase, a dust mitigation programme will be developed in the Site Closure and Restoration Plan (SCRP: see *Chapter 7* for further detail).

6.2.10 Impact Description and Significance: Summary

Table 6.9 provides a summary of the key impacts to air quality associated with the construction, operation and decommissioning of the proposed power plant.

6.2.11 Mitigation

Construction

Whilst there are no significant impacts identified for the construction phase of the proposed development, it is recommended that best practice measures are implemented to minimise the potential for dust to be generated and escape off-site. Recommended mitigation measures during construction are outlined in *Box 6.1.*

In addition to the mitigation measures set out in *Box 6.1*, a dust management programme will be implemented that sets out measures for the visual assessment of dust emissions, additional mitigation if excessive dust emissions are observed and formalised responses for responding to, substantiating and dealing with any dust nuisance complaints. The plan will also identify the receptors most at risk and the ambient conditions of wind speed and direction that could transport dust to these receptors. This will allow suitable mitigation to be implemented in a timely and focused manner.

Table 6.9 Summary of Significance for all Identified Impacts from Air Pollution

Impact	Source	Significance
Construction		
Dust	Site traffic associated with construction, worse in dry seasons	Insignificant Adverse Direct Temporary/Short term
PM_{10} and NO_2 / NO_x	Site Vehicle Emissions and vehicles accessing site	Insignificant Adverse Direct Temporary/Short term
Operation		
SO_2, NO_2, PM_{10}, $PM_{2.5}$, total particulates and CO	Burning of heavy fuel oil	Insignificant Direct Long Term
Sustainability	Burning of heavy fuel oil	Moderate – Minor Adverse Direct Long term
Dust	Dust emissions during operation are likely to be insignificant due to hardstanding and small numbers of on-site vehicles	Insignificant Direct Long term
Odour	Dust emissions during operation are likely to be insignificant due to hardstanding and small numbers of on-site vehicles	Insignificant Direct Long term
Greenhouse gases	Emissions of greenhouse gases during operations are significant	Significant Adverse Direct Long term
Decommissioning		
Dust	Site traffic associated with decommissioning, worse in dry seasons	Moderate Adverse Direct Temporary/Short term
PM_{10} and NO_2	Site Vehicle Emissions and vehicles accessing site	Insignificant Direct Temporary/Short term

Box 6.1 Mitigation

- Upon completion of finish grading, earth firebanks and slopes that will remain unseeded will be temporarily protected against erosion by applying a coat of liquid asphalt to the surface, as indicated below:
  - Tightly bonded surfaces: 1.4 litre/sq. meter of MC-30;
  - Loosely bonded fine- grained surfaces: 2.3 litre/sq.meter of MC-70 or SC-70; and
  - Loosely bonded coarse- grained surfaces:3.6 litre/sq. meter of MC-250 or SC-250.
- Natural binder material extracted from plants, as manufactured by Roadbind Inc. or equal will also be used for erosion and dust control, if required, for example on long term exposed surfaces, or on long term stockpiles. These products are environmentally safe, non-toxic, and biodegradable. The spraying rate shall be per manufacturer's recommendation.
- All materials with the potential to lead to dust emissions will be transported in sheeted trucks.
- Wash down of dirty equipment, such as excavators, dump trucks and drilling equipment will be undertaken as required, to avoid excessive build up of dirt and mud on equipment.
- Water suppression or dust extraction will be fitted where possible to construction equipment that has the potential to generate dust, e.g. during drilling, excavating, etc.
- Surfaces that are to be excavated or cleared will be dampened prior to clearing or excavation where there is potential for excessive dust to be created.
- In the event that there is a build up of dirt or mud on access roads of the highway, this will be cleaned to remove this build up.
- On-site vehicle speeds on unhardened roads and surfaces will be limited to less than 15 kph.
- Drop heights for material transfer activities such as unloading materials will be minimised.
- Bowsers (water tankers) or similar equipment will be available for use to wash down surfaces and roads and damp down surfaces.
- Drains and guttering on site will be maintained in a clean state to reduce the potential for materials to become dry and friable.
- Bitumen will not be overheated and where possible, bitumen will not be heated with open flame burners.
- Pots and tanks containing hot bitumen will be covered to minimise fume production.

Operation

The only specific mitigation measure for the control of impacts during operations, it to ensure that the sulphur content of the heavy fuel oil does not exceed 2%, as this will lead to increases in SO_2 emissions from the plant.

Decommissioning

Whilst there are no significant impacts identified associated with the decommissioning phase of the Project, it is recommended that best practice measures are implemented to minimise the potential for dust to be generated and escape off-site. These mitigation measures will be developed as part of the SCRP, and will be broadly similar to those identified in *Box 6.1* and the remainder of the above section describing management of dust impacts during construction.

6.2.12 Residual Impacts

Construction

The residual impacts during construction are likely to be insignificant, on the basis of the locations of nearby sensitive receptors, and meteorological conditions. However, the implementation of the recommended mitigation measures should ensure that any impacts are negligible.

Operation

The impacts of emissions of NO_x, NO_2 and SO_2 are of minor significance in light of the Kenyan and EU air quality standards. Implementation of the mitigation measures relating to fuel sulphur content should ensure that the impacts relating to SO_2 emissions are no worse than those predicted here.

Decommissioning

The residual impacts during decommissioning are likely to be insignificant, on the basis of the locations of nearby sensitive receptors, and meteorological conditions. However, the implementation of the recommended mitigation measures should ensure that any impacts are negligible.

6.2.13 Limitations

There are a number of assumptions and limitations within the assessment. That primary assumptions relating to the assessment of point source emissions are set out in *Section 6.2.1*. In addition, the following key limitations have also been noted.

- The emissions of all pollutants except SO_2 from the plant are based upon guaranteed emission limits from the technology suppliers (MAN). In practice, the emissions are likely to be somewhat lower than these.

- The emissions of SO_2 from the plant are based upon a fuel sulphur content of 2%. In practice this is the maximum sulphur content of the fuel that will be used in the plant and therefore SO_2 emissions may on occasion be lower that used in the assessment.

- There is a degree of uncertainty in the baseline conditions, due to the absence of adequate baseline monitoring. Consideration of the baseline with respect to other nearby sources of emissions suggests that the baseline is likely to be only a small percentage of the air quality standards in most cases and locations. The exceptions may be for PM_{10}, which may be elevated due to emissions arising from natural sources, and also in close proximity of the highway where the baseline concentrations of NO_2 and PM_{10} may be somewhat elevated due to road traffic emissions. It is proposed that monitoring be undertaken in line with IFC requirements if the plant becomes operational to validate this position and verify that no air quality standards are likely to be exceeded.

Table 6.10 Summary of Residual Impacts Significance for all Identified Impacts from Air Pollution

Impact	Source	Significance
Construction		
Dust	Site traffic associated with construction, worse in dry seasons	Insignificant Adverse Direct Temporary/Short term
PM_{10} and NO_2	Site Vehicle Emissions and vehicles accessing site	Insignificant Adverse Direct Temporary/Short term
Operation		
SO_2, NO_2, PM_{10}, $PM_{2.5}$, total particulates and CO	Burning of heavy fuel oil	Insignificant Direct Long Term
Sustainability	Burning of heavy fuel oil	Moderate – Minor Adverse Direct Long term
Dust	Dust emissions during operation are likely to be insignificant due to hardstanding and small numbers of on-site vehicles	Insignificant Direct Long term
Odour	Dust emissions during operation are likely to be insignificant due to hardstanding and small numbers of on-site vehicles	Insignificant Direct Long term
Greenhouse gases	Emissions of greenhouse gases during operations are significant	Significant Adverse Direct Long term
Decommissioning		
Dust	Site traffic associated with decommissioning, worse in dry seasons	Moderate Adverse Direct Temporary/Short term
PM_{10} and NO_2	Site Vehicle Emissions and vehicles accessing site	Insignificant Adverse Direct Temporary/Short term

6.3 NOISE

In order to assess the effects of the proposed development in terms of noise, the existing baseline noise environment (see *Section 4.1.6*) has been taken into account when developing appropriate noise assessment criteria. Both Kenyan national legislation and IFC guidance have been considered in assessing the noise from construction and operation of the plant, as appropriate.

The effect of the neighbouring substation, which has already been approved and is not being promoted or controlled by TPL, has not been taken into account in this assessment. There is no reliable information regarding noise emissions from this site, and it is assumed that the relatively small scale of the substation would not significantly increase the baseline noise levels used in assessing predicted noise levels from the main power plant at off-site locations.

Since empirical data suggest that vibration from construction plant is not likely to be perceptible beyond about 100 m and the nearest receptors are located approximately 100 m from the site, vibration during construction is not expected to be a significant effect of the Project. Vibration from operational equipment is unlikely to be perceptible beyond the site boundary. Therefore, vibration has not been considered further in this assessment.

6.3.1 *Impact Description and Significance: Construction*

Impact Description

The source of noise impacts during construction is likely to include local temporary noise from construction plant activities, including ground clearance, piling, concreting and equipment installation. Earthworks and civil works construction are expected to take approximately 7-9 months.

Construction traffic will generate very little additional noise, as it will access the site using the heavily trafficked Nairobi – Thika highway (which carries approximately 1800 movements per hour of which approximately 50% are heavy goods vehicles: HGVs). Construction flows to the site will be between 6 and 9 movements (i.e. total movements in either direction) per hour during a 10 hour working day. Construction traffic will use an access road that will be created on the south western side of the site boundary to service the neighbouring substation, and which will form the entrance for operational traffic to the TPL site. This route is at least 180 m from the nearest receptors (Receptor 3). These receptors are a similar distance from the Thika to Nairobi highway and traffic noise is not expected to result in a significant impact, and is not considered further in this Section.

Impact Significance

National Legislation

The Kenyan regulations relating to noise are covered by Section 147 of the Environmental Management and Coordination Act (EMCA), Kenyan Legal

Notice No.61 - *The Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.*

Part II, Section 13 - Construction at night states:

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

The "permissible noise levels" for the Second Schedule of Legal Notice No.61 are presented in *Table 6.11*.

The criteria that relate to construction noise are shown in *Table 6.11*.

Table 6.11 Second Schedule - Maximum Permissible Noise Levels for Construction Sites

Zone	Maximum Noise Level Limits Permitted (dB LAeq)	
	Daytime 07:00 to 22:00	Night 22:00 to 07:00
(i) Health facilities, educational institutions, homes for disabled etc.	60	35
(ii)Residential	60	35
Areas other than those prescribed in (i) and (ii).	75	65

In some cases the baseline noise may be sufficiently high that even noise levels from the plant that exceed the above standards may only give rise to small changes in ambient noise – and which result in noise impacts that will not cause a significant change. In line with the approach of the IFC, if changes in background noise as a result of noise emissions from the plant are no greater than 3 dB(A) then noise impacts are not deemed significant, even if they are above the Kenyan standards.

There are unlikely to be positive impacts in terms of noise. Construction noise impacts have been considered to be significant if they are Moderate or above as shown in *Table 6.12*.

For all receptors in this ESIA the Kenyan regulations are 60 dB(A) during the day and 35 dB(A) at night. If an impact takes place over a very short duration (less than approximately 2 weeks) the impact is defined as Minor in terms of its overall significance. If construction noise levels are below, or meet, the Kenyan Regulations the significance of the impact is Negligible. Minor and Negligible impacts would not justify noise mitigation beyond good site practice.

Table 6.12 Overall Significance Criteria for Construction Noise Impacts in the ESIA

	Low Magnitude Impact (1 to 5 dB above Kenyan Regulations)	Moderate Magnitude Impact (>5 to 10 dB above Kenyan Regulations)	High Magnitude Impact (Greater than 10 dB above Kenyan Regulations)
Residential Receptors	**Minor**	**Moderate**	**Major**
Educational Establishments	**Minor**	**Moderate**	**Major**

Predicted Impacts

The predicted noise levels, based on a high noise source level of 125 dB $L_{Aeq,\ 12\ hour}$ are shown in *Table 6.13*. It is assumed that construction will take place during daytime only.

Mitigation

Although the ***minor construction noise impacts*** shown in *Table 6.13* are not high enough to require further mitigation, good site practice will be employed to minimise noise, which could include the following measures:

- selection of low noise equipment;
- temporary screening of the equipment;
- switching equipment off when not in use; and
- construction of on-site buildings first, to act as noise screens.

Typically such measures can result in noise reductions of between 5 and 10 dB(A). For further details on mitigation measures during construction, see *Chapter 7 and Annex A.*

Residual Impact

Following successful implementation of the proposed mitigation, the significance will be reduced to ***negligible***, although it is recognised that there may be some increases in noise levels locally during parts of the construction period.

Table 6.13 Predicted Construction Noise Levels and Comparison to Overall Significance Criteria (Free-field)

Noise Sensitive Receptor	Predicted Construction Noise dB L_{Aeq}	Baseline Noise L_{Aeq}		Criterion Daytime		Impact		Comments
		day	night	day	night	day	night	
1 – Agro Tropical Coffee Farmer's Accommodation	53	42	40	60	N/A	-	N/A	Negligible
2 - Mang'u High School Teacher's Accommodation	54	47	35	60	N/A	-	N/A	Negligible
3 - Nearest Houses to Site – Building 1 (NE Facade)	64	62	50	60	N/A	4	N/A	Minor
3 - Nearest Houses to Site – Building 1 (SW Façade)	63	61	49	60	N/A	3	N/A	Minor
3A - Second Nearest House to Site – Building 2	58	63	51	60	N/A	-	N/A	Negligible
4 - Kanyire Farm	60	51	52	60	N/A	-	N/A	Negligible
5 - Witeithie Estate	56	67	61	60	N/A	-	N/A	Negligible
5A - Witeithie Estate Further From Road	54	47	41	60	N/A	-	N/A	Negligible

6.3.2 *Impact Description and Significance: Operation*

Impact Description

Operational noise is expected to be generated on a 24 hour basis over the lifetime of the Project, and could affect noise receptors around the Project site, particularly where lower baseline noise levels are experienced. This is expected to be a result of fixed equipment at the site. The effect of operational traffic movements is expected be low, with a maximum of approximately 13 heavy vehicle movements per day. These will be routed as for construction traffic to minimise the effects on the existing residential receptors, and significant noise impacts are not predicted. Therefore, traffic noise is not considered further in this section.

Impact Significance

Noise criteria for the operational phase of the Project have been established with reference to IFC Noise Guidelines and the Kenyan Legal Notice No. 61.

IFC Performance Standards

The IFC Performance Standards relating to Noise - Section 1.7 Environmental, Health, and Safety (EHS) Guidelines state:

> *Noise impacts should not exceed the levels presented in Table 1.7.1* [(1)] *or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.*

Although not explicitly stated, the guidance referring to the potential increase in background noise is interpreted to apply when existing (baseline) noise levels already exceed 55 dB $L_{Aeq, 1\ hour}$ daytime or 45 dB $L_{Aeq, 1\ hour}$ night-time for residential, institutional or educational establishments (see *Table 6.14*). These standards are applicable to operational noise only.

Table 6.14 IFC Noise Guidelines (from Table 1.7.1 of the IFC Performance Standards)

Receptor	Outdoor Noise Level dB $L_{Aeq, 1hr}$ Daytime 07:00 – 22:00	Outdoor Noise Level dB $L_{Aeq, 1hr}$ Night-time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

National Legislation

The Kenyan regulations relating to noise are covered by Section 147 of the Environmental Management and Coordination Act (EMCA), Kenyan Legal Notice No.61 - *The Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.*

Part II, Section 5 – Permissible Noise Levels states:

> *"No person shall make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property".*

The "permissible noise levels" for the First Schedule of Legal Notice No. 61 are presented in *Table 6.15*.

A Noise Rating Value (or NR Value) is also provided for in the Regulations. A NR value is always lower than the dB $L_{Aeq, Period}$ for a given sound source, which is reflected in the fact that limits in the Kenyan Regulations are 5 to 10 dB lower than those in *Table 6.15*. The NR is frequency related, and detailed frequency content would be required to assess compliance with this

(1) Shown as Table x.7 of this ESIA.

part of the standard. This is not available at this stage of the Project, and it has not been possible to use this standard in this case. The dB L_{Aeq} limits in *Table 6.15* are, therefore, deemed sufficient to assess significance in this case.

Table 6.15 First Schedule - Maximum Permissible Noise Levels

Zone		Sound Level Limits dB $L_{Aeq, Period}$ Daytime 07:00 to 22:00	Night 22:00 to 07:00
A Silent Zone (health facilities, educational and research institutions, courts, and any other area declared as such by the Authority)		40	35
B Places of Worship		40	35
C Residential	Indoor	45	35
	Outdoor	50	35
D Mixed residential (with some commercial and places of entertainment)		55	35
E Commercial		60	35

It should be noted that the Kenyan permissible noise levels for operational plants are more stringent than the IFC Performance Standards relating to noise, although there is some ambiguity in exactly how they should be interpreted, for example in terms of whether they apply inside or outside or at building facades, and how baseline noise is addressed. (In this assessment they have been interpreted as free-field noise levels outside the affected building).

A conservative approach would be to adopt the Kenyan standard of 55 dB during the day, and 35 dB during the night for residential receptors, and 40 dB during the day and 35 dB at night for Mang'u High School. Part IV of the Regulations states that where a sound source emits sound which fails to comply with the Regulations, such a person shall apply to the Authority for a license. Therefore, the potential for a plant to exceed the Schedule 1 noise levels and be permitted to operate is not excluded. These regulatory limits have been taken to be the onset of noise impact, and noise levels complying with the Kenyan Regulations are classed as Negligible.

In some cases the baseline noise may be sufficiently high that even noise levels from the plant that exceed the above standards may only give rise to small changes in ambient noise that would not result in a significant impact. In line with the approach of the IFC, if changes in background noise as a result of noise from the plant are no greater than 3 dB(A) then noise impacts are not significant - even if they are above the Kenyan standards or IFC standards. For a change in overall noise of 3 dB(A) the plant noise must be limited to the same level as the background noise. If this can be achieved, the impact is said to be Negligible. (The IFC performance standards also note that the background must be established carefully, and it highlights that intrusive occasional sources, such as aircraft or trains, should not be included in the measurement of background noise).

If the noise is above the background noise and exceeds the Kenyan Regulations, it may still meet the IFC standards: Low noise impact magnitudes have been predicted for these situations, which results in an assessment of Minor significance. A Moderate impact magnitude has been assigned to noise levels from the plant that are no more than 10 dB above the IFC performance standard, which results in an impact of Moderate significance. A High noise impact magnitude has been defined as one that exceeds the IFC performance standard by more than 10 dB(A) which would result in a Major significance. The method used for deriving the overall significance from the magnitudes is shown in *Table 6.16*. Irrespective of the above, if the background noise is likely to change by no more than 3 dB, then the impact has been classed as Negligible.

Table 6.16 Overall Significance Criteria for Operational Noise Impacts in the ESIA

	Low Magnitude Impact (Exceeds Kenyan Regulations, but plant levels meet or are below IFC criteria)	**Moderate Magnitude Impact (Exceeds IFC Performance Standard by no more than 10 dB)**	**High Magnitude Impact (Exceeds IFC Performance Standard by more than 10 dB)**
Residential Receptors	Minor	Moderate	Major
Educational Establishments	Minor	Moderate	Major

Noise levels that meet both the Kenyan Regulations and the IFC levels would have a Negligible significance. There are unlikely to be positive impacts in terms of noise.

Predicted Impacts

The noise predictions in *Table 6.17* are based on the preliminary noise information provided by the engineering team at MAN, and by TPL staff. These have been used to carry out preliminary noise predictions for the site using a three dimensional computer model of the site utilising the International Organisation for Standardization (ISO) 9613 [(1)] noise propagation algorithms. The final selection of equipment items and mitigation has not been determined at this stage of design.

(1)ISO 9613-2: Acoustics - Attenuation of sound during propagation outdoors -- Part 2: General method of calculation, ISO, 1996.

Table 6.17 Predicted Unmitigated Noise Levels and Comparison to IFC Noise Limits (Free-field) dB $L_{Aeq,\,1\,hour}$

Noise Sensitive Receptor Number	Plant Noise Level	Baseline Noise Level		Kenyan Regulations		IFC Criterion		IFC Performance Standard (i.e. Higher of IFC Criterion or Baseline)		Exceedance of IFC Criterion		Impact (Based on Worst Affected Period)
		Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
1 – Agro Tropical Coffee Farmer's Accommodation	46	42	40	50	35	55	45	55	45	-9	**1**	Moderate
2 - Mang'u High School Teacher's Accommodation	45	47	35	40	35	55	45	55	45	-10	0	Minor (exceeds Kenyan Regulations)
3 - Nearest Houses to Site – Building 1 (NE Facade)	55	62	50	50	35	55	45	62	50	-7	**5**	Moderate
3 - Nearest Houses to Site – Building 1 (SW Façade)	53	61	49	50	35	55	45	61	49	-8	**4**	Moderate
3A - Second Nearest House to Site – Building 2	52	63	51	50	35	55	45	63	51	-11	**1**	Moderate
4 Kanyire Farm	48	51	52	50	35	55	45	55	52	-7	-4	Negligible (exceeds Kenyan Regulations, but increase in noise <3 dB)
5 - Witeithie Estate	48	67	61	50	35	55	45	67	61	-19	-13	Negligible (exceeds Kenyan Regulations, but increase in noise <3 dB)
5A - Witeithie Estate Further From Road	45	47	41	50	35	55	45	55	45	-10	0	Minor (exceeds Kenyan Regulations)

Mitigation Measures

The predicted noise levels in the absence of noise mitigation measures are based on preliminary noise emission data provided by MAN. This has identified the need for noise mitigation to meet IFC standards and to limit noise impacts to ***minor significance***.

The key items that are likely to require mitigation in order to reduce noise levels at the nearest receptor (Receptor 3) are as follows:

- radiator fans;
- engine room;
- ventilation outlet units;
- air cooled condenser for DCC; and
- venting units.

The choice of noise mitigation measures will be developed during further detailed design. However, several well-established mitigation measures will be available such as selection of quieter equipment or provisions of on-site barriers to screen noise from key equipment items. These measures are expected to be adequate to achieve the noise reductions that are required (up to 5 dB(A)). TPL will commit to meeting noise limits to ensure the impacts predicted in *Table 6.17* are mitigated i.e. plant noise levels will meet the IFC guidelines or be no higher than the baseline levels stated. TPL will establish a contractual design limit to ensure that this is achieved.

Residual Impact

Following successful implementation of the proposed mitigation for on site equipment, it is considered that the significance will be reduced to below the IFC criteria, but that it may remain above the Kenyan standards which are more stringent. This will result in ***impacts being at worst, minor***.

The unmitigated noise predictions and the effectiveness of mitigation are currently being confirmed in detail with the plant equipment suppliers (MAN). These issues will be confirmed for the final ESIA. In the worst case, it is likely that noise impacts will be no worse than those in the unmitigated assessment above i.e. moderate impacts.

The vehicle movements are expected to result in Minor noise impacts.

6.3.3 Impact Description and Significance: Decommissioning

Impact Description

The decommissioning of the Project is likely to result in local temporary noise impacts that are similar to those generated during construction given that similar construction plant will be used.

Impact Significance

Decommissioning noise will be similar in nature to the Construction noise impacts have been considered to be significant if they are above the Kenyan construction standards as shown in *Table 6.18*.

Table 6.18 Overall Significance Criteria for Construction Noise Impacts in the ESIA

	Low Magnitude Impact **(1 to 5 dB above Kenyan Regulations)**	**Moderate Magnitude Impact** **(>5 to 10 dB above Kenyan Regulations)**	**High Magnitude Impact** **(Greater than 10 dB above Kenyan Regulations)**
Residential Receptors	**Minor**	**Moderate**	**Major**
Educational Establishments	**Minor**	**Moderate**	**Major**

For all receptors in this ESIA the Kenyan regulations are 60 dB(A) during the day and 35 dB(A) at night. If an impact takes place over a very short duration (less than approximately 2 weeks) the impact is defined as Minor in terms of its overall significance. If construction noise levels are below, or meet, the Kenyan Regulations the significance of the impact is Negligible. Minor and Negligible impacts would not justify noise mitigation beyond good site practice.

Predicted Impacts

Based on the discussions regarding construction (*Section 6.3.1*), only ***minor noise impacts*** are predicted without noise mitigation at Receptor 3.

Mitigation Measures

Similar mitigation measures will be used to mitigate noise impacts during decommissioning as are used during construction (described in *Section 6.3.1*), and these will be further developed in the SCRP (see *Chapter 7*).

Residual Impact

Following successful implementation of the proposed mitigation, the significance will be reduced to ***negligible,*** although it is recognised that there may be some increases in ambient noise levels during decommissioning.

6.4 WATER RESOURCES

The assessment has identified the key water resources issues that are likely to arise from the Project during the construction, operation and decommissioning phases. It provides relevant information to the construction contractors and operator, so that all phases can be carried out in the knowledge of the key sensitivities arising from the management of water resources.

The baseline situation for water resources has been reviewed, based on the available information about current water resources and water supply and waste water treatment infrastructure in the area where the Project is being developed. The different types of hazards to water resources that will arise during the construction, operation and decommissioning have been identified. This has been carried out from an understanding of the processes associated with the different parts of the proposed development and has been supplemented with knowledge gained through the experiences of the ESIA project team.

The impacts to water resources that may arise during the construction, operation and decommissioning of the Project, have been assessed based on the ESIA team's experience from similar power generation projects. Reference has also been made to international standards and guidelines such as the IFC Environmental, Health and Safety Guidelines for Thermal Power Plants, and the Reference Document on Best Available Techniques for Large Combustion Plants [(1)] (BREF Note) produced by the European Commission.

6.4.1 *Potential Impacts*

Impacts on water resources during the construction, operation and decommissioning of the Project will arise in two main ways:

- Exploitation of local water resources to provide water during construction and operation; and

- Contamination of water resources from construction, operation and decommissioning activities.

Water will be required during construction to provide:

- drinking water for construction staff;
- water for concrete batching; and
- dust mitigation and management.

During operation water will be required for the following:

- steam turbine system;
- fire fighting system;
- welfare and hygiene;
- cleaning and equipment washing; and
- cooling water.

Contamination of water resources may arise during construction from the following:

- construction of water abstraction borehole;
- sediment laden surface water run off;
- storage of fuel, oil and chemicals;
- refuelling of plant and equipment;
- use of cement and wet concrete;
- storage and handling of waste;
- installation of drainage systems; and
- construction of piles and foundations.

Operation of the Thika Power Plant could result in water resource contamination from the following processes:

- surface water drainage;
- process effluent and sewerage management;
- storage of fuel oil and water treatment chemicals;
- storage and handling of waste; and
- abnormal events such as fire and pollution incidents resulting in uncontrolled releases.

During decommissioning of Thika Power Plant the following activities could result in contamination of water resources:

- decommissioning of fuel storage tanks and associated pipe work;
- dismantling of effluent treatment plant;
- removal of diesel engines and transformers;
- draining of water systems and water treatment chemical storage;
- removal of piles and foundations.

6.4.2 Impact Description and Significance: Construction

During construction there are two main activities that may result in impacts on hydrology and hydrogeology:

- Construction of the borehole to abstract groundwater for use within the power plant process.

- Site preparation and construction activities that could result in increased surface water run-off and the release of contaminants and sediment into surface waters and groundwater.

(1)Integrated Pollution Prevention and Control (IPPC) Reference Document on Best Available Techniques for Large Combustion Plants; European Commission. May 2005.

In assessing the potential effects of the construction of Thika power Plant on surface and groundwater, the following issues have been taken into account:

- pollution of surface water arising from run-off during construction;
- pollution to groundwater arising from infiltration during construction (particularly suspended solids);
- pollution to groundwater arising from the creation of new pathways during construction (e.g. borehole and pile construction);
- pollution of surface and/or groundwater arising from accidental spills during construction (fuel, oils, grease, etc); and
- drawdown of groundwater caused by dewatering operations during excavation.

Borehole Construction

The main potential impacts to water resources through the construction of the water abstraction borehole are:

- inadequate penetration of aquifers and poor construction;
- creation of new pathways between pollutants and water resources; and
- introduction of contaminants and pollutants to the groundwater through drilling machinery or uncontrolled leaks and spills.

Each impact has been considered in turn below.

Inadequate Penetration of Aquifers and Poor Construction: Poor construction of the borehole may result in inadequate penetration of the aquifer, which would result in a low yield. It is expected that a borehole installed in the proposed location will yield in the range of at least 5 to 10 m^3/hr. A low yield would have a direct impact on the ability of the power plant to operate effectively and could present long term issues for the plant.

It is considered that poor construction of the borehole would result in a ***major significant impact***, as there would be a direct impact on the operations of the power plant.

Creation of New Pathways between Pollutants and Water Resources: During borehole construction, there is potential for new permanent or temporary pathways to be created between pollutant sources and the aquifers. Should this occur, there could be a secondary impact on the water abstraction source by affecting the water quality of an aquifer that is used for domestic, agricultural and other commercial uses in the locality.

It is expected that the upper aquifers will have high salinity values, and therefore it is essential that the upper aquifers should be completely sealed during construction to prevent contamination of fresh water.

Should the creation of this pathway result in groundwater contamination, this could have a ***moderate / major significant impact*** on the local water resources in the area. An impact on the groundwater could in turn result in harm to ecosystems, including animals and crops, and potentially human health.

Contamination from Borehole Construction Plant and Machinery: In installing the borehole, there is the potential for drilling fluids, oils and lubricants used in the process to contaminate groundwater and surface water. This could impact both directly and indirectly on potential domestic and non-domestic water sources, as well as nearby water bodies (the closest being the Komu River 200 metres north and north east of the site) and agricultural land, including vegetable plots located downstream of the site. If any drilling fluids are used, there is a potential risk of spillage; there is also a potential risk of leaks from machinery. This could result in temporary contamination of local and regional water resources.

Contamination of the groundwater from materials used in the construction of the borehole would have a ***moderate / major significant impact*** on local water resources. An impact on the groundwater could in turn result in harm to ecosystems, including animals and crops, and potentially human health.

General Construction Activities

The major activities during the construction phase of the Project include:

- Site preparation works;
- Construction of foundations; and
- Construction of buildings.

Site preparation work will comprise the terracing of the Thika Power Plant site, earthworks, and the excavations for foundations. Trenching, installation of underground services and provision of temporary construction facilities including vehicle parking facilities, storage/laydown areas and services will then take place.

Throughout the duration of the construction period, there will be a dedicated area set aside adjacent to the substation for the laydown and storage of plant equipment.

Both surface water and groundwater resources will be at risk during these construction activities from pollution from the accidental spillage of fuels, lubricants cement and wet concrete, or from the inadequate or unsafe disposal of sanitary wastewater from the construction work site and facilities.

The potential impacts that may therefore arise during the construction of the Project are as follows:

- direct discharges to surface water (Komu River) and adjacent vegetable plots and coffee plantation, from run-off during the construction phase, possibly containing increased loads of suspended solids and/or contaminants;

- accidental spillage or leakage resulting from storage of potentially polluting substances during construction affecting surface water (Komu River) and adjacent vegetable plots and coffee plantation; and

- disposal of drainage and effluent from construction sites.

The construction activities may also destabilise soils and/or leave exposed materials adjacent to watercourses which may subsequently erode during heavy rainfall and lead to sedimentation in downstream water bodies.

It is unlikely that significant impacts will occur on the high value coffee plantations on the adjacent plots, as these lie upstream of the site. However, the vegetable plots lie down stream, so without mitigation these activities could result in Moderate significant impacts.

Construction activities will, however, be fairly localised and temporary in nature; it is, therefore, unlikely that any induced erosion would be significant in comparison to the natural erosion that takes place in this region following periods of heavy rainfall.

Chemical toilets will be provided for construction workers. The waste will be removed from the Project site and disposed of by a licensed waste contractor as appropriate. ***No significant effects*** will therefore occur.

Water Supply Conflicts: It is assumed that any water required for the construction workforce or the construction activities themselves (e.g. mixing concrete, dust control, etc) will either be sourced from the local supply system under agreement with the Thika District, or brought to site in tankers and/or bottles by private licensed suppliers. It is not anticipated that any local community boreholes or other water supplies would be used for construction purposes.

No significant impacts are likely to occur from waster supply conflicts during construction assuming that water supplies are sourced appropriately as discussed.

Mitigation: Borehole Construction

Appropriate construction methodology will be applied to ensure that groundwater mixing does not occur. Additionally, in order to mitigate potential impacts that could result from poor borehole construction, international best practice borehole construction methodologies will be applied.

In order to mitigate against any occurrence of groundwater contamination, borehole construction plant will be suitably maintained, and spent fluids handled and disposed of in an appropriate manner.

The application of appropriate mitigation measures will minimise the potential for pollutant spills and contamination of water resources. ***No significant impacts*** on the water resources as a result of pollutant spillage or contamination during borehole construction are therefore likely to occur.

Mitigation: General Construction Activities

The potential contamination and/or erosion risks from construction related activities can be mitigated by industry-standard good construction management practices. This would necessarily include:

- Regular checking and maintenance of all plant and machinery to minimise the risk of fuel or lubricant leakages.

- Any hydrocarbons, fuels, lubricants and chemicals to be used will be stored in bunded and lockable oil storage tanks, with hoses and gauges kept within the bund. The capacity of the bund will be equal to 110% of the storage tank volume. All surface water or other contaminated water which accumulates in the bund will be removed by manually controlled positive lift pumps and not by means of a gravity drain. This water will be removed from the Project site and discharged in a public sewer in consultation with the relevant water companies.

- Training and equipping relevant staff in safe storage and handling practices, and rapid spill response and cleanup techniques.

- Minimal or total avoidance of soil disturbance close to watercourses, including open drainage channels (preferably establishing a 10 metre buffer zone and leaving existing vegetation in place), and no stockpiling of waste or fill materials close to or within channels.

- Effective construction site drainage measures, utilising cut-off drains (to divert surface runoff from exposed soils or construction areas), oil interceptors and silt traps to manage and retain sediments on site.

- Leaving vegetation *in situ* wherever possible, and re-vegetation of bare soil before the next rainy season.

- Adequate provision for the collection, treatment and disposal of sewage from site offices and accommodation will be provided.

- Exposed ground and stockpiles will be minimised to reduce silty runoff, and if necessary measures such as geotextiles will be used to shield spoil mounds.

- Wet concrete and cement will be prevented from entering any watercourses.

- Stockpiles will be kept away from waterways.

- Static equipment will be kept in spill trays or within bunded areas.

Options for managing surface water run-off during both the construction and operational phases of the Project are currently being discussed by TPL, which is examining a collective approach to coordinate surface water management with the neighbouring KPLC substation site. During construction it is likely that temporary drainage channels will be created to channel and divert surface water from the TPL site, away from the down slope agricultural plots. The KPLC contractor already has proposals for construction surface water management, and TPL is discussing whether these can developed jointly and upgraded as necessary to combine construction surface water management for the two adjacent sites.

Residual Impacts: Borehole Construction

By following the borehole construction and installation guidance, there will be No significant impact on the ability of the borehole to yield the required water for use within the process.

Additionally, with the application of best practice borehole construction methods there will be ***No significant impact*** on the underlying aquifers resulting from groundwater cross-contamination.

Residual Impacts: General Construction Activities

With the application of the mitigation measures described previously, ***No significant impacts*** are likely to occur during construction.

6.4.3 Impact Description and Significance: Operation

Impacts during operation could arise from the following:

- utilisation of the groundwater abstraction borehole;
- surface water and wastewater management; and
- accidental releases during abnormal events.

Groundwater Abstraction Borehole

The main potential impacts to water resources arising from the utilisation of the groundwater abstraction borehole are as follows:

- introduction of contaminants and pollutants to the groundwater;
- siltation of borehole; and
- water supply conflicts arising from depletion of groundwater resources.

Each impact has been considered in turn below.

Contamination and Pollutants to Groundwater: The power plant will operate with oil as the primary fuel source. There is the potential for fuel oil to contaminate the groundwater source through infiltration of the borehole abstraction system, or through other pathways resulting from inadequate bunding or poor installation. In addition, there is the potential for accidental leaks or spillage from operational machinery. Contamination of the groundwater may result in direct contamination of water resources used for domestic or agricultural purposes, which may cause harm to ecosystems or human health. This could result in potentially long-term effects on the water resources at a local and regional level.

There are at least seven known abstraction boreholes within 3km of the power plant site, which could be indirectly impacted from any contamination of the groundwater from the power plant operations. The potential impact of introducing contaminants to the groundwater is considered to be a ***moderate/ major significant impact***, based on the risk to human health and agricultural activities in the area.

Siltation of borehole: There is the potential for gradual siltation of the abstraction system, with fine sands and silts being pumped through the screening filters. This could result in damage to the pumping equipment and affect the operation of the power plant. In such a situation, the power plant may be unable to operate, and it would require the pumping system to be cleared and be a temporary impact on the operation of the facility.

Siltation of the abstraction borehole is, therefore, considered to be a Moderate significant impact. The likely result of this would be the inability of the power plant to operate, which would have a secondary impact on power users, however there are ***unlikely to be direct impacts*** on receptors.

Water Supply conflicts: Calculations have been made of the water balance available from the aquifer that will be exploited for the provision of process water. A summary of the estimated annual average water balance are provided in *Table 6.19*.

Given the calculated capacity and yields available from the aquifer, as shown in *Table 6.19*, ***no significant impact***s are likely to occur from water supply conflicts during operation.

Table 6.19 Summary of Annual Average Water Balance of Aquifer

Parameter	Estimated Value
Catchment Area	$1.45x\ 10^8\ m^2$
Aquifer Extent	$1.0x\ 10^6\ m^2$
Aquifer Thickness	6 m
Storage Coefficient	$1.8x10^{-5}$
Specific Yield	10%
Precipitation	675 mm/year
Recharge	$3.0x10^5\ m^3$/year
Proposed Abstraction	$2.555x10^4\ m^3$/year
Storage	$3x10^6\ m^3$

Source: Geo Con Limited, Hydro-geological and Geophysical Feasibility Study Report, 2010

Surface Water and Wastewater Management

During operation of the Thika Power Plant there will be changes in the existing surface water regime through the introduction of new impermeable surfaces. This presents an increased risk of runoff affecting sensitivities that lie downstream of the site such as the railway line and agricultural plots. The uncontrolled release of additional surface water could result in ***significant major impacts*** caused through physical damage to crops and erosion of topsoil. This would also result in a ***significant major secondary impact*** (loss of earnings, or of foodstuffs in the more likely case of subsistence farmers tending the vegetable plots downslope of the Project site).

Additionally, all wastewater on site has the potential to become contaminated because it is directly used as process/contact water, is foul water from welfare facilities, and because rainwater has collected in an area such as the tank farm where the presence of contaminants is possible. Depending on the volume of uncontrolled releases of these waste waters, ***significant minor/moderate negative impacts*** could occur on surface water and groundwater resources.

Contamination from Accidental Releases During Abnormal Events

With the incorporation of appropriate design measures and operational techniques into the design and operation of Thika Power Plant to prevent major accidents, contamination from accidental releases are not likely to be a significant issue. Notwithstanding the incorporation of these design issues, because of the potential volume of materials involved, the following risks could result in ***significant major negative impacts***:

- fire in the fuel delivery area;

- fire in the fuel oil storage tanks;
- fuel oil fire under various scenarios;
- fire in the diesel engines;
- substation fire;
- leaks of high pressure super heated steam (invisibility); and
- accidental release of hazardous chemicals (e.g. for water treatment).

Mitigation: Groundwater Abstraction Borehole

In order to mitigate the potential for contamination and pollutant escape, mechanical plant will be suitably maintained. Spent fluids will be handled and disposed of in an appropriate manner. Appropriate operational controls will be implemented and water quality monitoring will be carried out to ensure that there is no pollution of the groundwater.

To prevent such an occurrence, appropriate screening filters should be installed in the pumping system during construction of the borehole.

Mitigation: Surface Water and Wastewater

In order to ensure that flood risk to third parties does not increase when the Project is implemented, runoff will be attenuated on site prior to discharge at existing greenfield runoff rates, and the drainage system will be designed to accommodate any unpredictable exceedence. The rate of discharge will be maintained at existing rates, thus there will be no change in runoff rates or volumes leaving the site, and no impact upon the existing flooding regime.

To achieve this objective, surface water runoff generated during the operational phase of the Project will be channelled and discharged to ground in an unused part of the TPL site, via a soakaway or reticulated drainage network. The siting of soakaway/drainage areas, and their design, will take account of the risks of runoff affecting any sensitivities such as the railway line and agricultural plots that lie downstream. Only external areas of the site without the potential to be contaminated will be handled in this way, whilst all areas where the potential exists for surface water to become contaminated will be collected separately and sent to the ETP.

All wastewater on site that will have the potential to become contaminated either because it is directly used as process/contact water, or because rainwater has collected in an area such as the tank farm where the presence of contaminants is possible, will be collected, channelled and processed through the ETP.

The primary inputs to the ETP will arise from the following on site sources:

- oil separator, collecting run off from the unloading area;
- effluent from neutralisation plant (for oil/water separators);
- sump located in the workshop (includes wastewater from laboratory);
- sump located in the power house;

- sump located in the pump house;
- HFO separators (numerous);
- drain pit located in the tank farm; and
- leak oil sumps from all modules using oil.

Sampling of all wastewater will be undertaken before discharge from the ETP, and treatment will continue (via re-circulation for additional processing) until all applicable Kenyan and IFC discharge standards are met as shown in *Table 6.20*. It will then be discharged to ground in the same manner as surface water (see above). The output capacity of the ETP is approximately 7m^3 per hour.

Table 6.20 Effluent Quality Standards for Thermal Power Plant

Pollutant	Units	Kenyan standard [1]	IFC guideline [2]
pH	pH	6.5-8.5	6-9
Oil and grease	mg/l	nil	10
Total suspended solids	mg/l	30	50
Total residual chlorine	mg/l	0.1	0.2
Total chromium	mg/l	2.0	0.5
Copper	mg/l	1.0	0.5
Iron	mg/l	10	1.0
Zinc	mg/l	0.5	1.0
Lead	mg/l	0.01	0.5
Lead and its compounds	mg/l	0.1	-
Cadmium	mg/l	0.01	0.1
Cadmium and its compounds	mg/l	0.1	-
Total Mercury	mg/l	0.005	0.005
Arsenic	mg/l	0.02	0.5
Arsenic and its compounds	mg/l	0.1	-
Total coliform bacteria	Per 100 ml	30	400
Colour	Hazen units	15	-

Notes:
1. Kenyan Environmental Management and Coordination (Water Quality) Regulations, September 2006 – Third Schedule: Standards For Effluent Discharge Into The Environment

2. Environmental, Health and Safety Guidelines for Thermal Power Plants, International Finance Corporation , 2007 (http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_ThermalPower/$FILE/FINAL_Thermal+Power.pdf)

Therefore, assuming that the treatment system is adequately designed and, importantly, well maintained and operated at all times (including during processing plant maintenance and shutdown periods) then this should adequately mitigate any risk of water pollution from Thika Power Plant.

The operation of the wastewater treatment plants would necessarily include the periodic removal and safe disposal of any treatment sludge from the system and the regular monitoring of effluent water quality to ensure compliance with the standards shown in *Table 1.1* – the sampling frequency would be specified in the license agreement with the environment authorities, but would normally be daily.

Mitigation: Fuel Delivery, Fuel Oil and Chemical Storage

The mitigation of any water contamination risks from the storage, handling or transport of chemicals, wastes and fuel oil will effectively be addressed through the planned design and implementation of an environmental management system for the operation. This would necessarily include:

- appropriately designed storage facilities, including bunds and impervious services for any hazardous materials (fuels, lubricants, water treatment chemicals);

- covering all stockpiles to avoid rainwater ingress and runoff, including process waste residues;

- regular inspection and maintenance of all vehicles, equipment and storage facilities (including integrity checks for all underground fuel tanks); and

- appropriate spill response and cleanup strategies, and regular training and instruction of staff in their implementation (see *Annex D*).

Residual Impacts

With the application of best practice borehole management methods, including the installation of appropriate filters, there will be ***No significant impact*** on the underlying aquifers resulting from groundwater cross-contamination.

The application of the mitigation measures described previously will ensure that ***No significant impacts*** are likely to occur from fuel delivery, fuel oil and chemical storage during operation.

With the application of the mitigation measures described previously, ***No significant impacts*** are likely to occur from surface water and wastewater management during operation.

6.4.4 *Impact Description and Significance: Decommissioning*

During the decommissioning phase, the potential significant negative impacts to water resources are likely to be very similar to those considered during the construction phase of the Project, and the appropriate mitigation measures should be employed to reduce impact on receptors.

Notwithstanding any potential future uses of the Project area, the potential water resources impacts associated with decommissioning the Project would for the most part be positive for two main reasons. Firstly, it would remove the pressure on groundwater resources for the provision of process water, and secondly it would remove the risks to groundwater and surface water presented by the operations on site. The main significant direct negative impacts would, therefore, be as follows:

- Potential water pollution from the accidental spills of chemicals and/or product during the dismantling or decommissioning of the plant and equipment. This would include the disposal of residual sludge from the wastewater treatment facility, the decommissioning of fuel oil storage and delivery facilities (including underground pipe work), the removal of transformers, and the cleaning and disposal of equipment with residual fuel oil.

During decommissioning it will also be necessary to carefully decommission the groundwater abstraction borehole, or if it is to remain in continued use for it to be capped. This is so that it does not provide a pathway for contaminants during the dismantling of the plant and equipment.

Mitigation

The mitigation measures for the decommissioning phase of the Project are presented in *Section 5.7*, which describes the contents of the SCRP.

The SCRP also includes recommendations for monitoring to be continued following decommissioning to ensure there is no residual contamination of groundwater following cessation of the operations.

Residual Impacts

The application of the mitigation measures described in the Site Closure and Restoration Plan will ensure that ***No significant impacts*** are likely to occur during decommissioning of the Thika Power Plant.

6.4.5 *Summary of Impacts*

Table 6.21 provides a summary of the significant impacts likely to arise during construction, operation and decommissioning both prior to the application of mitigation.

Table 6.21 Summary of Impact Significance Pre-mitigation

Phase	Impact	Significance (pre-mitigation)
Construction	Pollution of surface water from run off	**Moderate Negative**
	Pollution to groundwater from infiltration	**Moderate/Major Negative**
	Pollution to groundwater via new pathways	**Moderate Negative**
	Pollution of surface water from accidental spills	**Major Negative**
	Poor yield from borehole	**Major Negative**
	Drawdown of groundwater	**No Significant Impacts**
	Management of wastewater	**No Significant Impacts**
Operation	Pollution of surface water and groundwater from process water and chemicals leakage	**Minor/Moderate Negative**
	Pollution of surface water and groundwater from fuel oil leakage	**Moderate/Major Negative**
	Pollution of surface water and groundwater from fuel oil delivery	**Moderate/Major Negative**
	Pollution of surface water and groundwater from surface water management	**Minor/Moderate Negative**
	Pollution of surface water and groundwater from storage and handling of waste	**Minor Negative**
	Damage to crops and increased soil erosion form increased surface water run off	**Major Negative**
	Water supply conflicts from borehole use	**No Significant Impacts**
	Pollution of surface water and groundwater from fire water and major uncontrolled releases of fuel oil and chemicals	**Major Negative**
Decommissioning	Pollution of surface water and groundwater from dismantling fuel storage tanks, fuel delivery area and associated pipe work	**Moderate/Major Negative**
	Pollution of surface water and groundwater from dismantling of effluent treatment plant	**Minor Negative**
	Pollution of surface water and groundwater from removal of diesel engines and transformers	**Minor/Moderate Negative**
	Pollution of surface water and groundwater from draining of water systems and water treatment chemical storage	**Minor/Moderate Negative**

Phase	Impact	Significance (pre-mitigation)
	Pollution of surface water and groundwater from surface water management	**Minor Negative**
	Pollution of surface water and groundwater from refuelling of plant and equipment	**Minor Negative**
	Pollution of surface water and groundwater from storage and handling of waste	**Minor Negative**
	Pollution of surface water and groundwater from creation of new pathways from the removal of piles and foundations.	**Minor Negative**

Table 6.22 provides a summary of the significant residual impacts likely to arise during construction, operation and decommissioning after the application of mitigation.

Table 6.22 Summary of Residual Impact Significance Post-mitigation

Phase	Impact	Significance (pre-mitigation)
Construction	Pollution of surface water from run off	No Significant Impacts
	Pollution to groundwater from infiltration	No Significant Impacts
	Pollution to groundwater via new pathways	No SigNIFICANT Impacts
	Pollution of surface water from accidental spills	No Significant Impacts
	Poor yield from borehole	No Significant Impacts
	Drawdown of groundwater	No Significant Impacts
	Management of wastewater	No Significant Impacts
Operation	Pollution of surface water and groundwater from process water and chemicals leakage	No Significant Impacts
	Pollution of surface water and groundwater from fuel oil leakage	No Significant Impacts
	Pollution of surface water and groundwater from fuel oil delivery	No Significant Impacts
	Pollution of surface water and groundwater from surface water management	No Significant Impacts
	Pollution of surface water and groundwater from storage and handling of waste	No Significant Impacts
	Damage to crops and increased soil erosion form increased surface water run off	No Significant Impacts

Phase	Impact	Significance (pre-mitigation)
	Water supply conflicts from borehole use	No Significant Impacts
	Pollution of surface water and groundwater from fire water and major uncontrolled releases of fuel oil and chemicals	No Significant Impacts
Decommissioning	Pollution of surface water and groundwater from dismantling fuel storage tanks, fuel delivery area and associated pipe work	No Significant Impacts
	Pollution of surface water and groundwater from dismantling of effluent treatment plant	No Significant Impacts
	Pollution of surface water and groundwater from removal of diesel engines and transformers	No Significant Impacts
	Pollution of surface water and groundwater from draining of water systems and water treatment chemical storage	No Significant Impacts
	Pollution of surface water and groundwater from surface water management	No Significant Impacts
	Pollution of surface water and groundwater from refuelling of plant and equipment	No Significant Impacts
	Pollution of surface water and groundwater from storage and handling of waste	No Significant Impacts
	Pollution of surface water and groundwater from creation of new pathways from the removal of piles and foundations.	No Significant Impacts

6.5 *TRAFFIC AND TRANSPORT*

The assessment is based largely on the analysis of field data and the description of the physical infrastructure and engineering works that will be necessary to implement the Project. The scope includes the review and verification of these findings and extends the assessment to address the potential environmental impacts that may arise as a result from traffic and transport, from both the construction and operation of the power plant and any mitigation and monitoring measures that are required in response.

The assessment has identified the key traffic and transport impacts that are likely to arise from the Project during construction and operation and provides the relevant information to the potential construction contractors and operator, so that the works and operations can be carried out in the knowledge of the key sensitivities of the identified receptors. This should enable these sensitivities to be addressed through measures which will, if possible, avoid the sensitivity altogether.

The most significant number of vehicle movements that will be required during the construction of the Project will arise from two main activities:

- the delivery of the plant, equipment and materials for the construction of the power plant; and

- the daily movements of personnel to and from the work site.

Approximately 19,633 trips will be required during the course of the 26 month construction period for the power plant. It was calculated how these vehicle movements will be distributed throughout the construction period. This enabled calculations of the overall potential construction vehicle movements to be made so that an assessment could be made of how these traffic volumes would affect the local road network.

During operation vehicle movements will arise from up to 80 permanent, managerial and support staff travelling to and from work. It was calculated how these vehicle movements will be distributed throughout the typical working day. This informed an assessment of how these traffic volumes would affect the local road network during operation.

Measures to mitigate the likely significant effects arising during construction and operation were then developed in the form of a Traffic Control Management Plan (TCMP). The assessment then identified the residual effects remaining following the application of these measures.

6.5.1 Significance Criteria

There are various ways of interpreting whether or not an impact will have a significant effect and the following guidance is given in the IEMA Guidelines for the Environmental Assessment of Road Traffic (1):

> '*For many effects there are no simple rules or formulae which define the thresholds of significance and there is, therefore a need for interpretation and judgement on the part of the assessor, backed up by data or quantified information wherever possible. Such judgements will include the assessment of the numbers of people experiencing a change in environmental impact as well as the assessment of the damage to various natural resources*'.

For this Project, significance was determined by considering the characteristics of the study area, the environmental sensitivity of the location and the characteristics of any potential impacts, taking into account factors such as the existing and additional Project traffic flows, road infrastructure quality, vehicle types and respective operating speeds and the proximity of communities (and other sensitive receptors such as Kuraiha School) to the road.

(1)Guidelines for the Assessment of Road Traffic; Institute of Environmental Assessment (IEA); 1993

The following criteria have been established using the Guidelines for Environmental Assessment of Road Traffic [1] produced by the former UK Institute of Environmental Assessment (now the Institute of Environmental Management and Assessment).

Table 6.23 Significance Criteria

Significance	Criteria
Major	These effects are likely to be important considerations at a regional or district scale but, if adverse, are potential concerns to the project, depending on the relative importance attached to the issue during the decision making process. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected communities or interests.
Moderate	These effects, if adverse, while important at the local scale, are not likely to be key decision making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource. They represent issues where effects will be experienced but mitigation measures and detailed design work may improve/enhance some of the consequences upon affected communities or interests. Some residual effects will still arise.
Minor	These effects may be raised as local issues but are unlikely to be of importance in the decision making process. Nevertheless, they are of relevance in the detailed design of the project and of consideration of mitigation or compensation measures
Negligible	No effects or those which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Source: "*Guidelines for the Environmental Assessment of Road Traffic*", former Institute of Environmental Assessment, 1992

Traffic generated during construction and operation of the Project will arise from the following:

- delivery of construction materials and equipment to the site;
- delivery of operational infrastructure, e.g. boilers, condensers, engines and storage tanks;
- spoil removal; and
- worker access to the site during construction and operation.

These additional vehicle movements could result in the occurrence of the following effects:

(1)Guidelines for the Assessment of Road Traffic; Institute of Environmental Assessment (IEA); 1993

- **Road User Delay***:* In international highway terms, the level of generated vehicle traffic with simultaneous construction of Nairobi - Thika highway upgrade could result in a significant amount of generated traffic.

- **Road User Impacts – Safety:** Due to the increase in construction traffic there is a potential for increases in road accidents between vehicles or between vehicles and pedestrians; and increased level of overtaking as a proportion of the additional traffic will be slower moving trucks, for example the low-loader lorries that will deliver the engines and boilers.

- **Highway Infrastructure Degradation***:* Traffic volume and certain vehicle parameters, e.g. axle-load and spacing as well as infrastructure quality are the key determinants of infrastructure degradation. To enable quantitative assessment of infrastructure capability and potential degradation, arising traffic volume and appropriate vehicle parameters have been identified and compared with design criteria for the highways concerned.

- **Increased Levels of Noise, Vibration and Air Pollution***:* Traffic volume, vehicle types, operating speeds as well as proximity to receptors are key determinants of these impacts. For further details, please refer to the appropriate sections within this ESIA.

The assessment of the effects arising from the generation of traffic during construction and operation therefore looks at the effects that they will have on the above issues.

Routing Options: Mombasa to Power Plant

The first phase of a routing study (1) was carried out to identify the numbers, types, spans and conditions of the existing bridges/structures along feasible routes from Mombasa to Thika. This study gives an insight into the potential routing options available for the movement of the large plant and equipment from Mombasa to Thika during construction as well as routing options for fuel delivery during operation.

The study was carried out with the following objectives:

- Carrying out detailed survey on existing bridges along the routes from Mombasa to Thika with a view of establishing their condition/state.

- Carrying out strength analysis of the existing bridges along the routes with a view of establishing their load carrying capacities.

- Carrying out a route survey for the safe movement of the cargo from Mombasa to Thika.

(1)Bridges along Various Routes Mombasa to Thika. Inception Report, Terms Kenya Limited and Union Logistics Limited., January 2011.

- Analyse the various routes to facilitate an informed decision on the choice of the route to use.

- Make recommendations on practical remedial measures/alternatives to crossing over the bridges.

- Provide costs for any remedial measures required along the proposed routes for the safe movement of the loads.

- Presentation of the recommended route to the relevant authorities for approval with a view of securing a transport permit.

The overarching objective of the study was to identify a route that would ensure the safe transport of the plant and equipment from Mombasa to Thika without damaging the existing bridges/structures along the proposed routes.

In total four possible routes were identified:

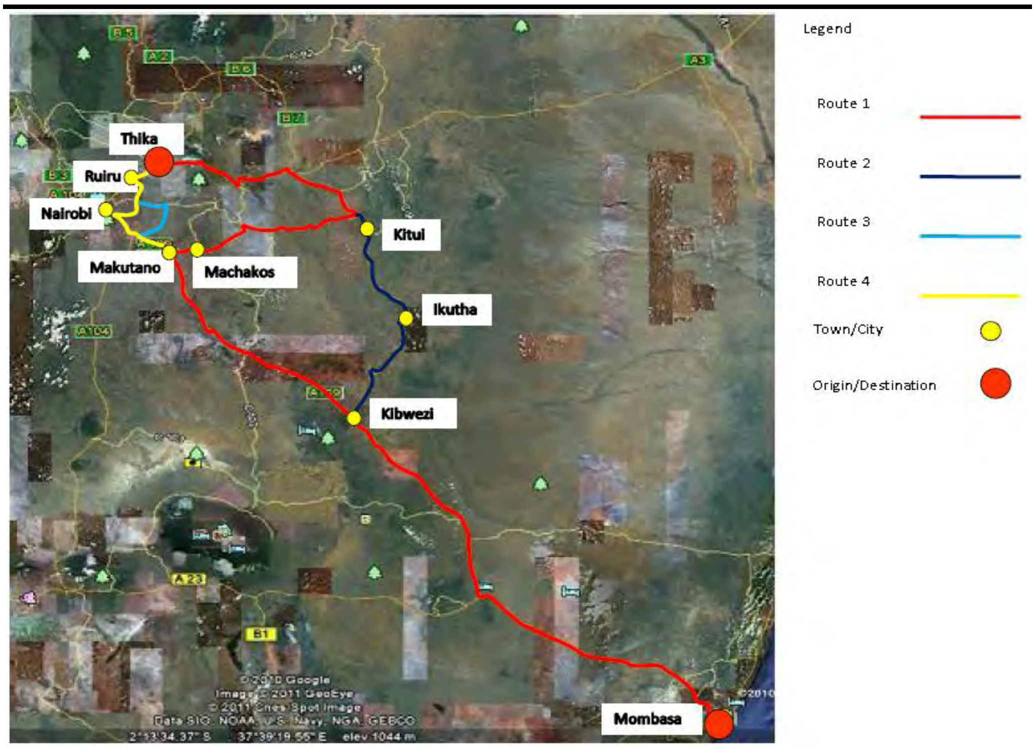
- ***Route 1:*** Mombasa-Kibwezi-Makutano-Machakos-Kitui-Thika;

- ***Route 2:*** Mombasa-Kibwezi-Ikutha-Kitui-Thika;

- ***Route 3:*** Mombasa-Kibwezi-Makutano-Athi river-Kinanie-Kamulu-Ruiru-Thika; and

- ***Route 4:*** Mombasa-Kibwezi-Makutano-Nairobi(Eastern bypass)-Ruiru-Thika.

Figure 6.3 Routing Options



6.5.2 *Impact Description and Significance: Construction*

Impact Description

Traffic generated during construction of the Project will arise from the following:

- delivery of construction materials and equipment to the site;
- long distance delivery of large operational infrastructure, e.g. boilers, condensers, engines and storage tanks;
- spoil removal; and
- worker access to the construction site.

Table 6.24 shows the numbers of vehicles required and their frequency of movement for the peak period of the construction works. The periods of construction that will generate the majority of the vehicle movements are the earthworks, civil engineering and the installation of the mechanical infrastructure. This will be for a period of approximately 12 months, with the Nairobi - Thika highway experiencing the highest volume of traffic between months five and 10 where there will be up to 1,688 movements per month (85 movements per day).

Table 6.24 ***Construction Vehicle Movements during the Peak Construction Period***

Movements during 12 month Construction Period				
	Total Movements	**Monthly Movements**	**Daily Movements**	**Hourly Movements**
Average Movements	12,576	1,048	53	6
Maximum Movements	20,256	1,688	85	9

Notes: Assumes an 11 month working year, a 20 day working month and a 10 hour working day.

Impact Significance

The additional vehicle movements could result in the occurrence of the following effects.

- **Road User Delay***:* In international highway terms, the level of generated traffic during construction is relatively small and represents an increase of <0.4% over the existing average peak hourly traffic flows. This is a very small increase in road traffic and will add very little to the volumes of traffic already in existence, and would be masked by the natural daily perturbations in highway flows. These increases are therefore unlikely to result in an adverse impact. Notwithstanding this point, the Thika Road is already operating at or close to saturated traffic conditions and as a result is currently undergoing a major upgrade to increase its capacity. It will, therefore, be necessary to manage the flow of vehicles too and from the construction site as they will be adding vehicles to an already "stressed" highway network that is subject to traffic controls during the disruptive upgrade works. Without mitigation ***Moderate negative impacts*** could occur. Measures to manage construction traffic are presented in the mitigation section below.

- **Road User Impacts – Safety:** The main road safety issue associated with the construction traffic is relates to the number of school children that have to cross the Nairobi - Thika highway, and – depending on the final layout of the highway interchange – potentially the construction site access road, to attend Kuraiha Primary School. Due to the increase in construction traffic there is a potential for increases in road accidents between vehicles and pedestrians, which is exacerbated by the highway upgrade works. The school day starts at 08:20 and finishes at 15:10: therefore the key periods of the day when school children will be navigating the local highway network will be during 07:30 – 08:30 and 14:30 – 15:30. Without mitigation ***Moderate negative impacts*** could occur. Measures to manage construction traffic during these sensitive periods are presented in the mitigation section below.

  The temporary increases in vehicle numbers on the highway network is relatively small in overall highway capacity terms. However, the Nairobi - Thika highway is already operating at or near saturation. The increase in traffic movements on the Nairobi - Thika highway during construction therefore has the potential to decrease community safety in the area and as such without mitigation ***significant major negative impacts*** are likely to occur. Measures to mange community safety during construction are presented in the mitigation section below.

  In addition to the coincidence of construction vehicle movements with the arrival and departure of school children, there is a potential for an increased level of overtaking. This is because a large proportion of the additional traffic will be slower moving trucks, for example the low loader lorries that will deliver the engines and boilers. Without mitigation ***minor negative impacts*** could occur. Measures to manage slower-moving construction traffic are presented in the mitigation section below.

- **Highway Infrastructure Degradation*:*** Traffic volume and certain vehicle parameters, e.g. axle-load and spacing as well as infrastructure quality, are the key determinants of infrastructure degradation. It is unlikely that given the relatively low daily volumes of construction vehicles that will access the construction site that road degradation will occur. However, the vehicle movements with the most potential to degrade the road are the abnormally sized and heavy loads that will be required to deliver the engines and boilers for the power plant. To enable quantitative assessment of infrastructure capability and potential infrastructure degradation, traffic volumes and vehicle parameters have been identified and compared with design criteria for the highway routes concerned.

An outcome of the abnormal loads routing study is that TPL has made a commitment that it will not transport heavy and abnormal roads via Nairobi. This is because of the subsequent impact that large and slow moving vehicles would have on the already saturated road conditions. This means that ***Route 4:*** Mombasa-Kibwezi-Makutano-Nairobi (Eastern bypass)-Ruiru-Thika has been discounted as a possible alternative.

The full routing study is still ongoing. There are, therefore, three routes still under consideration that could be utilised by the low-loader lorries to deliver the engines and boilers.

However, given the poor condition of some of the structures along the routes, without mitigation ***Moderate-major negative impacts*** could occur. Measures to manage slower-moving construction traffic are currently still under development as the route option study progresses. The specific mitigation measures proposed will be presented to the Highway Authority for consideration during the process to secure a Transport Permit. However, an indication of the measures that could be implemented to maintain the condition of the road and structures are presented in the mitigation section below.

- **Increased Levels of Noise, Vibration and Air Pollution***:* The increases in traffic volume during construction are unlikely to result in significant changes to the noise, vibration and atmospheric emissions. Traffic volumes are usually required to double in volume over existing levels for there to be a measurable change in these emissions. Traffic volumes are expected to increase by <0.4%, therefore ***No significant impacts*** will occur.

Mitigation

All of the traffic related impacts described previously can be mitigated very effectively by the implementation of standard best practices in terms of environmental controls and management practices during construction. The mitigation measures that are proposed will be implemented as part of a wider management plan for the Project.

A management plan is important both in ensuring the safety of construction personnel and local communities and in regard to minimising the environmental impact of the Project.

The key issues addressed by the management plan in terms of mitigation measures include:

- access to construction areas;
- routing of construction traffic;
- temporary traffic control and management;
- road crossings;
- parking facilities;
- keeping highways clean of mud and dust;

- driver training;
- road safety and awareness training for school children; and
- reducing the probability of traffic accidents.

The Contractor shall regularly update his management plan as the construction method is developed and vehicle movement requirements are identified in detail.

The Contractor shall consult with the relevant government agencies to identify where Project plans can complement existing road development plans at the District and Provincial level. The Contractor will also consult with the school principals - and key representatives of any communities that will suffer a significant increase in traffic - in order to identify alternative routes, or agree appropriate mitigation measures.

The management plan will include procedures which will assess the likely number and intensity of vehicular movements and outline methods which will be adopted to minimise the overall footprint and secondary impacts such as dust. It will include as a minimum the requirements shown in *Box 6.2*.

Box 6.2 ***Minimum Requirements for Traffic Management Plan***

The Traffic Management Procedures will include the following:

- identification of key sensitivities along proposed access routes;
- strategic analysis of projected vehicular movements and destinations and outline of access routes to minimise total area of new road to be built;
- identification, demarcation and construction of all access routes;
- trip minimisation;
- measures to prohibit off-road driving;
- outlines speed limits and methods of enforcement;
- means to inform and educate the community of traffic risks;
- vehicle equipment;
- vehicle maintenance and refuelling locations;
- inspection, auditing and reporting; and
- driver competency.

The following mitigation measures will be adopted within the management plan to reduce the impacts from the operation of this Project:

- identify those responsible for carrying out and managing the procedures;

- reference the procedures and activities the Contractor will develop and implement;

- identify work to be undertaken on the roads prior to construction activities to upgrade or stabilise the roads and structures;

- identify the routes that will be used with the estimated numbers of traffic movements, speeds and times of travel;

- justify where a route has to pass through residential areas and the measures that will be used to ensure the safety of the community and minimise the nuisance impact of traffic movements;

- identify how existing road development plans have been taken into account in the identification of routes and road restoration measures;

- identify the programme of road restoration measures that are likely to be required post construction;

- address how the Contractor can reduce the exposure of vehicle drivers, their passengers and other road users from the hazards of road-related accidents;

- identify (and adopt to the maximum extent feasible) all reasonably practicable alternatives to road transportation in order to reduce the number of trucks on the roads;

- provide details of audits and reviews of the components of the Project transport system;

- appropriate strategies for moving materials and people to/ from and within the Project area, including abnormal loads, e.g. ensuring that delivery of Project equipment does not coincide with the start/end of the school day;

- provisions for management of the connection point between the site access road and the main coastal road, and for any maintenance work that may be required;

- procedures for monitoring construction generated traffic movements and associated environmental problems;

- avoidance of mud on the main coastal road, including the provision and siting of wheel washes;

- measures to ensure that employees travelling to and from the site are able to do so in a safe manner, e.g. provision of mini buses;

- measures to prevent the use of unsuitable roads;

- a notification process to be developed to give residents/affected people advance warning of abnormal deliveries, e.g. during the planting or harvest seasons; and

- safety education for the pupils at schools located in close proximity to the site, that have the potential to be impacted by the operation of the Project.

In addition to the mitigation measures identified, regulations regarding the transportation of heavy loads limit the cargo weight and size to the maximum amounts allowed for transporting vehicles. The *Kenyan Traffic Act* (revised 2009), states that all heavy and medium vehicles are also required by law to carry a warning sign at the rear of the vehicle that:

> *"shall consist of reflective material having alternate diagonal stripes of red and white at approximately forty-five degrees to the edges of such material."*

Furthermore the load should be well packed and safely fastened to the vehicle and the license plate should be visible at all times.

Residual Impact

Following the development and application of a traffic management plan which includes the mitigation measures presented above, it is considered that there should be a ***minor negative residual impact*** as a result of the construction of the Project.

6.5.3 *Impact Description and Significance: Operational*

Impact Description

During the operation the Project will operate on a 24 hour basis and employees will work in three 8-hour shifts. Routine maintenance and deliveries will only be undertaken during daytime hours.

It has been estimated that on average 10 trucks per day will be required to maintain fuel supplies for the Project under 'normal' expected conditions (i.e. the plant operating at approximately 85% capacity) and that a maximum of 13 trucks per day may be required if the plant operates for extensive periods at 100% capacity. There will also be various other infrequent deliveries, such as monthly diesel deliveries.

There Project will employ 40-50 permanent staff and 6 – 10 managerial staff, there will also be 10 - 20 support staff employed per shift. Managerial staff will most likely work during the day shift and will have their own vehicles, while it is likely the majority of the permanent and support staff will use public transport or travel by bicycle or on foot.

Using the upper figures and the shift patterns, the number of trips generated by the operation of the Project has been calculated and is set out below. For the purpose of a robust assessment it has been assumed that:

- managerial staff will only work during the day shift;
- the number of permanent and support staff working each shift is identical; and
- 5% of permanent and support staff will have a vehicle.

Table 6.25 Operational Staff and Vehicle Movements (1)

Shift	Staff Numbers	Private Vehicle Movements per day(2)	Fuel Supply Delivery Movements	Total Daily Movements
Day Shift	17 + 20 + 10	20	15	35
Afternoon Shift	17 + 20	4	15	19
Evening Shift	17 + 20	4	n/a	4

(1) Movement is one way, therefore two movements are required per day

(2) Assumes single occupancy vehicles

Impact Significance

The levels of traffic generated during operation will be easily accommodated within the design capacity of the new, upgraded road network and will add very little to the volumes of traffic already in existence. However it should be noted that even this low level of increase will have a ***moderate negative impact*** on community safety in the area as the Nairobi - Thika highway due to the numbers of pedestrians crossing the highway and access road.

Mitigation

The mitigation measures that are proposed will be implemented as part of a wider management plan for the Project. The following mitigation measures will be adopted within the management plan to reduce the impacts from the operation of this Project:

- appropriate strategies for moving materials and people to/ from and within the Project areas, including ad hoc deliveries, e.g. ensuring that delivery of Project equipment does not coincide with the start/end of the school day;

- provisions for management of the connection point between the site access road and the Nairobi - Thika highway, and for any maintenance work that may be required;

- procedures for monitoring the generated traffic movements and associated environmental problems;

- avoidance of mud on the Nairobi - Thika highway, including the provision and siting of wheel washes;

- measures to ensure that employees travelling to and from the site are able to do so in a safe manner, e.g. provision of mini bus(es) if appropriate;

- measures to prevent the use of unsuitable roads;

- a notification process to be developed to give residents/affected people advance warning of unusual deliveries/delivery times (e.g. during maintenance required to replace a large item of plant or equipment); and

- safety education for the pupils at the schools located in close proximity to the site, that have the potential to be impacted by the operation of the Project.

Residual Impact

Following the application of a traffic management plan, it is considered that there will be ***minor negative residual impacts*** as a result of the operation of this Project.

6.5.4 Impact Description and Significance: Decommissioning

During the decommissioning phase of the Project, potential impacts related to traffic and transport are likely to be similar to those associated with the construction phase, which will arise from the demolition and removal of building structures, equipment and waste. Theses impacts are primarily associated with a potential injuries associated with road traffic accidents as a result of an abnormal number of heavy vehicle movements. Nuisance and disturbance caused by noise and dust along transport routes is also likely to be a potential issue for those people living or working along transport routes to be used by the Project (see *Chapter 7* for further information on SCRP). The decommissioning of the Project may cause ***Moderate negative significant impacts*** in the form of road user safety.

Mitigation

The mitigation measures that are proposed below should be implemented in order to reduce the potential impacts from decommissioning traffic:

- appropriate strategies for moving materials (including waste), machinery and employees to/from and within decommissioning areas, including abnormal loads, e.g. ensuring that delivery of Project equipment does not coincide with the start/end of the school day;

- provisions for management of the connection point between the site access road and the highway, and for any maintenance work that may be required, e.g. monitoring traffic flow and driver behavior at the intersection to ensure queues are not forming on the Nairobi - Thika highway as a result of HGVs exiting the site, and to ensure drivers are operating vehicles in a safe manner;

- procedures, such as recording numbers/time of vehicle movements for monitoring environmental problems associated vehicle movements, e.g. recording instances of safety, congestion, noise and air quality complaints;

- avoidance of mud/dirt build up on the highway, including the provision and siting of wheel washes (facilities provided to wash mud/dirt build up off vehicle wheels);

- measures to ensure that employees travelling to and from the site are able to do so in a safe manner, e.g. provision of mini buses/other forms of company provided transport etc;

- measures to prevent the use of unsuitable roads where possible e.g. roads that likely to cause safety concerns, such as small public roads that are regularly frequented by pedestrians where a suitable alternative is available; and

- a notification process to give residents/affected local communities advance warning of removal of plant/equipment or waste that will require abnormal vehicles.

Residual Impact

Following the development and application of a traffic management plan which includes the mitigation measures presented above, it is considered that there should be a ***minor negative residual impact*** as a result of the decommissioning of the Project.

6.5.5 Summary of Impacts

Table 6.26 provides a summary of the significant impacts likely to arise during construction, operation and decommissioning both prior to the application of mitigation.

Table 6.26 Summary of Impact Significance Pre-mitigation

Phase	Impact	Significance (pre-mitigation)
Construction	Road User Delay	**Moderate Negative**
	Road User Safety	
	- Pedestrians/Community Safety	**Moderate Negative**
	- Increased volume	**Major Negative**
	- Overtaking	**Minor Negative**
	- Highway infrastructure Degradation	**Moderate-Major Negative**
	- Noise, vibration and air pollution	**No Significant Impacts**
Operation	Pedestrians/Community Safety	**Moderate Negative**
Decommissioning	Road User Safety	**Moderate Negative**

Table 6.27 provides a summary of the significant residual impacts likely to arise during construction, operation and decommissioning after the application of mitigation.

Table 6.27 Summary of Residual Impact Significance Post-mitigation

Phase	Impact	Significance (pre-mitigation)
Construction	Road User Delay	**Minor Negative**
	Road User Safety	
	- Pedestrians/Community Safety	**Minor Negative**
	- Increased volume	**Minor Negative**
	- Overtaking	**Minor Negative**
	- Highway infrastructure Degradation	**Minor Negative**
	- Noise, vibration and air pollution	**No Significant Impacts**
Operation	Pedestrians/Community Safety	**Minor Negative**
Decommissioning	Road User Safety	**Minor Negative**

6.6 WASTE

The baseline situation for waste management has been reviewed, based on the available information about current waste management arrangements and infrastructure in the area where the Project is being developed. The different types of wastes that will arise during construction, operation and decommissioning have been identified. This has been carried out from an understanding of the processes associated with the different parts of the proposed development, and has been supplemented with knowledge gained through the experiences of the ESIA project team. There was no specific information available regarding the quantities of waste that are likely to arise so the impacts have been assessed 'qualitatively' from the scale of the proposed development and operation.

The impacts that wastes generated during the construction, operation and decommissioning of the Project may have, have been assessed based on the general environmental significance criteria outlined in *Chapter 3* and the ESIA team's experience from similar power generation projects. Reference has also been made to international standards and guidelines such as IFC's Environmental, Health and Safety Guidelines for Thermal Power Plants, and the Reference Document on Best Available Techniques for Large Combustion Plants [(1)] (BREF Note) produced by the European Commission.

6.6.1 *Impact Description and Significance: Construction*

A review of the construction methodology and power plant processes was carried out to identify the wastes likely to arise from the construction of the

(1) European Commission. May 2005. Integrated Pollution Prevention and Control (IPPC) Reference Document on Best Available Techniques for Large Combustion Plants.

Project and potential environmental impacts associated with the handling and disposal of the identified wastes.

Waste streams generated during construction of the Project are likely to consist of the following:

- excavation spoil;
- construction waste;
- general waste; and
- sewage and wastewater.

The generation and handling of these waste streams is discussed in the following sections.

Excavation Spoil

By far the largest quantity of waste arising from the Project will be spoil generated from the excavation of the terraces to create level platforms for the installation of the major items of plant and equipment.

The spoil which is excavated in creating the platforms will, wherever possible, be re-profiled around the site or re-used for landscaping. Therefore, as little spoil as possible will be disposed off site. However, there will be a surplus of excavated material that will need to be disposed offsite.

Construction Waste

This will comprise a variety of non-hazardous materials including wood (used timber), excess concrete, vehicle tyres and packaging materials (plastic, card, etc), together with a small amount of hazardous wastes such as used oils (from vehicles and machinery), paints, vehicle batteries, fluorescent light bulbs and contaminated containers (old paint tins, etc).

There will also be packaging waste such as wooden pallets, plastic, paper, and cardboard from the delivery of the equipment and machinery to be used by the Project. In addition there will be empty tins and other containers from lubricating oils and hydraulic oils.

Maintenance of the plant and machinery used during construction will also give rise to a range of potentially hazardous wastes including:

- used oils - lubricating and hydraulic oils;
- filters – air and oil filters;
- batteries – mainly lead-acid batteries used in vehicles and other machinery; and
- washout water from concrete mixing plant – this is highly alkaline and must not be allowed to enter watercourses or groundwater.

General Refuse

General refuse, similar in nature to domestic waste, will be generated by the construction workforce at the work site. This will comprise a range of mainly non-hazardous materials including food residues, paper, used containers (bottles, cans, etc), packaging and broken furniture.

Sewage/Wastewater

Again, this will be generated by the welfare facilities provided for the construction workforce. Septic tanks will be installed and used for the treatment of sewage generated at the construction site.

Impact Significance

If not controlled properly, there could be impacts from the wastes generated by the construction phase of the Project. Specifically a range of potentially hazardous wastes, such as used oils, will be generated that have the potential to cause pollution of surface waters and groundwater resources.

The following table summarises the potential impacts of wastes from the construction phase assuming no mitigation.

Mitigation

All of the waste related impacts likely to arise during construction can be mitigated very effectively by the implementation of standard best practices in terms of environmental controls and management practices. These measures are detailed in the *Annex C*, which describes the measures that the Contractor will implement during the construction of the Project.

Key aspects of the plan include:

- an inventory and schedule of likely wastes;
- an assessment of local waste management facilities;
- waste minimisation principles;
- means to maximise reuse /recycle opportunities;
- waste segregation (liquid and solid/reusable and recyclable);
- waste collection, storage and transfer; and
- specific disposal procedures for all waste streams identified including:
    - waste transfer notes if moved to a offsite licensed facility;
    - auditing and reporting procedures; and
    - closure processes to include appropriate monitoring and recording.

Table 6.28 Potential Impacts of Waste Streams Arising from Construction Phase - Unmitigated

Waste type	**Potential impacts**			
	Nature	**Type**	**Duration**	**Scale**
Hazardous wastes eg used oils, filters, paints, lead-acid batteries, concrete washout water	Negative Pollution of groundwater and/or surface waters	Major	Long-term	Regional
General wastes e.g. food, paper, plastics	Negative Use of existing dumpsites will exacerbate environmental problems – windblown litter, pollution of groundwater and surface waters, vermin and other disease vectors, health impacts from direct contact of scavengers with the waste	Moderate cumulative	Long-term	Local/ Regional
Inert wastes eg rubble, concrete, bricks	Negative Primarily nuisance due to the creation of dust and impacts from its transport to disposal sites.	Minor	Short-term (duration of construction phase)	Local
Easily recyclable materials e.g. metals, wood	Positive Use of recovered materials instead of virgin materials.	Minor	Short-term	Regional

Waste streams generated during construction should be managed with due regard to the waste hierarchy. Specifically, the following principles should be adopted in order of preference.

- **Waste Minimisation**
  By carefully selecting materials and avoiding over-ordering, it will be possible to minimise the amount of waste that arises during the construction.

- **Reuse and Recycling**
  Some of the more inert wastes such as concrete, mortar, etc can be reused in the construction of access roads, car parks and hard standings. It may also be possible to sell (or donate) some of the excess materials, such as wood and metals, for reuse and recycling in the local community.

  In the case of waste lead acid batteries from plant and machinery, although these can be recycled, it is important that this is undertaken in an appropriate way so as to avoid health, safety and environmental problems associated with the acid within the batteries and lead fumes if the plates are melted down. Such recycling should only be undertaken by companies with proper equipment and safeguards, and by staff that have been adequately trained and provided with appropriate personal protective equipment (PPE).

Used oils can also be recycled but, again, this requires specialised equipment that may not be available locally. Such wastes will therefore need to be securely stored until an economic load has been accumulated to allow them to be transported to appropriate facilities. The transport of such wastes to treatment facilities some distance from the Project site will itself give rise to environmental impacts but these will be less than the potential impacts associated with inappropriate disposal in close proximity to the Project site.

It may be possible to compost fruit and vegetable waste (and other plant waste) arising from the welfare and canteen facilities and to use the compost as a soil improver. Meat waste should not be composted in open windrows to avoid the potential spread of pathogens.

- **Waste Treatment**
  When as much waste has been reused and recycled as possible, the remaining wastes should be treated so as to reduce their hazardous nature and/or their volume prior to disposal.

  In the case of specific hazardous wastes, such as organic solvents or oils that cannot be recycled, this will entail transporting the wastes to specialist treatment facilities. In the case of most general wastes, incineration allows the volume to be reduced and, energy to be recovered from the waste. However, incineration should only be undertaken using facilities that ensure effective combustion and which incorporate measures to clean the flue gases and avoid air pollution.

- **Disposal**
  Although the least favourable means of managing waste, it is inevitable that some waste will need to be disposed; as will some of the residues from waste treatment processes.

  There are no practical alternatives to using the existing dumpsites for the wastes that cannot be treated and the residues from treatment processes. The Project will not generate sufficient waste requiring disposal, for example, to justify developing its own landfill site. The mitigation to reduce the impact due to disposal of wastes at the dumpsite will be to minimise the amount of waste that is sent there through the waste minimisation and reuse/recycling measures outlined above.

Residual Impacts

There will be minimal impact associated with those wastes which can be safely reused or recycled locally.

However, it will be important to ensure that materials are recycled appropriately so as not to cause damage to the environment or risks to the health and safety of those people involved in the recycling. This is particularly the case in developing countries such as Kenya where the general level of environmental awareness and knowledge of technologies and procedures to reduce environmental impact is not as high as in highly industrialised countries. This applies specifically to the recycling of lead-acid batteries and used oils.

Existing dumpsites used for the disposal of general waste within Thika District are typical of such sites in developing countries and can be expected to be the cause of health problems associated with the vermin and scavenging animals and a range of environmental problems including:

- Fires - resulting in smoke pollution.

- Potential surface water and groundwater contamination – from the deposited wastes and their degradation products (due to their being unlined).

Disposal of any wastes from the construction phase of the Project, other than wholly inert wastes, at the local dumpsites will exacerbate the existing environmental problems that they are causing. It is therefore important that the amount of waste generated during the construction phase which needs to be disposed at the dumpsites should be minimised through the waste minimisation and reuse/recycling measures described above. This includes the composting of food waste from welfare and canteen facilities.

If all the potentially hazardous wastes are disposed of correctly and the additional wastes deposited at the dumpsites can be reduced to the absolute minimum, and restricted mainly to inert wastes, the residual impact associated with wastes generated during the construction phase should be of minor significance and of a short-term duration.

The following table summarises the expected impacts of wastes from the construction phase following the application of mitigating measures.

Table 6.29 Potential Impacts of Waste Streams Arising from Construction Phase - Mitigated

Waste type	**Potential impacts**			
	Nature	**Type**	**Duration**	**Scale**
Recyclable hazardous wastes eg used oils, lead-acid batteries	Positive Use as a replacement for virgin materials	Minor (small volumes)	Short-term (duration of construction phase)	Regional
Hazardous waste requiring treatment/disposal eg filters, paints, concrete washout waters.	Negative If properly disposed main impacts will transport	Negligible (providing suitable treatment facilities can be found)	Short term	Regional
General, non-food wastes	Negative Use of existing dumpsite will slightly exacerbate environmental problems that it is causing	Minor cumulative	Short-term	Local/ Regional
Food waste	Positive Use of compost will improve quality of soil	Negligible (small quantities)	Short-term	Local
Inert wastes e.g. rubble, concrete, bricks	Positive Use in construction will displace virgin materials. Use as cover at dumpsite will improve environmental impact of dumpsite	Minor	Short-term	Local
Easily recyclable materials e.g. metals, wood	Positive Use instead of virgin materials	Minor	Short-term	Regional

6.6.2 *Impact Description and Significance: Operational*

During the operational phase of the Project there will be a number of wastes generated from the Thika Power Plant processes (process wastes) and a range of other wastes from the transport operations and administration associated with the Project. These may be summarised as follows:

Process Wastes

The main process waste streams created during the operation of the Thika Power Plant will comprise:

- air intake filters;
- used lubricating oils from plant machinery and vehicles;
- used hydraulic oils;
- sludge from the wastewater treatment plant;
- process sludge;
- separated oil sludge from oil/water separators; and
- used oil or water treatment chemical containers.

Other Wastes

In addition to the above process wastes, there will be a number of other wastes associated with the operation and maintenance of the Thika Power Plant including a number of hazardous wastes:

- used batteries from vehicles;
- used oil and air filters from machinery and vehicles;
- other maintenance waste including oily rags and paint residues; and
- very small quantities of expired drugs from the on site dispensary.

During operation, general refuse will be generated by the staff responsible for the operation and maintenance of the Thika Power Plant. This will comprise general domestic waste (food, packaging, etc) and office waste (mainly paper). The quantities of general waste generated during the operation will be relatively small because of the small numbers of staff employed on each shift.

Impact Significance

If not controlled properly, there could be impacts from the wastes generated during the operational phase of the Project. Specifically a range of potentially hazardous wastes, such as used oils, will be generated that have the potential to cause pollution of surface waters and groundwater resources.

The following table summarises the potential impacts of wastes from the operational phase assuming no mitigation.

Table 6.30 Potential Impacts of Waste Streams Arising from Operation Phase - Unmitigated

Waste type	**Potential impacts**			
	Nature	**Type**	**Duration**	**Scale**
Hazardous wastes e.g. used oils, filters, paints, lead-acid batteries, oil and water treatment chemical containers	Negative Pollution of groundwater and/or surface waters	Major	Long-term	Regional

Waste type	Potential impacts			
	Nature	Type	Duration	Scale
General wastes e.g. food, paper, plastics	Negative Use of existing dumpsites will exacerbate environmental problems – windblown litter, pollution of groundwater and surface waters, vermin and other disease vectors, health impacts from direct contact of scavengers with the waste	Moderate cumulative	Long-term	Local/ Regional
Sludge from WWT plant	Negative Pollution of groundwater and/or surface waters	Moderate	Long term	Local/ Regional
Sludge from oil/water separators	Negative Pollution of groundwater and/or surface waters	Major	Long term	Local/ Regional

Mitigation: Waste Management

The impact of the wastes from the operation phase of the Project can be mitigated by managing them in accordance with the Waste Management Plan and with due regard to the waste hierarchy.

Additionally, during operation of the Project:

- all hazardous materials are stored in clearly labelled containers;
- storage and handling of hazardous materials should be in accordance with national and local regulations appropriate to their hazard characteristics; and
- fire prevention systems and secondary containment will be provided for storage facilities, where necessary, to prevent fires or the releases of hazardous materials to the environment.
- **Waste minimisation**
  By carefully selecting materials and avoiding over-ordering, it will be possible to minimise the amount of waste that arises during operation.
- **Reuse and Recycling**
  It should be possible to sell (or donate) a range of materials for reuse and recycling in the local community and/or regionally. As discussed for the construction phase impacts, lead acid batteries can be recycled but it is important that this is undertaken in an appropriate way so as to avoid H&S and environmental problems. Similarly, used oils from plant and machinery can be recycled, but again this requires specialised equipment that may not be available locally.

It should also be possible to compost vegetable and fruit wastes generated by the welfare and canteen facilities if arrangements are made to collect these separately. The resulting compost could be used on landscape areas around the Project site and possibly on the adjacent t coffee growing areas.

Paper and plastic waste from the offices and welfare facilities could be segregated and sold for recycling. This will probably require them to be baled, or otherwise bulked, to enable them to be economically transported to a recycling company.

In order to maximise the amount of waste that is recycled, Thika Power Plant will need to identify companies that can recover waste oils and recycle paper, plastic, etc.

- **Treatment**
  Certain hazardous wastes such as used oil filters cannot be recycled and will need to be disposed of correctly in specialist facilities (e.g. high temperature incinerators). It is unlikely that such facilities exist locally and if necessary, such wastes should be exported to countries that have the facilities to ensure their environmentally sound treatment and disposal. The quantities of such hazardous wastes will, however, be very small so their overall impact will be relatively minor.

Any expired drugs from the on-site dispensary will be returned to the suppliers for treatment and disposal. There will be no other clinical wastes as there will be no on-site medical clinic.

- **Disposal**
  Inevitably, it will not be possible to reuse or recycle all of the waste generated at the site during operation of Thika Power Plant and some of it will need to be disposed. As for the construction phase, there will be few practical alternatives to using the existing dumpsites for the wastes that can not be treated (mainly inert wastes) and for the residues from, for example, water treatment plant (ie sludge). The main mitigation to reduce the impact due to disposal of wastes at the dumpsite will be to minimise the amount of waste that is sent there through the waste minimisation and reuse/recycling measures outlined above.

Residual Impact

As discussed for the construction phase impacts, there will be minimal impact associated with those operational wastes which can be safely reused or recycled locally. Indeed, recycling of used oils, for example, if undertaken appropriately will result in a positive impact, or environmental benefit, in that they will displace virgin oils. However, it will be important to ensure that appropriate facilities are used so as to avoid potential adverse impact on the environment and to minimise the risks to the health and safety of the people involved in the recycling.

Disposal of any wastes from the operation at the dumpsites will tend to exacerbate the existing environmental problems they are causing. It is therefore important that the amount of waste disposed at the dumpsites is minimised through the waste minimisation and reuse/recycling measures described above.

If the small quantities of all the potentially hazardous wastes are disposed of correctly and the additional wastes deposited at the dumpsites can be reduced to the absolute minimum, and restricted mainly to inert wastes, the residual impact associated with wastes generated during the operation of the Project should be of minor significance.

The following table summarises the expected impacts of wastes from the op operation phase following the application of mitigating measures.

Table 6.31 ***Potential Impacts of Waste Streams Arising from the Operation Phase - Mitigated***

Waste type	**Potential impacts**			
	Nature	**Type**	**Duration**	**Scale**
Recyclable hazardous wastes eg used oils, lead-acid batteries, oil and water treatment chemical containers	Positive Use instead of virgin materials.	Minor	Long-term (duration of the operation)	Regional
Hazardous waste requiring treatment/disposal e.g. filters, paints,	Negative If properly disposed main impacts will be transport related	Minor (providing suitable treatment facilities can be found)	Long term	National/ international (depending on availability of appropriate treatment facilities)
General, non-food wastes and sludge from the wastewater treatment plant	Negative Use of existing dumpsite will slightly exacerbate environmental problems that it is causing	Moderate cumulative	Long term	Local/ Regional
Food waste	Positive Use of compost on land will improve soil quality	Negligible (very small quantities involved)	Long-term	Local
Metals, wood	Positive Use instead of virgin materials	Minor (small quantities involved)	Long-term	Local

6.6.3 *Impact Description and Significance: Decommissioning*

When the Thika Power Plant and associated facilities are decommissioned, and assuming that the land is cleared as part of this process, a variety of different wastes will be generated. In broad terms, these will comprise:

- machinery;
- metal (mainly ferrous); and
- demolition waste.

Machinery

It may be possible to sell much of the redundant machinery and electrical equipment, including cabling, from the power plant. Equipment that it is not possible to sell for reuse elsewhere will probably be sold for scrap. Hence there is unlikely to be a significant impact in terms of the 'waste machinery' itself.

The majority of the ferrous metals should be sold for scrap.

Lubricating and hydraulic oils from machinery may need to be removed prior to transport/export, however, so there will be a potential impact if these are not properly managed.

Demolition Waste

Waste will arise from the demolition of the buildings and foundations – assuming that the land is cleared following decommissioning. Demolition wastes will comprise mainly inert materials from the fabric of the buildings but will also include wood, plastics, metals and potentially hazardous materials from switchgear and transformers.

There may be other wastes such as sludge from the ETP that will also need to be disposed when all the plant is disassembled.

Impact Significance

As indicated above, it would be expected that all of the machinery and equipment associated with the power plant and ETP will be either sold for reuse elsewhere or will be sold for its scrap value and hence this 'waste' will create minimal impact.

However the oils from the machinery, which may need to be drained prior to transport, have the potential for significant environmental impact if not managed properly.

It may be possible to recycle some of the demolition waste if there is a suitable construction project or road building scheme nearby. If there are no such projects that can utilise the rubble, it may be possible to use it to form access roads or as daily cover for the local dumpsites, thereby improving the dump site's environmental conditions. There is a potential for minor impact due mainly to dust and visual impact arising from the disposal of the rubble from the demolition if this is not managed properly.

The following table summarises the potential impacts of wastes from the demolition phase assuming no mitigation.

Table 6.32 Potential Impacts of Waste Streams Arising from the Decommissioning Phase - Unmitigated

Waste type	**Potential impacts**			
	Nature	**Type**	**Duration**	**Scale**
Used plant and machinery	Positive Assumed sold for reuse or scrap	Minor	Short-term	Local/regional/national (depending on where the equipment is reused/ recycled)
Hazardous wastes from plant and machinery at the site eg used oils, filters, lead-acid batteries	Negative Pollution of groundwater and/or surface waters	Major	Long-term	Regional
Sludge and other process waste remaining on site when the plant is decommissioned	Negative Pollution of groundwater and/or surface waters	Moderate	Long-term	Local/regional
Inert wastes from demolition of buildings e.g. rubble, concrete, bricks	Negative Primarily nuisance due to the creation of dust and impacts from its transport to disposal sites.	Minor	Short-term	Local
Easily recyclable materials from the demolition e.g. metals, wood	Positive Use instead of virgin materials	Minor	Short-term	Local

Mitigation

The impact of the wastes from the decommissioning of the Project can be mitigated by adopting the waste hierarchy

- **Waste Minimisation**
  Although the total amount of waste cannot be reduced, the amount which needs to be disposed of can be minimised by avoiding damage to equipment that may be reused and by careful segregation of materials that can be recycled.

- **Reuse and Recycling**

  Some of the more inert wastes such as concrete and mortar from demolition of buildings and foundations can be reused in the construction of new developments, roads and car parks/hardstandings, but only if there are such projects nearby that require these materials at the time of the decommissioning. In the absence of such reuse opportunities, the most productive use of these inert materials may be at the local dumpsites (or landfill if one has been developed by the time the Project reaches the decommissioning stage). The rubble can be used to form temporary access roads and/or, if particle size is sufficiently small, can be used to cover the other wastes to prevent lighter materials being blown around, preventing access to scavenging animals, reducing rainfall ingress and improving the visual appearance of the site.

It should also be possible to recycle materials such as wood and metals if the demolition is carefully controlled so that these materials can be recovered and segregated from the other wastes.

As discussed above, the power plant and machinery will probably be sold for reuse and any smaller items that can not be sold for reuse will be sold as scrap. Used hydraulic and lubricating oils from the machines should be collected and securely stored before being transported to an appropriate recycler (as identified during the operation phase – see above).

- **Treatment**

  A very small quantity of hazardous wastes may arise during the decommissioning which cannot be recycled. These will need to be disposed of correctly in specialist facilities (e.g. high temperature incinerators). As discussed previously, there may not be local facilities to treat all the hazardous wastes – even in the future - and, if necessary, such wastes will need to be exported to countries that have appropriate facilities, to ensure their environmentally sound treatment and disposal.

- **Disposal**

  Inevitably, some of the waste generated during decommissioning and demolition will need to be disposed. By the time that the Project is decommissioned, the local dumpsites may have been replaced by an engineered landfill. The inert materials from the demolition of buildings, if not used in other construction projects, may be used as cover material or to form temporary access roads at the landfill (or dumpsites if these are still in use). There will be few practical alternatives to using the landfill/dumpsites for the mainly inert wastes that arise during decommissioning and demolition. This will also apply to any sludge remaining from the ETP.

Table 6.33 Potential Impacts of Waste Streams Arising from the Decommissioning Phase - Mitigated

Waste type	**Potential impacts**			
	Nature	**Type**	**Duration**	**Scale**
Used plant and machinery	Positive Assuming sold for reuse or scrap	Minor	Short-term	Local/regional/national (depending on where the equipment is reused/ recycled)
Recyclable hazardous wastes eg used oils, lead-acid batteries	Positive Use instead of virgin materials	Minor	Short-term	Regional
Hazardous waste requiring treatment/disposal eg filters, paints,	Negative If properly disposed, main impacts will be transport	Minor (providing suitable treatment facilities can be found)	Short-term	National/ international (depending on availability of appropriate treatment facilities)
Sludge and other process waste remaining on site when the plant is decommissioned	Negative Groundwater pollution assuming disposal at local dumpsite – depends on availability of better landfill at time of decommissioning	Moderate (Negligible if better landfill available)	Long-term	Local/regional
Inert wastes from demolition of buildings eg rubble, concrete, bricks	Positive If recycled or used to improve dumpsite	Negligible	Short-term	Local
Easily recyclable materials from the demolition eg metals, wood	Positive Use instead of virgin materials	Minor	Short-term	Local

Residual Impact

There will be minimal impact associated with those wastes which can be safely reused or recycled locally. As discussed previously, it will be important to ensure that all such materials are recycled appropriately so as not to cause damage to the environment or risks to the health and safety of those people involved in the recycling. Local and national organisations that can safely recycle the different types of materials (e.g. wood, metals, paper, used oils and lead-acid batteries) will have been identified during the course of operations at the site so it should be possible to utilise these same companies for recycling any such wastes that arise during decommissioning.

If wastes that can be reused or recycled are recovered, if all the potentially hazardous wastes are disposed of correctly and if the quantity of the remaining wastes that need to be deposited at the landfill/dumpsites can be minimised, the residual impact associated with wastes generated during the decommissioning and demolition phase should be of minor significance and of a short-term duration.

6.7 *LANDSCAPE AND VISUAL*

This section considers the impacts of the proposed Project upon the landscape character, view and visual amenity, broadly categorised as landscape and visual impacts. It is acknowledged that the implementation of the power plant will introduce some degree of changes into the existing landscape and views.

The two main sources of landscape and visual impacts are the height and bulk of the proposed structures. Key potential impacts which arise from the proposed development have been summarised below. These have been discussed further in more detail in this chapter:

- long term landscape and visual impacts will result at the main Project site due to new buildings, in particular the installation of stack or chimney which is approximately 65 m in height and will be visible over the site boundary; and

- the installation of tanks as well as the main block housing steam turbines and engines (both approximately 16 -18 m high).

The landscape and visual impact assessment has been prepared in accordance with good practice and also incorporates the assessment methodology as described in the Guidelines for Landscape and Visual Impact Assessment (1) produced jointly by the British Landscape Institute and the British Institute of Environmental Management and Assessment (IEMA). This methodology is applicable both to the assessment of short term impacts during the construction of the Project, and to long term impacts during its operation.

Landscape character and resources should be considered to be of importance in their own right, and valued for their intrinsic qualities regardless of whether they are seen by people. Impacts on visual amenity as perceived by people are therefore clearly distinguished from, although closely linked to, impacts on landscape character and resources. Landscape and visual assessments are therefore separate, but linked processes and a clear distinction is drawn between impacts on landscape character and visual impacts, as described below.

(1)Guidelines for Landscape and Visual Impact Assessment:2nd Edition; The Landscape Institute and Institute of Environmental Management and Assessment; 2002

- Landscape impacts relate to the effects of the proposals on the physical and other characteristics of the landscape and its resulting character and quality.

- Visual impacts relate to the effects on views from visual receptors (e.g. residents, workers, tourists, etc) and on the amenity experienced by those people (sometimes referred to as visual impact receptors).

Significance Criteria

The significance of impacts is categorised in line with the general environmental significance criteria set out in *Chapter 3.*

The significance of landscape and visual impact is based and evaluated on two main factors, sensitivity of the landscape or viewer to change, and magnitude of change.

- **Sensitivity of the landscape or viewer to change**
  The sensitivity of the landscape depends upon its inherent nature, quality, condition and ability to accommodate change; and on any specific values (such as statutory landscape designations) that may apply. A World Heritage Site would, for example be more sensitive to change.

  The sensitivity of viewers depends upon the duration of their exposure to perceptible views of the site, the frequency of opportunities for them to visually perceive the site. Hence, a resident with a permanent view is considered to be of higher sensitivity than a worker or traveller with a transient viewing opportunity. The sensitivity of the receptor is described as *low*, *moderate* or *high*.

  The built characteristics of settlements in the surrounding areas (including the road side settlement houses close to the site and within the Witeithie Estate) are basic, and of low-average build quality. They are purely functional, having little or no aesthetic elements within their design. The residential/commercial buildings are of variable built quality, as a result of progressive organic growth (natural development in absence of a coordinated development plan). The residential Estates in the surrounding areas, especially Witeithie, form a large incongruous landscape feature in the surrounding area, due to their layout and unplanned development.

  In terms of aesthetics and architecture, there are no outstanding or significant features in the settlements neighbouring the Project site, nor any within the premises of Mang'u High School.

  For the above reasons the sensitivity of the receiving environment is considered to be *low*.

- **Magnitude of change**

The magnitude of change on landscape or visual receptors depends upon the nature and scale of the development and other factors such as distance from source, context and quantifiable elements such as area and length. The magnitude of impact is described as being imperceptible, small, medium or large.

Evaluation of Impact Significance

Impact significance is determined by cross-referencing the sensitivity of the landscape or viewer, with the magnitude of change expected as a consequence of the development. Thus an impact of major significance will usually occur where the sensitivity of the landscape or viewer is high and the magnitude of the impact is large. The assessment of impact significance also requires the application of professional judgement and experience as significance can be subjective. Each example is therefore assessed on a case-by case-basis.
The following definitions, as described in *Table 6.34* and *Table 6.35* are used in this assessment.

Table 6.34 Levels of Significance of Landscape Impacts

Sensitivity of Landscape			Magnitude of Change in Landscape caused by Proposed Development			
			Imperceptible	Small	Medium	Large
			An imperceptible, barely or rarely perceptible change in landscape characteristics.	A small change in landscape characteristics over a wide area or a moderate change either over a restricted area or infrequently perceived	A moderate change in landscape characteristics, frequent or continuous and over a wide area or a clearly evident change either over a restricted area or infrequently perceived.	A clearly evident and frequent/continuous change in landscape characteristics affecting an extensive area.
	Low	A landscape which is not valued for its scenic quality or where its character, existing land use, pattern and scale are tolerant of the type of change envisaged, and the landscape has capacity to accommodate change	Not significant	Not significant	Minor	Minor to moderate
	Medium	A moderately valued landscape, perhaps a locally important landscape, or where its character, land use, pattern and scale may have the capacity to accommodate a degree of the type of change envisaged.	Not significant	Minor	Moderate	Moderate to major
	High	A landscape protected by a regional (structure plan) or national designation and/ or widely acknowledged for its quality and value; a landscape with distinctive character and low capacity to accommodate the type of change envisaged	Not significant	Minor to moderate	Moderate to major	Major

This table is a guide only. The descriptions of levels of magnitude and sensitivity are illustrative only. Each case is assessed on its own merits using professional judgement and experience, and there is no defined boundary between levels of impacts

Table 6.35 Levels of Significance of Visual Impacts

			Magnitude of Change in View caused by Proposed Development			
			Imperceptible	Small	Medium	Large
			Change which is barely visible, at very long distances, or visible for a very short duration, perhaps at an oblique angle, or which blends with the existing view.	Minor changes in views, at long distances, or visible for a short duration, perhaps at an oblique angle, or which blends to an extent with the existing view.	Clearly perceptible changes in views at intermediate distances, resulting in either a distinct new element in a significant part of the view, or a more wide- ranging, less concentrated change across a wider area.	Major changes in view at close distances, affecting a substantial part of the view, continuously visible for a long duration, or obstructing a substantial part or important elements of view.
Sensitivity of Landscape	Low	Small numbers of visitors with interest in their surroundings. Viewers with a passing interest not specifically focussed on the landscape *e.g.* workers, commuters. The quality of the existing view, as likely to be perceived by the viewer, is assessed as being low	Not significant	Not significant	Minor	Minor to moderate
	Medium	Small numbers of residents and moderate numbers of visitors with a interest in their environment. Larger numbers of recreational road users. The quality of the existing view, as likely to be perceived by the viewer, is assessed as being medium	Not significant	Minor	Moderate	Moderate to major
	High	Larger numbers of viewers and/or those with proprietary interest and prolonged viewing opportunities such as residents and users of attractive and well-used recreational facilities. The quality of the existing view, as likely to be perceived by the viewer, is assessed as being high	Not significant	Minor to moderate	Moderate to major	Major

This table is a guide only. The descriptions of levels of magnitude and sensitivity are illustrative only. Each case is assessed on its own merits using professional judgement and experience, and there is no defined boundary between levels of impacts.

In addition, the following criteria were also used in the landscape and visual assessment:

- landscape/townscape integrity – compatibility with existing built environment; and

- visibility of lighting, and the effect of lighting on surroundings.

Limitations

This assessment is based on a desktop research and reconnaissance surveys using survey maps, topographical data and aerial photographs. This information was used to identify and understand the topographical features, land use and landscape patterns as well as the view catchment area (i.e. places from where the development might be seen).

The main limitations for the landscape and visual impact assessment are the absence of accurate 3D computer simulations (eg photomontages) which have not been prepared to illustrate the proposed power plant. However, professional judgement has been used to assess the landscape and visual impacts in their absence assisted, by field observations by ERM staff and photography from sensitive receptors.

6.7.2 *Impact Description and Significance: Construction*

A description of the construction schedule for the proposed Project has been provided in *Chapter 5* of this report. It is important to note that to the east of site, construction activities for the adjacent electric substation have already begun.

Figure 6.4 Ongoing Construction Activities for KPLC Sub Station and Transmission Line Project

Taking into consideration that construction for the substation has already commenced adjacent to the site, it is acknowledged that short-term landscape and visual impacts will continue and run into the construction phase of the power plant. However, these impacts would be phased, temporary and restricted to the construction period, and therefore the resulting landscape and visual impacts will also be temporary. Even though appropriate construction management will be in place, it is important to establish the key landscape and visual impacts which might arise during the remaining construction period. The mitigation measures described below have been recommended to ensure that the potential construction impacts are reduced by a considerable degree.

Potential Impacts

The key landscape and visual impacts resulting from the construction phase include those resulting from:

- impacts arising from the installation of site compound and security posts;
- the installation of temporary offices and sign boards;
- the development of temporary facilities for vehicle and pedestrian access and regulation;
- temporary works and installations, and temporary storage;
- the installation and movement of heavy and light construction machinery(including tall cranes);
- construction lighting, including high mast lighting for activities; and
- special load movement and storage.

As described earlier, the receiving environment is essentially a rural area, even though there are developed features such as the highway (and currently the upgrading project), adjacent construction activities for the substation, and relatively small-scale agriculture-based industries like the coffee farm and the large horticultural area under "poly-tunnel" to the east. It is acknowledged that the construction activity's visible expression, including lighting, will provide some degree of increased disruption to the landscape and intrusion into views, especially to visual receptors in the nearby small cluster of houses at the farm to the north of the Project site.

In the vicinity of the site, the main receptors are the small groups of houses to the east and north of the site, the populations of Witeithie and Ngoingwa Estates, Mang'u High School, and possibly other communities perhaps as far away as Thika.

Taking into consideration the development activities in the site surroundings, the inherent low sensitivity of the receiving landscape, absence of any landscape and visual designations it is considered that the construction impacts are most likely to be of ***minor negative*** significance with regard to both landscape and visual impacts. This takes into consideration *low* sensitivity of the site with *medium* magnitude of change for both landscape and visual. However, it is important to note that with the increase in distance there is significant reduction in magnitude and therefore in landscape and visual impacts.

Mitigation

The mitigation measures described below are an inherent part of good construction management practice. However, these are reiterated and recommended throughout the construction phase, and throughout the long term operation of the scheme, to minimise landscape and visual impacts:

- machinery and materials will be stored tidily during the works. Tall machinery including cranes will not be left in place for longer than required for construction purposes, in order to minimise its visual intrusion;

- temporary roads providing access to site compounds and work areas will be maintained free of dust;

- outdoor construction lighting, where required, shall be unobtrusive as possible and shall not allow light to shine upwards or towards residential areas; and

- security and work lighting (both during construction and operation) shall be shielded and directed downwards to prevent side-spill; the use of tall mast lights shall be carefully assessed, and avoided if possible, to minimise light impacts both during construction and operation.

6.7.3 Impact Description and Significance: Operational

Permanent landscape and visual impacts will arise once the plant is fully operational, due to the fact that the proposed Project is close to residential properties and the development will effectively increase the amount of infrastructure on the site and in the locality.

Embedded Mitigation within Design

The following mitigation measures are recommended throughout the operational phase of the proposed power plant to further minimise landscape and visual impacts:

- the design, orientation and materials will be appropriately and reasonably developed to match existing site and landscape characteristics;

- appropriate use of non-reflective surfaces and surface colour treatment;

- an appropriate landscape plan shall be developed and adopted using tree belts and buffer screenings to provide visual relief and shade;

- minimisation of external signage clutter and signs which have a silhouette effect on the skyline;

- roads providing access to site facilities and works areas will be landscaped and maintained free of dust where feasible;

- outdoor lighting shall be as unobtrusive as possible and shall be shielded and directed downwards to prevent side spill. The use of tall mast lights shall be carefully assessed before being implemented, taking into account the inherently rural location and the site's proximity to residential areas; and

- monitoring to ensure that visual screening and dust control measures in the Management and Action Plans for the Project are implemented effectively.

Potential Permanent Impacts - Impacts on Landscape

There are currently no designated landscapes within the study area (visual envelope) or in the wider area, and no known built or cultural heritage features located within the site or study area which would make the landscape more sensitive. The loss of the land within the existing boundary for the proposed expansion is considered to be *minor*, as the land use was converted from agricultural to industrial, and the site has already been cleared. Moreover, there is already construction activity on the adjoining substation site which reduces the Project area's sensitivity. As mentioned in the baseline section the surrounding land uses are primarily rural in essence; however, there is significant development in the area.

Bearing in mind the above-mentioned landscape receptors, and our assessment of the surrounding environment as being of *low* sensitivity and the proposed Project's magnitude of change as *medium*, the resultant impacts on the landscape during operation are considered to be of ***minor*** significance.

Potential Permanent Impacts - Visual Impacts

The main receptors in the vicinity of the site are the immediate populations of Ngoingwa Estate, Witeithie Estate, and Kiandutu and in the wider areas of Thika city and Gachororo due to the high built components of the Project like the stack, storage tanks and the powerhouse structure. In addition, agricultural workers and others using or passing through the landscape (e.g. those working on the coffee farm, users of the highway) could also be affected. There are currently no designated areas of visual importance (i.e. strategic views), or any in the process of being identified.

Table 6.36 discusses and assesses visual impacts of the Project at selected locations within the study area.

Table 6.36 Visual Impacts at fixed Viewpoint Locations

VP No	Description Of Viewpoint	Viewer Type and Number	Components in Existing View	Proposed View	Viewpoint Sensitivity	Magnitude of Change	Significance of Impact.
1	View from closest residences to east of site (approx 100 m)	H(Few)	Pedestrian path, shrub and vegetation, sloping land of which some areas have been cleared and dug	Direct views of the proposed power plant along with associated infrastructure at close distance	Considering the distance and very small number of residents the sensitivity is considered to be *medium*	The magnitude of change is considered to be *large* given the distance	*Moderate to major*
2	View from Mang'u High School Teachers accommodation (approx 400 m)	H(Few) W(Few)	Fencing and barbed wire, shrub and vegetation,	Direct views of the proposed power plant, mainly the stack. Due to the vegetation and trees it is unlikely that the plant buildings and lower infrastructure will be visible.	Considering the distance, and very small number of residents and workers the sensitivity is considered to be *medium*	The magnitude of change is considered to be *small* given the distance and taking intervening vegetation and topography into consideration and existing elements in the view.	*Minor*
3	View from Kanyire Farm on northern valley side(approx 600 m)	H(Few)	Undulating land, highway, Witeithie, telecommunication tower to the left , grassland, shrub and vegetation, construction work(embankment)	Direct views of the proposed power plant and associated infrastructure.	Considering the distance and the small number of residents the sensitivity is considered to be *medium*	The magnitude of change is considered to be *Medium* given the distance and taking vegetation and topography into consideration	*Moderate*

VP No	Description Of Viewpoint	Viewer Type and Number	Components in Existing View	Proposed View	Viewpoint Sensitivity	Magnitude of Change	Significance of Impact.
4	View from disused Brewery (approx 1100 km)	T(Few)	Nairobi - Thika highway, vegetation and open grassland	Indirect views of the proposed power plant. It is unlikely to be seen due to vegetation and topography	Considering that these will be transient views the sensitivity is considered to be *low*	The magnitude of change is considered to be *small* given the distance, topography and vegetation	*Not significant*
5	View from the northern corner of Witeithie Estate (approx 300 m)	H(Mod)	Nairobi - Thika highway, vegetation and open grassland, vehicles on highway, houses, electric poles and transmission lines	Direct views of the proposed power plant mainly the stack. The building and other facilities is unlikely to be seen due to vegetation and topography	Considering the distance, and the moderate number of residents in this location the sensitivity is considered to be *medium*	The magnitude of change is considered to be *small* given the topography the existing elements in the view and vegetation	*Minor*
6	View from the road crossing to Witeithie Estate (approx 600 m)	H(Few) W(Few)T(Few)	Nairobi - Thika highway, vegetation and open grassland, vehicles on highway, houses, electric poles and transmission lines	Indirect views of the proposed power plant. It is unlikely to be seen due to vegetation and topography	Considering that these will be transient views the sensitivity is considered to be *low*	The magnitude of change is considered to be *small* given the distance, topography and vegetation	*Not significant*

Key:
Viewer type: H = housing (residential); R = recreational; T = road users and commuters; W = workers.
Viewer numbers: Residential and Recreational: Many >50; Mod 15-50; Few 0-15, **Road users and Workers**: Many >1000, Mod >500, Few <500.

Night Time Effects of Lighting

Operation of the power plant will require lighting at night. This will be apparent in hours of darkness, particularly visible to and affecting nearby residential areas, and some residents as far away as Thika. Given the topography, night lighting is also likely to impact views within a relatively wide area, affecting some communities from which the power plant will be visible.

As the overall sensitivity of the receiving environment is considered to be *low* with a *medium* magnitude of change, the resulting impacts would be of ***minor significance***.

Stack Plumes

Stack Plumes will have the potential to affect the landscape character of areas and their visual amenity. However the plume's visibility is dependent on several factors, including:

- the strength and direction of wind;
- the ambient temperature of the atmosphere; and
- humidity.

Therefore bearing in mind that plume visibility is dependent on several factors, and that plumes from the stack are likely to be relatively unnoticeable under the normal operational regime, the impact significance is considered to be ***minor***.

Residual Impacts

The height and bulk of the proposed Project is generally dictated by its purpose, i.e. power generation, and in some respects the need to take necessary measures to protect the environment and human health (such as to build tall stacks to disperse the power plant's emissions to air). Nevertheless, the use of recommended mitigation measures could significantly reduce the landscape and visual impacts on the receiving environment, if implemented and managed according to industry best practice. In doing so, the Project will be less obvious in the surrounding landscape, and therefore less obtrusive. However, its residual impacts during operation will continue to be of ***minor significance*** (for landscape) and would ***range between minor and major significance (***for visual impact).

6.8 SOCIAL AND SOCIO-ECONOMIC IMPACTS

This section outlines the significance criteria that have been used during the social impact assessment.

6.8.1 *Social Impact Criteria*

Magnitude

For social assessment, the magnitude of an impact is the extent to which a human receptor gains or loses access to, or control over, socio-economic resources [1] resulting in a positive or negative effect on his or her well-being [2].

The term 'magnitude' in this respect covers all dimensions of the predicted impact to the natural or human environment including:

- the nature of the change (what resource and receptor is affected, and how);
- the spatial extent of the area impacted, or proportion of the population/ community affected;
- temporal extent (i.e. duration, frequency, reversibility); and
- where relevant, the probability of the impact occurring.

The assessment of impact magnitude needs to consider each of these factors. It is important to acknowledge that the scale of magnitude (from low to high) is in practice continuous and may not fit into a neat categorisation, and evaluation along the spectrum professional judgement and experience. Each impact is evaluated on a case by case basis, and the rationale explicitly described in the analysis of each impact.

(1) Socio-economic resources in this context refers to natural, physical, social and financial capital (stock of resources).
(2) A concept combining an individual's health, prosperity, their quality of life, and their satisfaction.

Table.6.37 Magnitude – the Degree of Change brought about in the Environment

Nature	**Resources**: The term resources is used to describe features of the environment such as water resources, habitats, species, landscapes, etc which are valued by society for their intrinsic worth and/or their social or economic contribution. For a socio-economic assessment resources can be business or community assets, amenities and opportunities. These include existing and potential resources within the areas of influence such as local business customers, employment and training opportunities, agricultural, residential and commercial land values etc. **Receptors:** The term receptor is used to refer to people and communities who may be affected by the proposed Project.
Extent	**On-site –** impacts that are limited to the Project site only. **Local –** impacts that affect an area in a radius of 2 - 3 km around the development area. **Regional –** impacts that affect regionally important resources or are experienced at a regional scale as determined by administrative boundaries. **National –** impacts that affect nationally important resources or affect an area that is nationally important/ or have macro-economic consequences. **Transboundary/International –** impacts that affect internationally important resources or have transboundary consequences.
Duration	**Temporary** – impacts are predicted to be of short duration and are intermittent/ occasional. **Short-term** – impacts that are predicted to last only for the duration of the construction period. **Long-term** – impacts that will continue for the life of the Project, but cease when the Project stops operating. **Permanent** – impacts that cause a permanent change in the affected receptor and resource that endures beyond the Project lifetime.
Probability	The likelihood that an impact will occur: **Unlikely** - The impact is unlikely to occur. **Likely** - The impact is likely to occur under most conditions. **Definite** – The impact will occur.

Evaluating the Sensitivity of Resources/Receptors

For social and socio-economic impacts, we define the degree of sensitivity of a receptor as:

> *"a stakeholder's (or groups of stakeholders') resilience or capacity to cope with sudden changes or economic shock"***.**

The sensitivity of a resource is based on its quality and value/importance, for example: its local, regional, national or international designation; its importance to the local or wider community; or its economic value.

Stakeholders may be more sensitive for a variety of reasons and for the purpose of this scheme the following factors have been considered:

- age, gender, race or religion;
- land rights and ownership patterns;
- income/employment/unemployment;

- livelihood (current and extent of livelihood alternatives);
- services, *e.g.* health, amenities (quality and access);
- access to, and use of, natural resources including water;
- food security and reliance on subsistence farming;
- education/skills;
- health or disability;
- support networks; and
- exclusion or marginalisation (e.g. degree of access to resources, services and formalised rights).

The groups which have been identified as being potentially, drawing on the above criteria, include the following:

- those living below the poverty line;
- the unemployed;
- those with low education levels or are unskilled;
- female-headed households;
- the elderly; and
- those who do not own the land that they use or live on.

Evaluation of Significance

As described in above, magnitude and sensitivity are looked at in combination to evaluate whether an impact is significant, and if so, its degree of significance. For social impact assessment, the perceptions of stakeholders of particular issues, expressed as opinions around certain issues, are particularly important and consequently the concept of perception is explicitly brought into the evaluation of significance after an impact is evaluated. When an impact is of significant stakeholder concern this may be cause to raise the significance rating, for example from moderate to major. This alteration prompts the formulation of more rigorous and appropriate mitigation measures which focus on the source of the impact and also address stakeholder perceptions. The risk of not addressing stakeholder perceptions is that reputational damage could arise, resulting in the loss of a 'social licence to operate'.

6.8.2 Impacts

This section focuses on social and socio-economic impacts that are likely to result from the proposed Project. The key social and socio-economic issues considered are as follows:

- impacts on employment and the local economy during construction;

- impacts on employment and the local economy during operation;

- impacts of a new workforce on community health and wellbeing during construction and operation; and

- employment legacy issues associated with a change in land use.

The benefits associated with increased power generation for Kenya are not covered here, as they have previously been discussed in *Chapter 1* as part of the rationale for the Project. Impacts associated with nuisance impacts (noise, air quality, traffic, etc.) and visual impacts are also discussed elsewhere in this report.

6.8.3 Impacts on Local Employment and the Local Economy during Construction

Impact Description

The proposed Project has a construction phase of approximately two years. It will generate both direct and indirect employment opportunities throughout this construction period (1).

During the construction phase it is expected that there will be a total 500 construction workers recruited via a contractor (or possibly contractors). During peak construction periods there are expected to be up to 350 workers on site, including both skilled and unskilled personnel. The construction contractor(s) will be responsible for recruitment and management of these workers. Approximately 25 employees will be employed directly by TPL during the construction phase, the majority of whom will have the opportunity to become permanent staff after the transition to the operational phase.

TPL commits to sourcing employees from local communities where people with appropriate skills are available, and will require its contractors to implement the same recruitment policy. The large labour pool which appears to exist in the Thika area will allow TPL and its contractor(s) to access some of the relevant skills locally: the social survey conducted by ERM identified that local skills included construction work, engineering and information technology. However, it is likely that the majority of employment opportunities for local communities will be in unskilled and semi-skilled positions (such as drivers, cleaners, field workers, security staff, etc: the social survey showed these skills to be evident amongst local communities).

It is also likely that indirect job opportunities will be available to local people through the requirement for local goods and services, such as food, laundry, transport, etc.

Temporary employment during construction will result in a regular income for workers' households, which can be expected to result in an increased

(1) 'Drect' employment in this instance refers to employment related to the development of the Project, through employment with either TPL or its subcontractors; 'indirect' employment refers to work with Project suppliers, and those involved in providing services to project employees.

quality of life in the short term (i.e. during employment), with a greater ability to invest in social services such as education and health-care.
Those employed by TPL and their contractors will also increase their skills and experience, potentially improving their future employment opportunities.

Pre-Mitigation Significance Rating

The *sensitivity* of social receptors to this impact is considered to be low to moderate. There is quite high unemployment in the area, but the local population appears to have many of the skills required to gain employment, although most (particularly youth) have experience only as casual labourers in small and medium industries, or in agriculture. Employment was specifically raised by stakeholders as a perceived benefit of the Project.

The *magnitude* of this impact is assessed as minor to moderate, in terms of the total number of jobs likely to be available to local people, and the length of the construction period.

Impacts on local employment and the local economy during construction are therefore assessed to be ***positive impacts of minor to moderate significance***, prior to any mitigation or enhancement.

Mitigation and Enhancement Measures

- *Development and implementation of a Human Resources Policy:* This policy will reflect the requirement to hire locally, where possible, with preferential treatment for those most affected by the Project (e.g. the residents of the nearest communities, particularly Witeithie). It will also prohibit discrimination on the grounds of race, ethnicity, religion, gender, and political affiliation; and detail health and safety requirements in line with Kenyan labour law and the IFC Performance Standards. There will be percentage targets for recruitment from affected communities (set according to the availability of the relevant skills), and a requirement for monitoring and reporting of performance. All TPL contractors will be required to apply the same policy. No-one under the age of 18 will be hired to work on the Project: this will require a pre-employment check on identification documents to verify the age of applicants.

- *Provision of on-the-job training*: Where practicable, TPL will provide further training for workers during employment, which may enhance their prospects of advancement within the Project workforce, and provide a demonstrably better skills set for further employment opportunities after the construction period.

- *Requirement for contracts*: All employees (including short-term staff, and all contractor staff), will have a contract of employment, clearly describing their conditions of employment and demonstrating TPL's compliance with Kenyan labour laws. Contracts will state that all salaries will be paid in a timely manner as per conditions of employment, and in a manner appropriate to local needs.

- *Provision of employment certificates to workers on completion of contracts*: These will support workers in seeking further employment after their work on the Project is complete, as a certificate will provide evidence of skills and experience, contributing to post-construction "employability" and thus reducing the impacts associated with loss of employment after the construction phase.

- *Development and implementation of a Local Procurement Policy:* This policy will include:

  - an evaluation of local capacity to provide specific goods and services;
  - a strategy for local supplier development and the long-term sustainability of the local suppliers following completion of the construction phase;
  - a target percentage of suppliers that will be used locally; and
  - a process of monitoring and reporting, to demonstrate the value of local sourcing and selection processes.

- *Stakeholder Engagement Plan:* TPL and the construction contractor will clearly communicate the recruitment plans and procurement opportunities for construction, using methods such as:

  - adverts in local newspapers and local government bulletins;
  - registration with the district employment department;
  - adverts in local job centres and village notice boards; and
  - distribution of pamphlets to local businesses.

- *Grievance Mechanism:* The construction contractor will have a clear mechanism in place to resolve any employment and local supplier-related grievances (see *Annex G*).

Residual Impacts

With the implementation of these mitigation and enhancement measures, TPL will be able to deliver a ***moderate positive impact*** during the construction phase of the Project.

6.8.4 Impacts on Local Employment and the Local Economy during Operation

Impact Description

The proposed Project has an operational period of at least 25 years, during which it will generate direct employment for up to approximately 80 personnel. TPL commits to sourcing employees from local communities where appropriate skills are available; however, unlike construction the majority of positions are likely to be for skilled, technical and managerial staff, and so employment opportunities in local communities will mostly be limited to a smaller number of to semi- and unskilled positions (drivers, cleaners, security staff, and secretarial – maybe up to around 20 persons in total).

Those who do secure permanent jobs with TPL will benefit from long-term income generation for their household, resulting in an increased quality of life with a greater ability to invest in social services, such as education and health-care. The provision of permanent jobs may also have small knock-on benefits to the local economy (e.g. through staff use of local services), although it is not possible to estimate their extent.

Pre-Mitigation Significance Rating

The *sensitivity* of the social receptors to this impact is considered to be low to moderate. There is quite high unemployment in the area and at most 20 or so persons (many semi-and unskilled workers) are likely to have the right skills profile for permanent positions with TPL. Any employment opportunities would, however, be very beneficial to households in the area, which would be a long term impact.

The *magnitude* of this impact is assessed as minor, due to the low number of jobs likely to be available to local people during operation.

Impacts on local employment and the local economy during operation are therefore assessed to be of ***minor positive significance*** prior to any mitigation or enhancement measures.

Mitigation and Enhancement Measures

The majority of mitigation measures will be a continuation of those deployed during the construction phase.

Residual Impact

With the implementation of the aforementioned mitigation and enhancement measures, TPL will be able to deliver an impact of ***minor to moderate positive significance*** during the operational phase of the Project.

6.8.5 Impacts of a New Workforce on Community Health and Wellbeing during Construction and Operation

Impact Description

An influx of workers, often single men, who do not come from the locality can lead to changes in society, introducing different values and norms. There is also an increased risk of communicable disease, including sexually transmitted infections (STIs) such as HIV/AIDS, which is a key issue in the area. Increased crime rates could also result, and this was raised as a specific concern by stakeholders during the social survey.
TPL will source employees from local communities where the skills base makes that possible, and will require its contractor(s) to follow a similar

recruitment policy. Nevertheless, it is likely that some workers will be from outside of the local area (e.g. Thika District more broadly, and/or other nearby population centres such as Nairobi), particularly to fill the skilled positions, estimated at 200 of the 500 workers during construction, and likely up to 40-50 persons on the permanent operational workforce.

Speculative job seekers, or people looking for trading opportunities, may also be attracted to the area, but this is relatively unlikely given the nature of communities in the area, and was not raised a significant concern during consultation. The local communities near the Project site are mostly in relatively recent settlements which have developed over the past 10 years or more as a result of growth in the number of industrial and commercial operations in the Thika area. As such, people in the area have generally mixed backgrounds and are used to newcomers moving into the area.

As the majority of workers will be recruited locally, or live relatively short distances from the site, there are no plans for on-site accommodation. Workers will reside in their current homes, travelling to and from site on a daily basis. Bus transport will be provided for workers to minimise the number of vehicle movements in and around the site.

Most of the population of Thika District has relatively poor access to health facilities and there is a doctor to patient ratio of approximately 1 to 11,620. Only one of the health facilities in the district is a hospital, and the average patient has to travel 5km to reach a health facility. Any additional pressure put on these facilities as a result of new workers in the area will directly impact local users.

Pre-Mitigation Significance Rating

The *sensitivity* of the receptors in the local area around the proposed plant is moderate. Communities are used to people moving into the area, but there is already pressure on local health services and some existing issues with crime.

The *magnitude* of the impact is low, because there will not be any worker camps, the number of workers from outside the local area will be minimised, and buses will transport a majority of workers to and from the site, thus reducing additional interaction with the local communities.

Impacts of a new workforce on community health and wellbeing during construction and operation are therefore assessed to be of ***minor negative significance*** prior to any mitigation or enhancement.

Mitigation and Enhancement Measures

- *Health Risk Assessment*: This will be completed by the construction contractor(s) prior to commencement of works, with the aim of capacity limitations with regards to health services that might be required for workers. As part of this assessment, if the construction contractor finds the existing infrastructure is insufficient, they will cooperate with TPL to identify feasible and cost-effective improvements to support the predicted increase in demand for health services, or to create additional healthcare provision specifically for workers.

- *Workforce Management Plan*: This plan will contain requirements for all workers to undergo health checks as part of their induction, to ensure that contagious/epidemic diseases are identified and treated. It will also contain a clear code of conduct for workers to manage their interactions with the local community.

- *Grievance Mechanism*: The construction contractor will have a clear mechanism in place to resolve any grievances relating to worker conduct.

Residual Impacts

With the implementation of the above mitigation and enhancement measures, it is predicted that impacts associated with a new workforce on community health and wellbeing will be ***negligible***.

6.8.6 Legacy Issues Associated with the Change in Land Use

Impact Description

As described previously, the Project site was originally owned by the Agro Tropical coffee plantation, and is part of the land parcel sold to KPLC in a 'willing seller, willing buyer' transaction in 2010.

The four hectare Project site will be leased directly from KPLC by TPL. It represents just over 5% of the original land area under cultivation by Agro Tropical, which employs part-time, seasonal, casual workers from local communities (as described in *Section 4.5.2*). At its maximum (during harvesting) the total casual workforce is approximately 400: thus even if employed year-round the number affected by the reduction in the area under cultivation would be around 20 persons. In fact, for at least half the year it is likely to be no more than ten persons. This loss of casual employment was not raised by any stakeholders during consultation, and so is not regarded as a significant issue for local communities.

Pre-Mitigation Significance Rating

The *sensitivity* of the receptors in the local area around the proposed plant is moderate. Unemployment in the area is high and many people in the local communities (particularly Witeithie) rely to an extent on Agro Tropical for seasonal employment opportunities.

The *magnitude* of the impact is low because the area of the Project site is a small proportion of the coffee farm and as noted above it is likely that relatively few jobs were lost as a result of the land take.

Legacy issues associated with the change in land use are therefore assessed to be a ***minor negative significance*** prior to any mitigation or enhancement measures.

Mitigation and Enhancement Measures

- *Employment Policy:* Where possible, TPL will look to recruit from the local communities surrounding the proposed Project site, both during construction and operation. Recruitment will include unskilled and semi-skilled labourers, and so will likely include those who have worked as casual workers on the coffee plantation.

- *Social Investment Strategy:* TPL will develop and implement a social investment strategy that will look to foster social development initiatives with the proposed Project. The strategy's aim will be to create innovative solutions to key issues in the local area, and to be based on a robust needs assessment for the local communities – see *Annex H* for details.

Residual Impacts

With the implementation of the aforementioned mitigation and enhancement measures, it is predicted that impacts associated with the reduction of the area under coffee will be ***negligible***.

6.9 CUMULATIVE IMPACTS

In theory, any development such as the TPL Project may also be taking place at the same time as other developments, causing impacts affecting the same resources or receptors, such that there will be cumulative effects with the proposed Project. The impacts of developments already underway or committed (such as the highway upgrading, and the neighbouring KPLC substation and transmission project) have been taken into account by including them in the future baseline for the Project within this impact assessment. The impact of these developments is therefore accounted for in the baseline against which the impact of the Project is assessed.

ERM's research of relevant documents (e.g. the Thika District Development Plan 2008-2012) and consultations with local and District stakeholders, including District Officers, has not identified any other developments in the area which are in preparation or envisaged, but which are not yet committed. There is a general aspiration that Thika should develop economically – and that industry should be a part of that development – but no specific developments have yet been proposed. Nor is there any indication that the area south of Thika close to the Project site would be favoured over other areas for any such developments in the future. ERM has, therefore, concluded that there are no significant future developments for which this ESIA should consider cumulative effects with the Project.

Any future potential development in the area around the Project site will require a variety of permits, including an EIA approval and a "change of use" clearance. By building good relationships with the local authorities through an ongoing engagement process, TPL will be in a position to influence the nature of future developments, and to lobby against those which are inappropriate or not compatible with the pre-existing TPL power plant. This approach would also mitigate against the possibility of future constraints on the plant's operations.

7 *ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN*

7.1 *INTRODUCTION*

This chapter sets out the *Environmental and Social Management Plan* (ESMP) for the Project, having first described the organisational arrangements for its implementation. The objectives of the ESMP are to:

- draw together the measures proposed to mitigate environmental and social impacts, and group them logically into components with common themes;
- define the specific actions to be taken, roles and responsibilities for these actions, timetables for implementation and associated incremental costs; and
- describe the planning for monitoring, training, capacity building and resource requirement.

A Monitoring Programme is provided as the final section of the Chapter.

7.2 *ORGANISATIONAL ARRANGEMENTS FOR ENVIRONMENTAL AND SOCIAL MANAGEMENT*

This section summarises current and future arrangements for management of environmental of social issues associated with the construction and operation of the Thika Power Plant. It should be noted that these arrangements are still being developed; where appropriate, steps and timescales to finalisation are indicated. The organisational arrangements under development form the framework for the responsibilities set out in the subsequent components of the ESMP.

7.2.1 *Current Arrangements (Construction)*

The current arrangements give lead responsibility for environmental and social issues during construction to TPL's in-country project management team. **Specific responsibility for environmental management and community liaison** resides with a single individual (the EM/CLO), who carries out these duties along with other functions relating to finalisation of detailed design and management of the start-up of construction. **The EM/CLO reports to TPL's board,** via the TPL in-country project manager.

The current EM/CLO has an engineering background, but a demonstrably good grasp of the issues which are his responsibility under this function. TPL will provide any necessary training/capacity building to the individual, and his successors: any training and development needs will be identified during regular training needs assessments of all TPL staff, or in response to evolving issues requiring additional expertise in specific topics.

The key responsibilities of the EM/CLO include:

- Monitoring performance of all contractors and TPL staff against the ESMP and contract conditions and, where non-compliances are identified, issuing and enforcing corrective actions requests;
- Regular walk-round environmental auditing of construction activities, as per the ESMP;
- Development and delivery of training and awareness-raising for TPL and contractors' staff, and communities;
- Provision of regular feedback and progress reports to neighbouring communities and other stakeholders;
- Management of the Grievance Process;
- Reporting on TPL's environmental and social performance (including any regular monitoring reports required by NEMA or by lenders).

Where necessary (eg for monitoring of topics where specific technical training/knowledge is required), TPL will engage external expertise.

As noted in the introduction to this section, revisions to the organisational arrangements for environmental management and community liaison may potentially be required as construction progresses.

7.2.2 *Future Arrangements (Operation)*

Following the completion of construction, ie before the plant becomes operational and starts to deliver power into the Kenyan grid, the arrangements in place for environmental management and community liaison will be subject to full-scale management review (with a view to revision as appropriate). The scope of the review of environmental management and community liaison requirements will focus on ensuring that suitable arrangements are in place for the long-term operation of the plant, to:

- Engage effectively with the range of organisations with a direct stake in the operation of the Thika Power Plant, including local communities and schools, local government agencies, NEMA, and others;
- Address the multidisciplinary nature of the potential operational impacts of the Project, and to implement and monitor the required mitigation measures;
- Establish day-to-day responsibilities for environmental and social management, and reporting;
- Define and implement requirements for independent monitoring and reporting on environmental and social performance;
- Identify needs for external professional advice on engineering, environmental and social issues.

Accordingly, the structures required for the governance and implementation of the ESMP in the operational phase will be:

- **A TPL environmental and social unit based at the plant**, consisting of one or more staff with appropriate experience of environmental and social management and sufficient training in specific topic areas under their responsibility, who have adequate equipment and access to further training as may be required (hereafter referred to as the 'ESMP Unit');
- Professional staff employed by the contractor or operator to ensure that the contractor / operator fulfils its obligations within the ESMP;
- A contracted CBO to deliver the Social Investment Programme (see *Section 7.2.9 and Annex H*);
- A plan and process for effective, regular communication with and reporting to NEMA;
- Suitable processes for regular feedback and communication with local communities and other stakeholders.

7.2.3 The ESMP Unit

The Unit will consist of one or more qualified staff, with experience appropriate to oversee the implementation of the ESMP. Initial and ongoing training will be provided as necessary to strengthen the capacity of the individual(s) in the Unit. The functions the Unit will provide via its staff will be:

- Environmental management and monitoring, including capability to task and manage the work of sub-contracted environmental technical specialists as necessary;
- Environmental auditing and reporting; and
- Community liaison.

The ESMP Unit will report directly to Plant Manager (as shown by the "Health and Safety Officer" box on the organisational chart in *Figure 7.1*). The staff will be supported administratively by the plant's general administrative function.

The ESMP Unit will have day-to-day responsibility for the implementation of the ESMP. In order to fulfil this responsibility, it will work closely with Project and plant staff, contractors, the CBO implementing the Social Investment Strategy, and others as appropriate. It will receive reports on implementation of aspects of the ESMP and monitoring reports from each of these, and in turn carry out monitoring and auditing of their performance. A key function of the ESMP Unit will be to identify any cases where any party fails to meet the requirements of the ESMP, and any unforeseen adverse environmental or social impacts arising, and to initiate and supervise, monitor and report on the necessary corrective actions. In keeping with Kenyan environmental law, NEMA will provide its function in identifying any instances where the Thika Project could be failing to meet the requirements of the ESMP, and recommend corrective actions: in any such instances, the ESMP will act as primary liaison with NEMA to ensure prompt and effective resolution.

The ESMP Unit will support the Plant Manager by supplying environmental and social information required for preparation of reports to meet formal obligations (eg to lenders and NEMA).

7.3 *THE ESMP*

7.3.1 *Overview*

The ESMP has been developed to meet international standards on environmental and social management and performance, specifically those set out by the IFC and the AfDB.

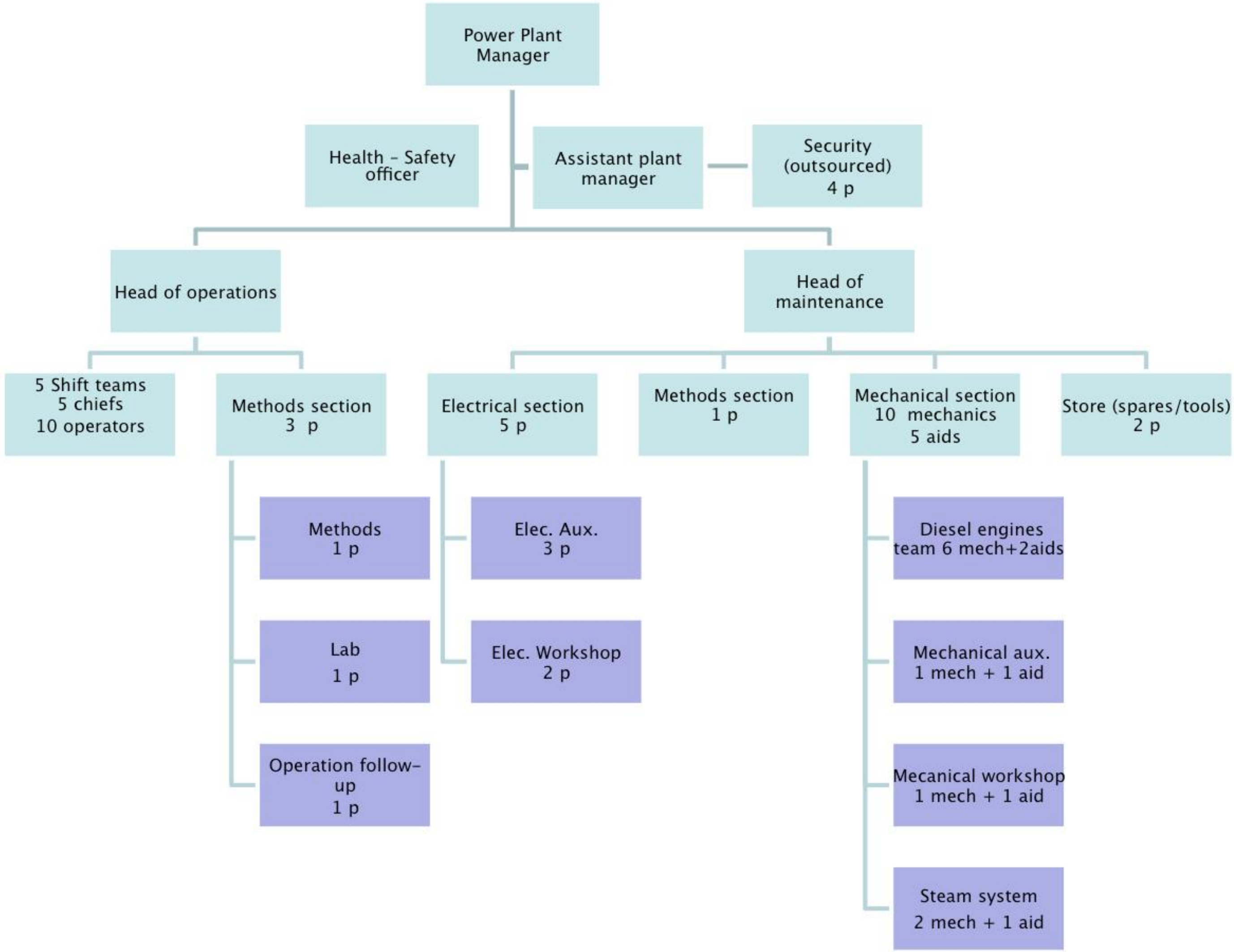
This ESMP will be incorporated into TPL's Environmental Management System (EMS), which TPL will develop before the Project becomes operational. It will be essential for successfully implementing the Project's environmental and social performance throughout the life of the Project. Having this framework in place ensures a systematic approach to bringing environmental and social considerations into decision making and day-to-day operations. It establishes a framework for tracking, evaluating and communicating environmental and social performance and helps ensure that environmental and social risks and liabilities are identified, minimised and managed. The ESMP will be a living document, and will continue to develop during the design and construction phase to enable continuous improvement of the Project's environmental and social performance.

The plan details the mitigation and enhancement measures TPL has committed to implement through the life of the Project and includes desired outcomes, performance indicators, targets or acceptance criteria, timing for actions, responsibilities, and associated costs. TPL will have principal responsibility for all measures outlined in the ESMP, but may delegate responsibility to its contractor(s), where appropriate. In cases where other individuals or organisations have responsibility for mitigation measures, this is clearly indicated within the ESMP table.

Capacity building and training requirements are also described, where these relate to specific skills required to deliver the ESMP action in question. General training, which will be provided to TPL's employees (and contractors' employees as appropriate), is not indicated in the plan. An example of training that is not listed here is the general worker health and safety training that all TPL employees will receive.

To support this ESMP, suggested management plans and policy outlines have been provided in the form of annotated tables of contents and details have been provided where practical (see *Annexes A - H*). These will be used by TPL in the production of full management plans and policies for the Project. These plans may be staged, ensuring that the appropriate focus and level of detail is provided for construction and operational activities. They will be finalised by TPL, where appropriate in consultation with the NEMA and other key stakeholders.

Figure 7.1 Proposed TPL Organisational Arrangements: During Operation



Specific management plans will include:

- Construction Management Plan (*Annex A*);
- Traffic Control Management Plan (*Annex B*);
- Construction Spoil and Waste Management Plan *(Annex C);*
- Unplanned Events and Emergency Response Plan (*Annex D*);
- Occupational Health and Safety Plan (*Annex E*);
- Worker Management Plan *(Annex F);*
- Stakeholder Engagement Plan *(Annex G)*; and
- Social Investment Strategy *(Annex H)*.

7.3.2 ESMP costs

The costs of implementing the ESMP (CAPEX and OPEX) are presented in *Table 7.1.* These total $ 361, 360. The totals in *Table 7.1* are broken down in *Tables 7.2* and *7.4*.

Additional resources will be required in terms of commitment of TPL staff resources. Where appropriate, estimates have been included of the staff time required.

Table 7.1 Breakdown of ESMP costs

CAPEX (one off equipment purchases / plans)	**Cost, US$**
Air quality equipment	$75,000.00
Met equipment	$30,000.00
One off AQ set up and install	$20,000.00
Noise equipment	$3,200.00
Conceptual landscape plan (initial cost of conceptual plan only)	$2,500.00
Total	$130,700.00
OPEX (one off costs during construction / commissioning phases only)	
Noise monitoring during construction (ambient and then construction monitoring)	$8,000.00
Noise monitoring during commissioning (ambient)	$860.00
TPL staff training	$10,000.00
Total	$18,860.00
OPEX (additional costs predicted over assumed 25-year project lifetime)	
Noise monitoring during operation (over project lifetime of 25 years)	$4,300.00
Implementation of mitigation in the traffic management plan	$50,000.00
Air quality and met monitoring - maintenance, periodic data validation as required (contingency)	$100,000.00
Safety programme implementation	$7,500.00
Summary	
CAPEX	$130,700.00
OPEX (one off construction/commissioning phase)	$18,860.00
OPEX (additional costs predicted over assumed 25-year project lifetime	$211,800.00
TOTAL (over lifetime of project, i.e. CAPEX, OPEX construction, OPEX annual + additional lifetime costs)	**$361,360.00**

Note 1: these are only the additional material costs above costs or resources that are assumed to fall within general TPL staff job requirements
Note 2: this does not cover any costs related to the Stakeholder Investment Strategy

7.3.3 *Structure of this ESMP chapter*

The remainder of this chapter is structured as follows:

- ***Table 7.2*** below contains a summary of the mitigation measures specified in the ESIA together with timing, estimated costs (where available) and requirements for capacity building and training.

- ***Section 7.4:*** contains a summary of the Detailed Design Considerations and Operating Procedures.

- ***Section 7.5*** contains an overview of the Construction Management Plan.

- ***Section 7.6*** presents the monitoring programme, which is set out in *Table 7.4*.

- ***Annexes A - H:*** set out management plan structure and content (where available) in more detail, including the measures that will be part of TPL's management plans, policies and procedures for the Project.

Table 7.2 Summary Environmental and Social Management Plan (ESMP)

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
Emissions to Air During Construction						
1	• Whilst there are no significant impacts identified associated with the construction phase of the proposed development, it is recommended that best practice measures are implemented to minimise the potential for dust to be generated and escape off-site. • In addition, a dust management programme will be implemented that sets out measures for the visual assessment of dust emissions, additional mitigation if excessive dust emissions are observed and formalised responses for responding to, substantiating and dealing with any dust nuisance complaints.	• Minimisation of dust emissions and avoidance of a dust nuisance. • Avoidance of health impacts to the workforce and local community.	• No significant ingress of construction dust into properties of local communities.	• Monitoring programme will be developed in line with the requirements of the IFC EHS Guidelines for Thermal Power Plants. • Grievance mechanism records.	• In advance of and during construction activities.	• Within the general responsibilities of the construction supervisor – no significant material additional costs
Emissions to Air During Operation						
2	• The sulphur content of the heavy fuel oil will not exceed 2%, as this would lead to increases in SO_2 emissions from the plant. • Emissions monitoring for SO_2, NOx, CO and PM.	• Emissions limited to minimise impact on human health.	• Emissions within standards set by the Applicable Air Quality Standards and Guidelines.	• Emissions monitoring. Details to be agreed with NEMA prior to operation and to be in line with the requirements of the IFC EHS Guidelines for Thermal Power Plants.	• During operation.	Air quality monitoring costs: • Capital cost NOx/SO2/PM ~ **\$75,000** including data logger • Capital cost meteorological measurements ~ **\$30,000** • Installation & set-up air quality monitoring equipment ~ **\$20,000** • Periodic operational costs, air quality and

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
						met monitoring (including data validation) ~ **US $ 100,000** • **Total: ~$225,000** Monitoring of sulphur content is under the general responsibilities of the construction supervisor – no material additional costs associated with this activity.
Noise Disturbance during Construction and Decommissioning						
3	• Although the Minor construction noise impacts are not high enough to require further mitigation, good site practice will be employed to minimise noise. • Construction noise will be managed through the following measures: • selection of low noise equipment; • temporary screening of the equipment; • switching equipment off when not in use; and • construction of on-site buildings first to act as noise screens.	• Minimisation of noise to avoid exceedence of noise criteria as set out in Chapter 6. • To minimise noise disturbance to local residents and receptors.	• Kenyan regulations relating to noise covered by Section 147 of the Environmental Management and Coordination Act (EMCA), Kenyan Legal Notice No.61 - The Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control)	• Noise monitoring will be required to ensure noise levels are within agreed limits.	• During construction	Capital costs (one-off purchasing noise measurement equipment) ~ **$3,200** Monitoring cost (ambient noise prior to construction) ~ **$430** ($430 x 1) Monitoring cost (during construction) ~ **$4,300** ($430 x 10)) **Total: $8,000**

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
			Regulations, 2009.			
Noise Disturbance during Operations						
4	• The predicted noise levels have identified the need for noise mitigation to meet IFC standards and to limit noise impacts to Minor significance. • The key items that are likely to require mitigation in order to reduce noise levels at the nearest receptor are as follows: • radiator fans; • engine room; • ventilation outlet units; • air cooled condenser for DCC; and • venting units. • The choice of noise mitigation measures will be developed during further detailed design. However, several well-established mitigation measures will be available such as selection of quieter equipment or provisions of on-site barriers to screen noise from key equipment items. • TPL will establish a contractual design limit to ensure that agreed noise levels are achieved.	• Minimise operational noise levels to meet IFC and Kenyan standards.	• Permissable noise levels as set out in the Kenyan regulations relating to noise i.e. Section 147 of the Environmental Management and Coordination Act (EMCA), Kenyan Legal Notice No.61 - The Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. These are 55 dB during the day, and 35 dB during the night for residential receptors, and 40 dB during the day and 35 dB at night for Mang'u High School. • In line with IFC guidance i.e. if	• Noise monitoring will be required to ensure noise levels are within agreed limits.	• During operation.	Monitoring cost (ambient noise during commissioning) ~ **$860** (1 x daytime and 1 x night time @ $430 each) Monitoring cost (during operation) ~ **$4,300** (5 x $860) **Total: $5,200**

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
			changes in background noise as a result of noise from the plant are no greater than 3 dB(A) then noise impacts are not significant even if they are above the Kenyan standards or IFC standards. For a change in overall noise of 3 dB(A) the plant noise must be limited to the same level as the background noise. • For Thika, plant noise levels will meet the IFC guidelines or be no higher than the baselines levels stated. • Refer to Chapter 6 for details of significance criteria.			
Impacts on Water Resources						
5	• Appropriate construction methodology will be applied to ensure that groundwater mixing does not occur. Additionally, in order to mitigate potential impacts that could result from poor borehole construction, international best practice borehole construction methodologies will be	Minimise risk to water resources from construction activities	• IFC Environmental, Health and Safety Guidelines for	• Water abstraction to be monitored to ensure compliance with WRMA	• During construction and operation.	• Development of Construction Management Plan will entail

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
	applied • The potential contamination and/or erosion risks from construction related activities can be mitigated by industry-standard good construction management practices. Full details of these will be included in a Construction Management Plan, as set out in Annex A. • TPL, which is examining a collective approach to coordinate surface water management with the neighbouring KPLC substation site. During construction it is likely that temporary drainage channels will be created to channel and divert surface water from the TPL site, away from the down slope agricultural plots; a similar approach will be developed to divert and distribute site run-off (particularly stormwater run-off).		Thermal Power Plants. • Reference Document on Best Available Techniques for Large Combustion Plants (BREF Note) produced by the European Commission. • International best practice.	permit requirements • In addition the Construction Management Plan will set out requirements for monitoring of construction activities and compliance with legislation/guidance and best practice.		approximately 20 man days of TPL staff or others as appropriate. • No material additional costs are anticipated above general budgets for responsibilities of TPL environment manager for the implementation of the plan.
Traffic and Transport Impacts						
6	• Measures to mitigate the likely significant effects from traffic movements arising during construction, operation and decommissioning have been developed in the form of a Traffic Control Management Plan (TCMP), see *Annex B* for details. • The management plan will include procedures which will assess the likely number and intensity of vehicular movements and outline methods which will be adopted to minimise the overall footprint and secondary impacts such as dust. • The key issues addressed by the management plan in terms of mitigation measures include: • access to construction areas; • routing of construction traffic; • temporary traffic control and management; • road crossings; • parking facilities; • keeping highways clean of mud and dust; • driver training; • road safety and awareness training for school children; and	• Mitigate impacts from increased construction and operational traffic on the following: • Road user delays; • Road user safety; • Highway infrastructure degradation; and • Increased levels of noise, vibration and air pollution.	• IEMA Guidelines for the Environmental Assessment of Road Traffic used to inform significance criteria which are fully defined in *Chapter 6*.	• The TCMP will set out requirements for monitoring.	• During construction and operation.	• Development of TCMP will entail approximately 20 man days of TPL staff or others as appropriate. • Approximately **$50,000** over project lifetime to implement the mitigation measures that will be included in the TCMP.

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
	• reducing the probability of traffic accidents.. • Regulations regarding the transportation of heavy loads limit the cargo weight and size to the maximum amounts allowed for transporting vehicles. The Kenyan Traffic Act (revised 2009), states that all heavy and medium vehicles are also required by law to carry a warning sign at the rear of the vehicle.					
Waste Management						
7	• All of the waste related impacts likely to arise during construction, operation and decommissioning can be mitigated very effectively by the implementation of standard best practices in terms of environmental controls and management practices. These measures are detailed in the Waste Management Plan (WMP), which describes the measures that the Contractor will implement during the construction of the project. Refer to Annex A: Construction Management Plan for details. • Waste streams generated during construction should be managed with due regard to the waste hierarchy. Specifically, the following principles should be adopted, in order of preference: • Waste minimisation; • Reuse and recycling; • Waste treatment; and • Disposal. • Good practice also requires that during operation of the Project: • all hazardous materials are stored in clearly labelled containers; • storage and handling of hazardous materials is in accordance with national and local regulations appropriate to their hazard characteristics; and • fire prevention systems and secondary containment will be provided for storage facilities, where necessary, to prevent fires or the releases of hazardous materials to the environment.	• Minimisation of waste generated; • Effective treatment and disposal of generated waste, in line with national and international standards.	• IFC Environmental, Health and Safety Guidelines for Thermal Power Plants, and the Reference Document on Best Available Techniques for Large Combustion Plants (BREF Note) produced by the European Commission.	• The Waste Management Plan will set out requirements for monitoring.	• During construction and operation.	• Development of Waste Management Plan will entail approximately 20 man days of TPL staff or others as appropriate. • No material additional costs are anticipated above general budgets for responsibilities of TPL environment manager for the implementation of the plan.
Unplanned Events						
8	• TPL will develop an EMS that will, among other things, seek to prevent and limit environmental accidents and develop contingency procedures	• Prevent and limit environmental	• IFC EHS Guidelines for	• The Unplanned Events and	• During construction and	In addition to development of the

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
	in case of such accidents. Given that most unplanned and emergency events have both environmental and health and safety consequences, the EMS, will be developed along side the Health and Safety Management System. Ideally this will be done within the overall framework of an Integrated Quality, Environmental and Health and Safety Management System. • A Safety Programme will be set up by TPL for specific use at the Project site. This will include details on: • Training, instruction and information; • Inspection and testing; • Accident investigation and reporting; • Accident report review and follow up; and • Year end report. • A comprehensive Emergency Response Plan will be developed and implemented • As an integral part of the Safety Programme and the Emergency Response Plan, fire prevention and fire fighting capability will be among the top priority requirements of the Project • A Hazard and Operability (HAZOP) study will be conducted on the plant during the design stage. Further assessments will be carried out on major new equipment or subsequent design modifications. • Mitigation measures to prevent contamination of land and water will be developed and implemented. • Risk assessment procedures will be developed and implemented by trained personnel. • Further details are set out in *Annex D*.	accidents and ensure contingency procedures are in place in case of such accidents.	Thermal Power Plants	Emergency Response Plan will set out requirements for monitoring.	operation	EMS development of the following plans and procedures will take around 20 man days of TPL staff or other's time: o Emergency Response Plan o Risk Assessment Procedures o Safety programme set-up o Safety programme implementation over project lifetime • Approximately **$5,000 to $10,000** for materials to support the safety programme implementation • HAZOP costs to be developed as part of engineering scope of work.
Landscape and Visual Impacts						
9	• Good practice mitigation measures will be implemented to mitigate	• Minimisation of	• Significance	• Monitoring to	• During	• Costs have been

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
	construction, operation and demolition impacts. These include: • machinery and materials will be stored tidily during construction. Tall machinery including cranes will not be left in place for longer than required • temporary roads and works areas will be maintained free of dust; • outdoor construction lighting shall be unobtrusive and shall not allow light to shine upwards or towards residential areas; • security and work lighting (both driving construction and operation) shall be shielded and directed downwards • The following mitigation measures are recommended throughout the operational phase of the proposed power plant to further minimise landscape and visual impacts during operation: • the design, orientation and materials will be appropriately and reasonably developed to match existing site and landscape characteristics; • appropriate use of non-reflective surfaces and surface colour treatment; • an appropriate landscape plan shall be developed and adopted using tree belts and buffer screenings to provide visual relief and shade; • minimisation of external signage clutter and signs which have a silhouette effect on the skyline; • roads providing access to site facilities and works areas will be landscaped and maintained free of dust where feasible; • outdoor lighting shall be as unobtrusive as possible and shall be shielded and directed downwards to prevent side spill. The use of tall mast lights shall be carefully assessed before use; • monitoring to ensure that visual screening and dust control measures in the Management and Action Plans for the Project are implemented effectively.	any impacts of the proposed project upon the landscape character, view and visual amenity.	criteria as set out in the Guidelines for Landscape and Visual Impact Assessment produced jointly by the British Landscape Institute and the British Institute of Environmental Management and Assessment (IEMA).	ensure that visual screening and dust control measures in the Management and Action Plans for the Project (see Annexes) are implemented effectively.	construction and operation.	built into capital project costs and operation and maintenance budgets regarding visual design of the plant. • Good practice mitigation will not incur significant additional material costs above general housekeeping best practice. • Development of Conceptual Landscape Plan will cost around **$2,500**. Further detailed plan and costs of landscaping will be ascertained depending on the conclusions of the Conceptual Landscape Plan.
Social and Socio-Economic Impacts						
	• Impacts on local employment and the local economy during construction, operation and decommissioning will be managed through the following: • Development and implementation of a Human Resources Policy; • Provision of on the job training;	• Maximise impacts on employment and the local economy during construction.	• Kenyan labour law and the IFC Performance Standards	• The Occupational Health and Safety Management Plan, the Worker Management Plan,	• During construction and operation	Development of the following plans and policies will entail around 20 man days of TPL (or other's)

REF	Mitigation/ Enhancement Measures	Desired Outcomes	Performance Indicators or Acceptance Criteria	Monitoring	Timing of Mitigation/ Enhancement Measures	Cost / resources
	• Employee contracts shall be mandatory; • Provision of employment certificates to workers on completion of contracts; • Development and implementation of a Local Procurement Policy; • Development and implementation of a Stakeholder Engagement Plan (see Annex G); and • Implementation of a clear Grievance mechanism. • Impacts of a new workforce on community health and wellbeing during construction and operation will be mitigated through the following: • Develop and implement a Health Risk Assessment; • Develop and implement a Workforce Management Plan; and • Implement a clear Grievance Mechanism • Where possible (as skills permit) TPL will look to recruit from the local communities surrounding the proposed Project site during construction and operation. • TPL will develop and implement a social investment strategy that will support social development initiatives in communities neighbouring the proposed Project.	• Maximise impacts on employment and the local economy during operation. • Minimise impacts of a new workforce on community health and wellbeing during construction and operation. • Minimise impacts on employment legacy issues associated with the change in land use.		The Stakeholder Engagement Plan and the Social Investment Strategy will set out relevant monitoring requirements.		time: • Human Resources Policy • Stakeholder Engagement Plan • Local Procurement Policy • Health Risk Assessment • Workforce Management Plan • social investment strategy Provision of on the job training (costs to be incorporated into Workforce Management Plan as developed)

7.4 *DETAILED DESIGN CONSIDERATIONS AND OPERATING PROCEDURES*

7.4.1 *Overview*

There are a number of considerations during both detailed design and operation to minimise environmental and social impacts. Specific measures identified as being required to mitigate significant impacts are described here. These will be developed by TPL or its contractor(s) into a series of operational management plans which will ensure that all of these mitigation measures are implemented. These procedures will need to capture any further mitigation measures that are identified as the design progresses.

7.4.2 *Measures to Mitigate or Enhance Impacts on Air Quality*

TPL will be required to ensure that the plant is designed to ensure that the sulphur content of the heavy fuel oil will not exceed 2%, as this will lead to increases in SO_2 emissions from the plant.

Emissions monitoring for SO_2, NO_x, CO and PM will be required as set out in the IFC EHS Guidelines for Thermal Power Plants.

7.4.3 *Measures to Mitigate or Enhance Impacts from Noise*

The predicted noise levels have identified the need for noise mitigation to meet IFC standards and to limit noise impacts to minor significance. TPL will be required to develop design procedures to ensure that the plant is designed to these noise levels. TPL will establish a contractual design limit to ensure that agreed noise levels are achieved. The key items that are likely to require mitigation in order to reduce noise levels at the nearest receptor are as follows:

- radiator fans;
- engine room;
- ventilation outlet units;
- air cooled condenser for DCC; and
- venting units.

7.4.4 *Measures to Mitigate or Enhance Impacts on Water Resources*

Overview

A number of measures have been identified to mitigate impacts on water resources. Operational procedures will need to be drawn up to ensure that these are implemented during the design or operational phase.

Groundwater Abstraction Borehole

In order to mitigate the potential for contamination and pollutant escape, mechanical plant will be suitably maintained. Spent fluids will be handled and disposed of in an appropriate manner. Appropriate operational controls will be implemented and water quality monitoring will be carried out to ensure that there is no pollution of the groundwater.

To prevent such an occurrence, appropriate screening filters should be installed in the pumping system during construction of the borehole.

Surface Water and Wastewater

In order to ensure that flood risk to third parties does not increase particularly the risks from stormwater), runoff will be attenuated on site prior to discharge at existing greenfield runoff rates, and the drainage system will be designed to accommodate any unpredictable exceedence. The rate of discharge will be maintained at existing rates, thus there will be no change in runoff rates or volumes leaving the site, and no impact upon the existing flooding regime.

To achieve this objective, surface water run off generated during the operational phase of the Project will be channelled and discharged to ground in an unused part of the TPL site, via a soakaway or reticulated drainage network. The siting of soakaway/drainage areas, and their design, will take account of the risks of runoff affecting any sensitivities such as the railway line and agricultural plots that lie downstream. Only external areas of the site without the potential to be contaminated will be handled in this way, whilst all areas where the potential exists for surface water to become contaminated will be collected separately and sent to the ETP.

All wastewater on site that will have the potential to become contaminated either because it is directly used as process/contact water, or because rainwater has collected in an area such as the tank farm where the presence of contaminants is possible, will be collected, channelled and processed through the ETP.

The primary inputs to the ETP will arise from the following on site sources:

- oil separator, collecting run off from the unloading area;
- effluent from neutralisation plant (for oil/water separators);
- sump located in the workshop (includes wastewater from laboratory);
- sump located in the power house;
- sump located in the pump house;
- HFO separators (numerous);
- drain pit located in the tank farm; and
- leak oil sumps from all modules using oil.

Sampling of all wastewater will be undertaken before discharge from the ETP, and treatment will continue (via re-circulation for additional processing) until all applicable Kenyan and IFC discharge standards are met as shown in *Table 7.3*. It will then be discharged to ground in the same manner as surface water (see above).

The operation of the wastewater treatment plants would necessarily include the periodic removal and safe disposal of any treatment sludge from the system and the regular monitoring of effluent water quality to ensure compliance with the standards shown in *Table 7.3* – the sampling frequency will be as specified in the license agreement with the relevant authorities, but would normally be daily.

Table 7.3 Effluent quality standards for Thermal Power Plant

Pollutant	Units	Kenyan standard [1]	IFC guideline [2]
pH	pH	6.5-8.5	6-9
Oil and grease	mg/l	nil	10
Total suspended solids	mg/l	30	50
Total residual chlorine	mg/l	0.1	0.2
Total chromium	mg/l	2.0	0.5
Copper	mg/l	1.0	0.5
Iron	mg/l	10	1.0
Zinc	mg/l	0.5	1.0
Lead	mg/l	0.01	0.5
Lead and its compounds	mg/l	0.1	-
Cadmium	mg/l	0.01	0.1
Cadmium and its compounds	mg/l	0.1	-
Total Mercury	mg/l	0.005	0.005
Arsenic	mg/l	0.02	0.5
Arsenic and its compounds	mg/l	0.1	-
Total coliform bacteria	Per 100 ml	30	400
Colour	Hazen units	15	-

Notes:
1. Kenyan Environmental Management and Coordination (Water Quality) Regulations, September 2006 – Third Schedule: Standards For Effluent Discharge Into The Environment
2. Environmental, Health and Safety Guidelines for Thermal Power Plants, International Finance Corporation , 2007 (http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_ThermalPower/$FILE/FINAL_Thermal+Power.pdf)

Fuel Delivery, Fuel Oil and Chemical Storage

The mitigation of any water contamination risks from the storage, handling or transport of chemicals, wastes and fuel oil will effectively be addressed through the planned design and implementation of an environmental management system for the operation. This would necessarily include:

- appropriately designed storage facilities, including bunds and impervious services for any hazardous materials (fuels, lubricants, water treatment chemicals);
- covering all stockpiles to avoid rainwater ingress and runoff, including process waste residues;
- regular inspection and maintenance of all vehicles, equipment and storage facilities (including integrity checks for all underground fuel tanks); and
- appropriate spill response and cleanup strategies, and regular training and instruction of staff in their implementation (*See Annex D*).

7.4.5 *Measures to Mitigate or Enhance Impacts from Traffic and Transport*

Measures to mitigate the likely significant effects from traffic movements arising during operation have been developed in the form of a Traffic Control Management Plan (TCMP), see *Annex B* for details. The management plan will include procedures which will assess the likely number and intensity of vehicular movements and outline methods which will be adopted to minimise the overall footprint and secondary impacts such as dust.

The key issues addressed by the management plan in terms of mitigation measures for operational traffic include:

- appropriate strategies for moving materials and people to/ from and within the project areas, including ad hoc deliveries, e.g. ensuring that delivery of Project equipment does not coincide with the start/end of the school day;
- provisions for management of the connection point between the site access road and the Nairobi - Thika highway, and for any maintenance work that may be required;
- procedures for monitoring the generated traffic movements and associated environmental problems;
- avoidance of mud on the Nairobi - Thika highway, including the provision and siting of wheel washes;
- measures to ensure that employees travelling to and from the site are able to do so in a safe manner, e.g. provision of mini buses;
- measures to prevent the use of unsuitable roads;
- a notification process to be developed to give residents/affected people advance warning of unusual deliveries/delivery times (e.g. during maintenance required to replace a large item of plant or equipment); and
- safety education for the pupils at the schools located in close proximity to the site, that have the potential to be impacted by the operation of the Project.

7.4.6 *Measures to Mitigate or Enhance Impacts from Waste*

Waste Management

The impact of the wastes from the operation phase of the Project can be mitigated by managing them in accordance with the Construction Spoil and Waste Management Plan *(Annex C)* and with due regard to the waste hierarchy.

The international standards also require that during operation of the Project:

- all hazardous materials are stored in clearly labelled containers;

- storage and handling of hazardous materials is in accordance with national and local regulations appropriate to their hazard characteristics;

- fire prevention systems and secondary containment will be provided for storage facilities, where necessary, to prevent fires or the releases of hazardous materials to the environment.

The Construction Spoil and Waste Management Plan will outline how waste streams generated during operation should be managed with due regard to the waste hierarchy. Specifically, the following principles should be adopted in order of preference:

- Waste Minimisation;
- Reuse and Recycling;
- Waste Treatment; and
- Disposal.

7.4.7 *Measures to Mitigate or Enhance Impacts from Unplanned Events*

TPL will develop an Environmental Management System (EMS) that will, among other things, seek to prevent and limit environmental accidents and develop contingency procedures in case of such accidents. Given that most unplanned and emergency events have both environmental and health and safety consequences, the EMS, will be developed along side the Health and Safety Management System. Ideally this will be done within the overall framework of an Integrated Quality, Environmental and Health and Safety Management System.

A provisional Unplanned Events and Emergency Response Plan has been drafted and is detailed in *Annex D*. This plan includes the following requirements:

- A Safety Programme will be set up by TPL for specific use at the plant. This will include details on:

    - Training, instruction and information;
    - Inspection and testing;
    - Accident investigation and reporting;
    - Accident report review and follow up; and
    - Year end report.

- A comprehensive Emergency Response Plan will be developed and implemented;

- As an integral part of the Safety Programme and the Emergency Response Plan, fire prevention and fire fighting capability will be among the top priority requirements of the Project;

- Mitigation measures to prevent contamination of land and water will be developed and implemented;

- Risk assessment procedures will be developed and implemented by trained personnel; and

- A Hazard and Operability (HAZOP) study will be conducted on the plant during the design stage. Further assessments will be carried out on major new equipment or subsequent design modifications.

7.4.8 Measures to Mitigate or Enhance Impacts from Landscape and Visual Impacts

The following mitigation measures are recommended throughout the operational phase of the proposed power plant to further minimise landscape and visual impacts during operation:

- the design, orientation and materials will be appropriately and reasonably developed to match existing site and landscape characteristics;

- appropriate use of non-reflective surfaces and surface colour treatment;

- an appropriate landscape plan shall be developed and adopted using tree belts and buffer screenings to provide visual relief and shade;

- minimisation of external signage clutter and signs which have a silhouette effect on the skyline;

- roads providing access to site facilities and works areas will be landscaped and maintained free of dust where feasible;

- outdoor lighting shall be as unobtrusive as possible and shall be shielded and directed downwards to prevent side spill. The use of tall mast lights shall be carefully assessed before being used due to proximity of residential areas and its inherent rural location; and

- monitoring to ensure that visual screening and dust control measures in the Management and Action Plans for the Project are implemented effectively.

7.4.9 *Measures to Mitigate or Enhance Impacts from Social and Socio-Economic Impacts*

Overview

Procedures will be required to be drafted to detail how TPL propose to manage impacts relating to workforce and local communities during the operational period. A number of provisional specific management plans have been produced which TPL will need to fully develop and implement. These include:

- Occupational Health and Safety Plan *(Annex E)*;
- Worker Management Plan *(Annex F)*;
- Stakeholder Engagement Plan *(Annex G)*; and
- Social Investment Strategy *(Annex H)*.

More detail is provided in *Annexes E – H,* but some of the specific measures outlined are summarised below.

Occupational Health and Safety Plan

The Occupational Health and Safety Plan includes requirements for:

- development of an EHS management system;
- job descriptions to include health and safety requirements;
- contractor selection criteria in relation to health and safety;
- recruitment procedures to include assessment of health and safety capabilities;
- development of health and safety training programme;
- risk assessments and health monitoring for workers; and
- health surveillance programme.

Worker Management Plan

The Worker Management Plan includes requirements for:

- development of hiring guidelines on the basis of commitment to optimises local participation in the workforce;
- transparent and accessible application and short-listing process;
- guidance on the selection of applicants;
- implementation of an effective grievance mechanism;

- training plan for the workforce; and
- management and monitoring of this Plan.

Stakeholder Engagement Plan

A Stakeholder Engagement Strategy is already in development and has been implemented as the Project has developed. During operation, TPL will build on this and develop a strategy for ongoing engagement with stakeholders. The SEP will incorporate relevant measures that have been developed as part of the ESIA to mitigate potentially significant adverse impacts and enhance positive impacts. Below are some of the mitigation measures suggested as a part of the ESIA mitigation and enhancement strategy:

- TPL and the construction contractor will clearly communicate the recruitment plans and procurement opportunities for the operation phase of the power plant, using methods such as adverts in local newspapers and local government bulletins, registration with the district employment department, adverts in local job centres and village notice boards and pamphlets to local businesses.

- Grievance Mechanism: Both TPL and the construction contractor will have a clear mechanism in place to resolve any employment and local supplier-related grievances.

Social Investment Strategy.

As a part of its long term commitment to the development of the community and the region in which it is located, TPL plans to develop and implement a series of Social Investment (SI) activities in the surrounding area. The aim of these SI activities is to improve socio-economic and health conditions in the area and ensure that TPL has a net beneficial impact in the area and acts as a 'good neighbour'.

To assist development of these SI activities, *Annex H* presents an SI Strategy which will be used by TPL in the design and implementation of the SI process. The Strategy will be aligned with the management plans that will emerge from the ESMP development process, thus allowing TPL to manage its environmental and social impacts while investing in the development of the area.

TPL has initiated discussions with a Thika-based consortium of Community Based Organisations, with the objective of this group taking a lead role identifying, supporting implementation, and monitoring the SI initiatives that are taken forward. Local communities will have a key place in identification of suitable initiatives, and decision-making as to which ones are prioritised for funding by TPL.

7.5 *CONSTRUCTION MANAGEMENT PLAN (CMP)*

A table of contents for the Construction Management Plan (CMP) is provided in *Annex A*. This plan will be finalised by TPL (with their construction contractor(s)) and shared with NEMA (and other relevant stakeholders, as appropriate).

TPL's contractor(s) will be required to comply with the CMP throughout the construction phase of the Project. A number of specific measures have been identified as required as part of the CMP to mitigate or enhance potentially significant impacts resulting from the Project. Those measures are set out in the provisional CMP in *Annex A*.

7.6 *MONITORING PROGRAMME*

Table 7.4 provides details of the monitoring programme which TPL will implement to support the ESMP. Information is provided on the following aspects of the monitoring which will be undertaken:

- Monitoring activity;
- Parameters to be monitored;
- Monitoring location(s);
- Phase (construction and/or operation);
- Monitoring duration and frequency;
- Cost/resource requirements;
- The party incurring the cost;
- The party responsible for implementing the monitoring measure; and
- The potential response in the event of an exceedance.

Table 7.4 Monitoring Programme

	Monitoring Activity	Monitoring Parameters	Monitoring locations	Phase	Monitoring duration / Frequency	Costs / resource requirements	Party incurring cost	Party implementing the measure	Potential response in event of exceedence
Air Quality									
1	Visual assessment of dust: routine and, if necessary, in response to a complaint through the Grievance Mechanism.	Dust levels in atmosphere	Construction areas, in particular storage areas for dust-generating materials, areas with traffic flow etc.	Construction	Daily during construction period, in particular during periods of dust generating activity or in response to a compliant.	Under the general responsibilities of the construction supervisor – no material additional costs associated with this activity.	Construction contractor	Construction contractor	Additional dust mitigation measures if excessive dust emissions are observed.
2	Continuous monitoring of air quality during plant operation against EU / Kenyan standards.	• NOx • SO • PM • CO Air quality measurements shall be recorded and compared to the levels modelled in the ESIA.	Mang'u High School or another suitable secure location.	Operation	Continuous during the operational period of the power plant.	• Capital cost NOx/SO2/PM ~ **$75,000** including data logger • Capital cost meteorological measurements ~ **$30,000** • Installation & set-up air quality monitoring equipment ~ **$20,000** • Periodic operational costs, air quality and met monitoring (including data validation) ~ **US $ 100,000** • **Total: ~$225,000**	TPL	TPL staff / independent qualified air quality technician employed by TPL as necessary.	Review stack emissions and equipment performance and on basis of investigations take further appropriate action.
Greenhouse Gases									

	Monitoring Activity	Monitoring Parameters	Monitoring locations	Phase	Monitoring duration / Frequency	Costs / resource requirements	Party incurring cost	Party implementing the measure	Potential response in event of exceedence
3	Monitor sulphur content of heavy fuel oil to ensure it does not exceed 2%.	Sulphur content of heavy fuel oil by monitoring fuel delivery records.	Sulphur content of heavy fuel oil.	Operation	Quarterly	Under the general responsibilities of the construction supervisor – no material additional costs associated with this activity.	TPL	TPL environment manger	Revert to fuel supplier, enforce contract terms (ie < 2% sulphur content)
Noise									
4	Measurements of existing ambient noise will be carried out at the 2 most sensitive locations prior to the start of construction.	Noise level, $L_{Aeq,\,1\,hour}$	The following 2 noise sensitive receptor locations: • 2 – Mang'u High School Teachers' Accommodation • 3 – Nearest Houses to Site – Building 1 (NE façade)	Construction	Once prior to the start of construction. Sufficient number of samples to represent the variable daytime noise environment and ideally to cover times when construction is likely to produce the highest noise outputs.	Capital costs (one-off purchasing noise measurement equipment) **~ $3,200** Monitoring cost ~ **$430** ($430 x 1)	TPL	Qualified acoustic survey technicians	N/A
5	Monitor noise levels during construction at 2 most sensitive locations during construction.	Noise level, $L_{Aeq,\,1\,hour}$	The following 2 noise sensitive receptor locations: • 2 – Mang'u High School Teachers' Accommodation • 3 – Nearest Houses to Site – Building 1 (NE façade)	Construction	At the start of each new construction phase or after significant changes in plant location. Additionally, consider monitoring at these or other sites if a complaint appears to be justifiable.	Monitoring cost ~ **$4,300** ($430 x 10)	TPL	Qualified acoustic survey technicians	Review equipment performance and site practices

	Monitoring Activity	Monitoring Parameters	Monitoring locations	Phase	Monitoring duration / Frequency	Costs / resource requirements	Party incurring cost	Party implementing the measure	Potential response in event of exceedence
6	Measurements of existing ambient noise will be carried out at 4 locations prior to the operation phase of the Project (during commissioning).	Noise level, $L_{Aeq,\,1\,hour}$	The following 4 noise sensitive receptor locations: • 1 – Agro Tropical Coffee Farmer's Accommodation • 2 – Mang'u High School Teachers' Accommodation • 3 – Nearest Houses to Site – Building 1 (NE façade) • 5A – Witeithie Estate further from road	Operation	Once prior to operation. The duration should be long enough to produce a representative sample of the noise level and should be a minimum of 1 hour. Measurements to be made during the quietest time of the two periods under consideration (day and night).	Monitoring cost ~ **$860** (1 x daytime and 1 x night time @ $430 each)	TPL	Qualified acoustic survey technicians	N/A
7	Monitor noise levels at 4 locations during commissioning and operation.	Noise level, $L_{Aeq,\,1\,hour}$ Noise measurements shall be recorded and compared to the mitigated noise levels stated in the ESIA.	The following 4 noise sensitive receptor locations: • 1 – Agro Tropical Coffee Farmer's Accommodation • 2 – Mang'u High School Teachers' Accommodation • 3 – Nearest Houses to Site – Building 1 (NE façade) • 5A – Witeithie Estate further from road	Operation	Once during construction then every five years for lifetime of the project (= 5 occasions based on lifetime of 25 years) or if there is a significant change in plant. Measurements should be made at the same time as the ambient noise was measured (item 6).	Monitoring cost ~ **$4,300** (5 x $860)	TPL	Qualified acoustic survey technicians	Review equipment performance and site management.
Water resources									
8	Monitor water usage against	As per WRMA permit	As per WRMA permit	Construction / operation	As per WRMA permit	Under the general responsibilities of the	TPL	TFL environment	Review water abstraction

	Monitoring Activity	Monitoring Parameters	Monitoring locations	Phase	Monitoring duration / Frequency	Costs / resource requirements	Party incurring cost	Party implementing the measure	Potential response in event of exceedence
	terms of any water abstraction permits / agreements with Thika District.	requirements	requirements		requirements.	environment manager – no significant material costs associated with this activity		manager	records and permit conditions
9	Monitor wastewater before discharge from the Effluent Treatment Plant	Kenyan and IFC discharge standards (see *Table 6.20* of ESIA)	N/A	Operation	Prior to discharge	No material additional costs above general operation and maintenance costs.	TPL	ETP operational staff	Re-treatment within the ETP until standards are met.
Landscape and Visual									
10	Monitor to ensure that dust control and visual screening measures are implemented effectively.	For dust monitoring see row 1. Visual screening monitoring to be conducted approximately every 1.5 to 3 months depending on species of trees planted.	At locations where screening has been carried out	Operational	Every 1.5 to 3 months during operational phase depending on species of trees planted	Under the general responsibilities of the environment manager – no significant material costs associated with this activity	TPL	TFL environment manager	Review and amend landscape plan if appropriate
Regular Environmental Auditing									
11	Regular auditing of equipment, plant and processes	Integrity of equipment and plant, and adherence to relevant onsite processes. Auditing will help to identify problems such as leaks of fuel or or lubricant, integrity checks for process equipment and	Various on-site locations as appropriate	Construction / operation	As part of regular, monthly audits during the construction and operational phases	Part of general construction / operational audits by environment manager – consequently no material additional costs associated with this activity would be anticipated.	TPL	TFL environment manager	Work with contractors / TFL operational staff to rectify any non-compliances picked up during regular audits.

	Monitoring Activity	Monitoring Parameters	Monitoring locations	Phase	Monitoring duration / Frequency	Costs / resource requirements	Party incurring cost	Party implementing the measure	Potential response in event of exceedence
		adequacy of general site housekeeping.							
Topic Specific Management Plans									
12	Monitor requirements laid out in the suite of topic specific management plans which will be developed for the Project.	Separate plans will be developed as follows: • Construction Management Plan • Traffic Control Management Plan • Construction Spoil and Waste Management Plan • Unplanned Events and Emergency Response Plan • Occupational Health and Safety Plan • Worker Management Plan • Stakeholder Engagement Plan • Social Investment Strategy	N/A	Construction / operation	As specified in specific management plans	Under responsibility of the environment manager / CLO – consequently no material additional costs associated with this activity would be anticipated.	TPL	TFL environment manager	Investigate and respond appropriately as per requirements of the relevant specific management plan.
Grievance Mechanism									
13	Monitor issues raised through the Grievance Mechanism	Number of, and type of complaints received on any project-related activity	N/A	Construction / operation	Continuously throughout construction and operational phases of the project.	Under responsibility of the environment manager / CLO – no material additional costs associated with this activity.	TPL	TFL environment manager / CLO	Monitor grievances and respond as appropriate; undertake further investigation into issues is appropriate (eg

	Monitoring Activity	Monitoring Parameters	Monitoring locations	Phase	Monitoring duration / Frequency	Costs / resource requirements	Party incurring cost	Party implementing the measure	Potential response in event of exceedence
									further monitoring relating to noise or dust complaints)
Employment									
14	Monitor numbers of local people being recruited during construction and operation.	Numbers of locals being employed as % of total employees	N/A	Construction / operation	Ongoing	Under responsibility of environment manager / human resources department – no material additional costs associated with this activity	TPL	TPL environment manager / human resources department	Review opportunities for employment of local people.

Annex A

Construction Management Plan

ANNEX A: CONSTRUCTION MANAGEMENT PLAN

A1.1 INTRODUCTION

A1.1.1 Overview

The following text provides an outline of the Construction Management Plan (CMP) for the Project, describing how it will be finalised by TPL and the construction contractor(s) prior to the commencement of construction activities. Where specific mitigation measures have been identified as part of the ESIA process these are outlined in the relevant sections. TPL or its contractor(s) will be required to develop the CMP to ensure these mitigation measures are implemented and to identify any other relevant mitigation measures in consultation with regulators.

A1.1.2 Purpose

The purpose of the CMP is to provide TPL and its contractors with a framework for managing all construction-related activities in and around the Project site, based on guidelines and standards for construction management outlined by the Government of Kenya and the IFC.

A1.1.3 Responsibility

This section will provide details of those responsible for implementing the measures detailed in the plan. Responsibilities may be for groups of people or individuals.

TPL or the contractor(s) shall consult with the relevant government agencies to agree specific mitigation measures and the content of the CMP.

A1.1.4 Review of Effectiveness

This section will outline how TPL and the construction contractors will review the effectiveness of the CMP at key stages in the Project. This will be important for assessing the suitability and effectiveness of the plan. Issues for review are likely to include:

- ease of implementation;
- responsibility for actions;
- monitoring requirements;
- communication and reporting lines; and
- timeframes.

The contractor(s) shall regularly update this management plan as the construction method is developed specific requirements are identified in detail.

A1.2 DRAFT GUIDELINES FOR CONSTRUCTION MANAGEMENT

A1.2.1 Overview

This section will provide construction management guidelines that define minimum standards of construction good practice for the following environmental impacts:

- Dust and Air Pollution;
- Noise Disturbance;
- Impacts on Water Resources;
- Traffic and Transport Resources;
- Waste Management;
- Landscape and Visual Impacts; and
- Socio-economic Impacts.

Mitigation measures that have been identified in the ESIA for each of these topics are set out below. This will form the basis on which TPL or its contractor(s) will further develop the CMP.

A1.2.2 Dust and Air Pollution

Best practice measures will be implemented to minimise the potential for dust to be generated and escape off-site. Mitigation measures during construction include:

- Upon completion of finish grading, earth firebanks and slopes that will remain unseeded will be temporarily protected against erosion by applying a coat of liquid asphalt to the surface, as indicated below:

  - tightly bonded surfaces: 1.4 litre/sq. meter of MC-30;

  - loosely bonded fine-grained surfaces: 2.3 litre/sq. meter of MC-70 or SC-70; and

  - loosely bonded coarse-grained surfaces: 3.6 litre/sq. meter of MC-250 or SC-250.

- Natural binder material extracted from plants, as manufactured by Roadbind Inc. or equal will also be used for erosion and dust control, if required, for example on long term exposed surfaces, or on long term stockpiles. These products are environmentally safe, non-toxic, and biodegradable. The spraying rate shall be per manufacturer's recommendation.

- All materials with the potential to lead to dust emissions will be transported in sheeted trucks.

- Wash down of dirty equipment, such as excavators, dump trucks and drilling equipment will be undertaken as required, to avoid excessive build up of dirt and mud on equipment.

- Water suppression or dust extraction will be fitted where possible to construction equipment that has the potential to generate dust, e.g. during drilling, excavating, etc.

- Surfaces that are to be excavated or cleared will be dampened prior to clearing or excavation where there is potential for excessive dust to be created.

- In the event that there is a build-up of dirt or mud on access roads of the highway, this will be cleaned to remove this build-up.

- On-site vehicle speeds on unhardened roads and surfaces will be limited to less than 15 kph.

- Drop heights for material transfer activities such as unloading materials will be minimised.

- Bowsers (water tankers) or similar equipment will be available for use to wash down surfaces and roads and damp down surfaces.

- Drains and guttering on site will be maintained in a clean state to reduce the potential for materials to become dry and friable.

- Bitumen will not be overheated and where possible, bitumen will not be heated with open flame burners.

- Pots and tanks containing hot bitumen will be covered to minimise fume production.

Further dust management measures are also set out in *Annex C* - Construction Spoil and Waste Management Plan.

In addition to the mitigation measures set out above, a dust management programme will be implemented that sets out measures for the visual assessment of dust emissions, additional mitigation if excessive dust emissions are observed and formalised responses for responding to, substantiating and dealing with any dust nuisance complaints. The plan will also identify the receptors most at risk and the ambient conditions of wind speed and direction that could transport dust to these receptors. This will allow suitable mitigation to be implemented in a timely and focused manner.

A1.2.3 Noise Disturbance

The "permissible noise levels" during construction, under Kenyan legislation are presented in *Table A1.1* below. These are discussed further in *Chapter 6*.

Table A1.1 Second Schedule - Maximum Permissible Noise Levels for Construction Sites

Zone	Maximum Noise Level Limits Permitted (dB LAeq)	
	Daytime 07:00 to 22:00	Night 22:00 to 07:00
(i) Health facilities, educational institutions, homes for disabled etc.	60	35
(ii)Residential	60	35
Areas other than those prescribed in (i) and (ii).	75	65

Although the minor construction noise impacts detailed in *Chapter 6* are not high enough to require specific mitigation, good site practice will be employed to minimise noise, which would include the following measures:

- selection of low noise equipment;
- the proper maintenance of plant, including plant housings and silencers;
- placing noisy plant as far as possible from sensitive receptors;
- temporary screening of the equipment;
- switching equipment off when not in use;
- construction of on-site buildings first, to act as noise screens;
- informing neighbouring building occupants when particularly noisy operations are planned; and
- identifying a site liaison officer to deal with noise and other environmental matters.

A1.2.4 Water Resources

Overview

A number of mitigation measures will be required to mitigate any potential impact on water resources during construction. These are set out below.

Borehole Construction

Appropriate construction methodology will be applied to ensure that groundwater mixing does not occur. Additionally, in order to mitigate potential impacts that could result from poor borehole construction, international best practice borehole construction methodologies will be applied.

In order to mitigate against any occurrence of groundwater contamination, borehole construction plant will be suitably maintained, and spent fluids handled and disposed of in an appropriate manner.

General Construction Activities

The potential contamination and/or erosion risks from construction related activities can be mitigated by industry-standard good construction management practices. This would necessarily include:

- regular checking and maintenance of all plant and machinery to minimise the risk of fuel or lubricant leakages;

- any hydrocarbons, fuels, lubricants and chemicals to be used will be stored in bunded and lockable oil storage tanks, with hoses and gauges kept within the bund. The capacity of the bund will be equal to 110% of the storage tank volume. All surface water or other contaminated water which accumulates in the bund will be removed by manually controlled positive lift pumps and not by means of a gravity drain. This water will be removed from the Project site and discharged in a public sewer in consultation with the relevant water companies;

- training and equipping relevant staff in safe storage and handling practices, and rapid spill response and cleanup techniques;

- minimal or total avoidance of soil disturbance close to watercourses (preferably establishing a 10 metre buffer zone and leaving existing vegetation in place), and no stockpiling of waste or fill materials close to or within channels;

- effective construction site drainage measures, utilising cut-off drains (to divert surface runoff from exposed soils or construction areas), oil interceptors and silt traps to manage and retain sediments on site;

- leaving vegetation in-situ wherever possible, and re-vegetation of bare soils before the next rainy season;

- adequate provision for the collection, treatment and disposal of sewage from site offices and accommodation will be provided;

- exposed ground and stockpiles will be minimised to reduce silty runoff, and if necessary measures such as geotextiles will be used to shield spoil mounds;

- wet concrete and cement will be prevented from entering any watercourses;

- stockpiles will be kept away from waterways;

- static equipment will be kept in spill trays or within bunded areas;

Options for managing surface water run off during both the construction and operational phases of the Project are currently being discussed by TPL, which is examining a collective approach to coordinate surface water management with the neighbouring KPLC substation site. During construction it is likely that temporary drainage channels will be created to channel and divert surface water from the TPL site, away from the down slope agricultural plots. The KPLC contractor already has proposals for construction surface water management, and TPL is discussing whether these can developed jointly and upgraded as necessary to combine construction surface water management for the two adjacent sites.

A1.2.5 Traffic and Transport

A separate detailed Traffic Control Management Plan will be developed specifically to address impacts on traffic and transport during the construction phase. The provisional Traffic Control Management Plan is detailed in *Annex B*. Specific mitigation measures have been developed to control the following:

- access to construction areas;
- routing of construction traffic;
- temporary traffic control and management;
- road crossings;
- parking facilities;
- keeping highways clean of mud and dust;
- driver training;
- road safety and awareness training for school children; and
- reducing the probability of traffic accidents.

A1.2.6 Construction Spoil and Waste Management

A provisional Construction Spoil and Waste Management Plan to minimise waste generated and for the treatment and disposal of any waste and contaminated material encountered during the construction stage has been produced and is detailed in *Annex C*.

The management plan will be further developed by TPL and its contractors, in compliance with relevant regulations and include waste (including hazardous) disposal methods, the waste category and quantities of materials generated, opportunities for recycling and/or re-use, disposal, transportation procedures and licensing requirements; and policy for cleaning up accidental spills.

The plan will outline how waste streams generated during construction should be managed with due regard to the waste hierarchy. Specifically, the following principles should be adopted in order of preference:

- Waste Minimisation;
- Reuse and Recycling;
- Waste Treatment; and
- Disposal.

The Waste Management Plan specifically covers the following wastes:

- Construction spoil - handling and storage;
- Construction spoil – transport;
- Dust prevention – haul routes;
- Dust prevention – concrete batching and pouring;
- Dust prevention - cutting/grinding/grouting /packing;
- Hazardous waste management;
- Solid waste management;
- Segregation of solid wastes;
- Welfare facility and catering wastes; and
- Waste transport.

A1.2.7 *Unplanned Events*

TPL will develop an EMS that will, among other things, seek to prevent and limit environmental accidents and develop contingency procedures in case of such accidents. Given that most unplanned and emergency events have both environmental and health and safety consequences, the EMS, will be developed along side the Health and Safety Management System. Ideally this will be done within the overall framework of an Integrated Quality, Environmental and Health and Safety Management System.

A provisional Unplanned Events and Emergency Response Plan has been drafted and is detailed in *Annex D*. This plan includes the following requirements:

- A Safety Programme will be set up by TPL for specific use at the Thika Power Plant. This will include details on:

    - training, instruction and information;
    - inspection and testing;
    - accident investigation and reporting;
    - accident report review and follow up; and
    - year end report.

- A comprehensive Emergency Response Plan will be developed and implemented;

- As an integral part of the Safety Programme and the Emergency Response Plan, fire prevention and fire fighting capability will be among the top priority requirements of the Project;

- Mitigation measures to prevent contamination of land and water will be developed and implemented; and

- Risk assessment procedures will be developed and implemented by trained personnel.

A1.2.8 Landscape and Visual Impacts

A number of mitigation measures are described below which will need to be detailed in the final Construction Management Plan to minimise landscape and visual impacts:

- Machinery and materials will be stored tidily during the works. Tall machinery including cranes will not be left in place for longer than required;

- Temporary roads and works areas will be maintained free of dust;

- Outdoor construction lighting shall be unobtrusive, and light shall not shine upwards or towards residential areas; and

- Security and work lighting (both driving construction and operation) shall be shielded and directed downwards.

A1.2.9 Social and Socio-Economic Impacts

Overview

This section of the CMP will detail how TPL propose to manage impacts relating to workforce and local communities during the construction period. A number of provisional specific management plans have been produced which TPL will need to fully develop and implement. These include:

- Occupational Health and Safety Plan *(Annex E)*;
- Worker Management Plan *(Annex F)*;
- Stakeholder Engagement Plan *(Annex G)*; and
- Social Investment Strategy *(Annex H)*.

Some of the specific measures outlined in these plans are summarised below:

Occupational Health and Safety Plan

The Occupational Health and Safety Plan includes requirements for:

- development of an EHS management system;

- job descriptions to include health and safety requirements;

- contractor selection criteria in relation to health and safety;

- recruitment procedures to include assessment of health and safety capabilities;

- development of health and safety training programme;

- risk assessments and health monitoring for workers; and

- health surveillance programme.

Worker Management Plan

The Worker Management Plan includes requirements for:

- development of hiring guidelines on the basis of commitment to optimises local participation in the workforce;

- transparent and accessible application and short-listing process;

- guidance on the selection of applicants;

- implementation of an effective grievance mechanism;

- training plan for the workforce; and

- management and monitoring of this Plan.

Stakeholder Engagement Plan

Annex G details the Stakeholder Engagement Plan which already has and is being implemented as the Project develops. During construction, TPL will build on this and develop a strategy for ongoing engagement with stakeholders. The SEP will incorporate relevant measures that have been developed as part of the ESIA to mitigate potentially significant adverse impacts and enhance positive impacts. Below are some of the mitigation measures suggested as a part of the ESIA mitigation and enhancement strategy:

- TPL and the construction contractor will clearly communicate the recruitment plans and procurement opportunities for the construction and operation phase of the power plant, using methods such as adverts in local newspapers and local government bulletins, registration with the district employment department, adverts placed in local job centres and on village notice boards, and pamphlets to local businesses.

- Grievance Mechanism: The construction contractor will have a clear mechanism in place to resolve any employment and local supplier-related grievances.

Social Investment Strategy.

As a part of its long term commitment to the development of the community and the region in which it is located, TPL plans to develop and implement a series of Social Investment (SI) activities in the surrounding area. The aim of these SI activities is to improve socio-economic and health conditions in the area and ensure that TPL has a net beneficial impact in the area and acts as a 'good neighbour'.

To assist development of these SI activities, *Annex H* presents an SI Strategy which will be used by TPL in the design and implementation of the SI process. The Strategy will be aligned with the management plans that will emerge from the ESMP development process, thus allowing TPL to manage its environmental and social impacts while investing in the development of the area.

TPL has initiated discussions with a Thika-based consortium of CBOs, with the objective of this group taking a lead role identifying, supporting implementation, and monitoring the SI initiatives that are taken forward. Local communities will have a key place in identification of suitable initiatives, and decision-making as to which ones are prioritised for funding by TPL.

Annex B

Traffic Control Management Plan

ANNEX B: TRAFFIC CONTROL MANAGEMENT PLAN

B.1 INTRODUCTION

The purpose of this management plan is to ensure that construction of the Scheme components does not adversely affect road users and other sensitive receptors. This Traffic Control Management Plan (TCMP) therefore identifies the potential impacts and appropriate measures to mitigate them.

Prior to the commencement of construction, the contractor(s) shall use the TCMP as the basis for undertaking a detailed Traffic Assessment (TA) and preparing a detailed TCMP; this will identify specific measures to mitigate any predicted impacts. The contractor's (or contractors') TCMP shall include detailed procedures that demonstrate how the impacts of traffic on communities have been taken into consideration. The contractor(s) shall develop and submit:

- procedures within 30 days of the start of the construction phase; and
- detailed project-specific procedures that specify how the requirements of their TCMP will be implemented to the satisfaction of the appropriate traffic authorities.

The contractor(s) shall regularly update their TCMP as the construction method is developed and vehicle movement and timing requirements are identified in detail.

The contractor(s) shall consult with the relevant government agencies to identify where Project plans can complement existing road development plans at the district and provincial level. The contractor(s) will also consult with the leaders of any communities that will suffer a significant increase in traffic in order to identify alternative routes where possible, or appropriate mitigation measures.

The contractor(s) will:

- identify those responsible for carrying out and managing the procedures;
- reference the procedures and activities the contractor(s) will develop and implement;
- identify work to be undertaken on the roads prior to construction activities to upgrade or stabilise the roads if necessary;
- identify the routes that will be used with the estimated numbers of traffic movements, speeds and times of travel;

- justify where a route has to pass through residential areas and the measures that will be used to ensure the safety of the community and minimise the nuisance impact of traffic movements;

- identify how existing road development plans have been taken into account in the identification of routes and road restoration measures;

- identify the programme of road restoration measures that are likely to be required post construction;

- address how the Contractor(s) can reduce the exposure of vehicle drivers, their passengers and other road users from the hazards of road-related accidents;

- identify (and adopt to the maximum extent feasible) all reasonably practicable alternatives to road transportation (rail) in order to reduce the number of trucks on the roads; and

- provide details of audits and reviews of the components of the project transport system.

Table B.1.1 Traffic Control Management Plan (Construction)

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
Access to construction areas	The following environmental aspects shall be considered in finalising the location of the access road that will be constructed specifically for the Scheme: • environmentally sensitive areas; and • pedestrians.	*B1.1*	Contractor	No separate cost. Included in design fees.	Developed during Project planning, implemented during construction.
	Other measures for mitigating the impact of access roads are as follows: • Access will be via specified routes, which will be agreed with the relevant authorities. • Existing, upgradeable roads will be used where practicable, to avoid the need to construct new roads. • Access roads to previously inaccessible sensitive areas will be avoided.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• If the Contractor requires additional routes, a specific proposal will be submitted to the relevant authorities for consideration and approval. • Suitable measures will be implemented to avoid damage to public roads and any damage will be repaired to an equal or better standard in a timely manner. • The Contractor will remove all temporary roads or road enlargements, except where local communities or landowners request that a new road be left in place.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• Temporary access roads will be kept free from deposits to prevent silt, oil or other materials from entering drains or watercourses. Small dams in roadside ditches may therefore be required to assist in silt retention, particularly on steep slopes.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	• Access routes to be used by construction traffic will be properly signposted. This shall be sufficient to prevent vehicles from leaving the designated routes and ensure that the appropriate speed limits are enforced particularly through residential areas. • Access and site roads will be maintained in good condition. • Temporary roads will be removed when no longer needed and will be reinstated. All damage to existing roads will also be reinstated. • Any additional routes will be selected to avoid ecologically sensitive areas, and to minimise erosion. • The Contractor will liaise with the appropriate regulatory authorities to gain approval to use, and regularly inspect, the road infrastructure.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Routing of construction traffic	• Relevant authorities will be consulted to agree on specific routes for use by construction traffic to avoid any sensitive residential areas and unsuitable parts of the road network. • Precautions will be taken by the Contractor to avoid damage to the public highways used by vehicles or other items of equipment. Timber mats, tyres or steel plates will be laid as necessary, in particular under tracked equipment. Any road damage will be repaired. • Advance warning will be given of any proposed road diversions and closures. • The Contractor should consider whether to use buses to transport workers to the construction site. • The Contractor will comply with all statutory vehicle limits (width, height, loading, gross weight) and any other statutory	*B1.2*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	requirement.				
Temporary traffic control and management	• Traffic flows will be timed, wherever practicable, to avoid periods of heavy traffic flow along main roads. In addition, the Contractor will not commence any work that affects the public highway until all agreed traffic safety and management measures essential for the works are accepted and agreed with the relevant authorities.	*B1.3*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• In terms of traffic control, vehicles will be prohibited from reversing unattended into the construction site. Vehicles and plant shall enter and exit the site in a forward direction, as far as possible. In addition, the Contractor will ensure that all heavy goods vehicles are equipped with audible reversing alarms.				
	• Clear signs, flagmen and signals will be set up where necessary. Where temporary traffic signals are required, the details and locations of the signs shall be discussed with the relevant authorities. The signs will be fixed safely and securely to ensure that they do not become detached or dislocated, and will be visible and comprehensible by all. The Contractor will also carry out maintenance checks to clean and re-secure signs if necessary.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• Appropriate supervision will be provided by the Contractor to control the flow of traffic when machinery needs to cross roads.				
	• Liaison with the police and other authorities will occur prior to the movement of any abnormal loads. In particular, liaison with the relevant Highway Authority will occur prior to transportation on major highways and motorways.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• Access to commercial and residential properties shall be maintained and speed limits will be established and enforced over all construction traffic routes.				

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	• Where roads used by children to reach schools are used by construction traffic, road safety education will be provided at schools. Vehicle traffic will be prohibited during hours that children are travelling to and from school. • Ambulances and fire services will be consulted regarding road diversions. Road diversions will not increase the response time of these services to local communities. • Access to residential and commercial properties will be maintained.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• If road closures are required, diversions will be planned and communicated to the authorities (including emergency services and public transport providers) and affected communities in advance (via the pre-construction community meeting) and will be properly sign-posted. Crossing for pedestrians and animals will be provided to avoid the need for a diversion. No diversion will be permitted that prevents a public transport service from continuing or requires a diversion of more than 1km for vehicles or a diversion of more than 500m for pedestrians or livestock. Notification periods for road closures are as follows: two weeks minimum notice on closure of up to 28 days; one month minimum notice on closure of 28 days to three months; three months notice for closure over three months or for permanent closure.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• Education on traffic safety will be provided by the Community Liaison Officer(s) (CLOs) to communities not normally subjected to major infrastructure construction.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• Fuel use will be minimised during the transportation of construction materials and personnel. A fuel use assessment will be undertaken, in conjunction with safety assessments, at the outset of the construction programme. • A 30km/h speed limit shall be enforced on the access road.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	The speed limit shall be 50km/h in the towns and villages. The speed limit on the motorways and highways shall be 90km/hr. • A 30km/h speed limit shall be established and enforced over all construction traffic routes.				
Parking facilities	• Signposted, parking facilities shall be provided at accessible locations on the road network. The parking of construction vehicles on footways, and double parking, shall be prohibited on public highways in the vicinity of the working width.	*B1.4*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• The Contractors will ensure that part of the Construction Site is set aside for the parking of emergency service vehicles. The Contractor is expected to make provision for a dedicated parking area on the construction base for the private vehicles of construction personnel.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Maintaining Highways	The Contractor is expected to keep highways free from mud and dust and to ensure that no vehicle or other items of equipment leaving the construction base or working width, deposit soil, debris or rock on public highways or public right of ways. Measures will be implemented to ensure that the transport of mud and dust from the site onto public highways and roads is limited. Such measures may include: • paving the access road; and • the use of hard core surfaces on access roads;	*B1.5*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• the provision of an easily cleaned hardstanding area within the construction site for vehicles entering, parking and leaving; • the provision of wheel washing facilities adjacent to the egress points for use by vehicles leaving the construction base/working width;		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	• the appointment of site personnel to clean the construction hardstanding area and to remove any mud or debris deposited on the public highways; • the provision to clean hardstanding areas and to clean any mud or debris deposited by work vehicles on roads or footways in the vicinity of the construction site;		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• fully sheeting all works vehicles carrying potentially dusty material or likely to deposit loose materials on the public highway during transit; and • the Contractor shall clean and maintain temporary and permanent roads, and shall remove mud and debris from public roads.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Road Related Accidents	Hazards to personnel associated with vehicle transportation, both on- and off-road, will present one of the most significant risk exposures of the Project. Accordingly, the Contractor shall be expected to develop and implement management systems and procedures that will provide the highest level of control over these hazards. Accordingly, the Contractor's procedures shall specifically cover arrangements for the following important aspects: • the source of and number of qualified drivers required; • training and approval requirements for drivers; • hours of driving and rest periods; • security arrangements for drivers, vehicles and loads; • arrangements for driver communication with control points and vehicle equipment; • language/communication issues; • the source of suitable vehicles (e.g. quality and specification); • the number of vehicles required; • the programme for preventative vehicle maintenance;	*B1.6*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	• vehicle routes, route planning and alternative routes; • overall vehicle movements; • procedures for the emergency recovery of vehicles; • an appraisal of the social impact of vehicles in the local community; • procedures for spot checks and audits of the transport system and for reporting problems.				
	The contractors Journey Management Plan shall include the following provisions: • a specific Journey Management form shall be completed and approved for journeys of more than 25 kilometres;		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• pre-use vehicle inspections shall be completed and recorded on the approved form; • all drivers shall be trained and evaluated in defensive and off-road vehicle operation		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• passengers shall comply with the 'Safe Passenger's Code' and drivers shall comply with the 'Safe Driver's Code'; and • no unauthorised passengers shall be carried.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Vehicle Standards and Maintenance	The Contractor shall comply with all other aspects of the Construction Health and Safety Management Plan, which include requirements for vehicle standards and maintenance. The contractor shall also ensure that:	*B1.7*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• All vehicles shall be maintained so that their noise and emissions do not cause nuisance to workers or local people.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	• New vehicles: vehicles/equipment purchased 'as new' after contract award shall comply with the appropriate emission standards in force on the purchase date.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
					construction.
	• Older vehicles: vehicles/equipment not purchased 'as new' after contract award shall be maintained so that noise and emissions levels are no greater than when the vehicle/ equipment was new.		Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
	The contractor shall produce method statements, as part of their TCMP, to cover routine maintenance and to minimize equipment emissions. Routine maintenance shall be to a high standard to ensure that vehicles are safe and that emissions and noise are minimised. Method statements shall require regular maintenance of diesel engines to ensure that emissions are minimised, for example, by cleaning fuel injectors.	*B1.8*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Annex C

Construction Spoil and Waste Management Plan

C1.1 INTRODUCTION

The purpose of this Management Plan is to address the risks presented by the generation and handling of construction spoils and waste during construction, operation and decommissioning. Particular risks to be avoided and managed during construction include the following.

- Pollution of the ground and groundwater if hazardous liquids such as used oils and cement/ wet concrete are not properly stored and disposed.
- Increased pollution of groundwater and surface waters, windblown litter, smoke from fires and potential health impacts to nearby residents to the waste disposal sites due to increased amounts of waste deposited.
- Fugitive dust arising from the handling and storage of excavated spoil, concrete batching, rubble, and other inert construction wastes.

The responsibility for minimising the impacts associated with construction spoil handling and waste management will rest primarily with the contractor(s) responsible for the construction and installation of equipment.

TPL should ensure that the contracts for all aspects of the construction include requirements to minimise waste generation and ensure proper disposal of those wastes that do arise in accordance with this management plan.

C1.2 CONSTRUCTION SPOILS AND DUST MANAGEMENT

By far the largest quantity of waste arising from the Project will be spoil generated from the excavation of the terraces to create the level platforms for the installation of the major items of plant and equipment.

The objective of the Construction Spoils and Dust Management Plan will be that as little spoil as possible should be disposed off site. The spoil which is excavated in creating the platforms will, wherever feasible, be re-profiled around the site or re-used for landscaping. There is a deep topsoil layer, and so TPL has initiated discussion with potential users who would be prepared to take part or all of it, for alternative beneficial uses. However, there is still likely to be a surplus of excavated material that will need to be disposed off site, even after transfer of topsoil to these other beneficial uses.

C1.3 WASTE MANAGEMENT

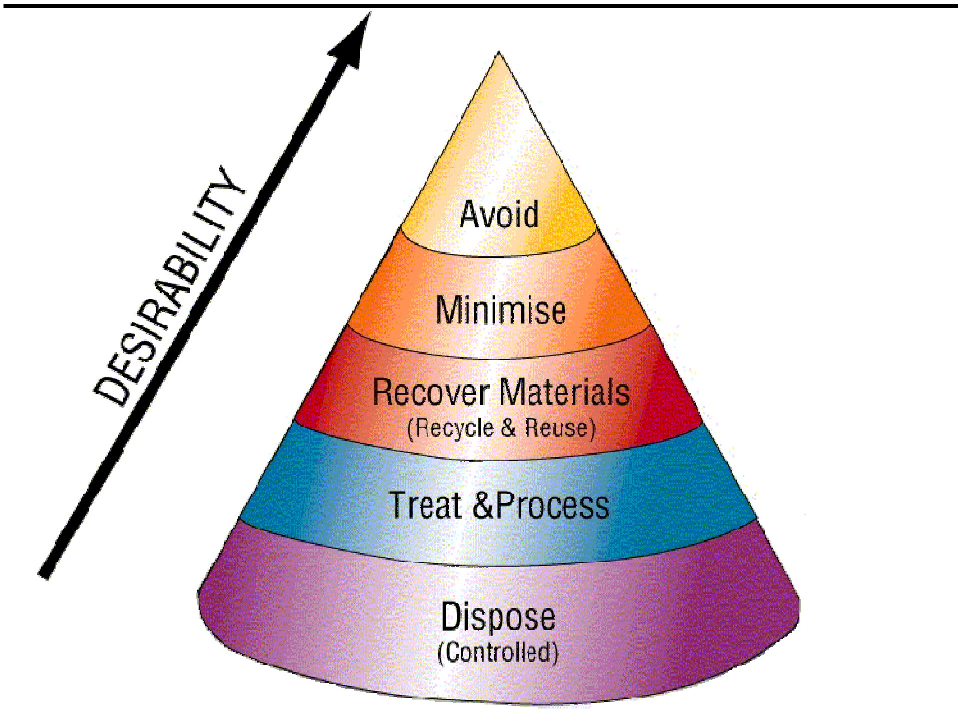
Objectives

During construction and operation the overall objective is to minimise the impacts of waste generated through the following;

- minimise the amount of waste that is generated;
- maximise the amount of waste that is recovered for recycling – including segregation of recyclable wastes at source;
- minimise the amount of waste that is deposited at landfill;
- ensure any hazardous wastes (e.g. used oils, lead-acid batteries) are securely stored and transferred to appropriate facilities;
- avoid dust impacts from handling of construction wastes;
- ensure all wastes are properly contained, labelled and disposed of in accordance with local regulations; and
- waste is disposed of in accordance with the waste management hierarchy.

The internationally recognised and accepted hierarchy of waste management is illustrated in *Figure C1.1*.

Figure C1.1 Waste Management Hierarchy



During decommissioning the overall objective is to minimise the impacts of waste generated through the following.

- reuse as much of the project's equipment and machinery as possible by selling it for use on other projects and selling for scrap any equipment that can't be sold for reuse;
- maximise the amount of waste from demolition of buildings that is recovered for recycling – including segregation of recyclable wastes such rubble, metals and wood;
- minimise the amount of waste that is deposited at the local dumpsite;
- ensure any hazardous wastes (eg used oils, lead-acid batteries) are securely stored and transferred to appropriate facilities;
- avoid dust impacts from handling of rubble from demolition wastes; and
- ensure all wastes are properly contained, labelled and disposed of in accordance with local regulations.

Content

The contractor(s) will incorporate into the construction programme the following "good site practices" which will reduce the risk of impacts arising from waste management activities. The contractor(s) will produce a waste management plan that will cover the following key aspects:

- develop inventory and schedule of likely wastes;
- assessment of local waste management facilities;
- waste minimisation principles;
- maximise reuse /recycle opportunities;
- waste segregation (liquid and solid/reusable and recyclable);
- waste collection, storage and transfer;
- specific disposal procedures for all waste steams identified including waste transfer notes if moved to a offsite licensed facility;
- auditing and reporting procedures; and
- closure process which will include appropriate monitoring and recording.

Table C1.1 Construction Spoil and Waste Management Plan (Construction)

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
Construction Spoil – Handling and Storage	• Where possible align windrows with the prevailing wind to minimise surface area exposed to wind erosion. • Keep stockpiles to a minimum practicable height and use gentle slopes. • If practicable compact stockpile surfaces. • Minimise the storage time of stockpiles. • Minimise the height and fall of materials during handling.	*C1.1*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.
Construction Spoil – Transport	• Ensure that all dust generating materials transported to and from the construction works are covered by sheeting. • Clean wheels of vehicles leaving the work sites so that dirt and mud is not spread on surrounding roads. • Ensure that exhausts do not discharge directly at the ground	*C1.2*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.
Dust prevention – Haul Routes	• Locate haul routes away from sensitive sites if possible. • Pave heavily used areas, or use geotextiles e.g. around batching plant or haul routes. Sweep these regularly. • Pave access roads to the construction site. • Reduce the width of haul roads (while still allowing two-way traffic) to minimise surface area from which dust may be produced. • Sweep paved access roads (while still allowing two-way traffic) and public roads when necessary.	*C1.3*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	• Limit vehicles speeds – the slower the vehicles the less dust generated.				
Dust prevention – Concrete batching and pouring	• Mix large quantities of concrete or bentonite slurries in enclosed/shielded areas. • Before concrete pours, vacuum dirt out of formwork rather than blowing it out. • Keep large concrete pours clean after they have gone off. They can generate large quantities of dust.	*C1.4*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.
Dust prevention – cutting/grinding/ grouting /packing	• Minimise cutting and grinding on site. • On cutters and saws, use equipment and techniques such as dust extraction to minimise dust. Consider a wet cutting saw or use vacuum extraction.	*C1.5*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.
Hazardous Waste Management	• Hazardous wastes, such as batteries and fluorescent lights, will be collected, stored safely and then transported to an appropriate facility. • Waste oil generated at the construction sites will be collected and stored on site in sealed drums before being transported to an approved disposal facility. • All storage areas for hazardous substances will be hard surfaced with a secondary containment system in place.	*C1.6*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.
Solid Waste Management	For all construction works the following procedures will be applied to solid waste management: • All waste will be collected and segregated for reuse, recycling or disposal. • Waste will be disposed of at a licensed site by an authorised	*C1.7*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	disposal contractor, where they are located within a reasonable distance of the site. • Records of all waste stored, disposed of and transported shall be kept. • Other wastes (e.g. chemicals, oils, etc) will be segregated and stored for transport to recycling or disposal facilities. The Project will require contractors to take reasonable measures to dispose/recycle/transport wastes in a manner consistent with law and good environmental practice.				
Segregation of Solid Wastes	• Solid wastes will be segregated at source. • The Project will separate recyclable waste where possible. • Recyclable solid waste (plastic PET bottles, tin cans, aluminium cans and cardboard) should be compacted where possible for storage prior to removal. • Waste shipment request forms will be completed and used for monitoring waste streams and volumes removed from the construction site.	*C1.8*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.
Welfare Facility and Catering Wastes	• All non hazardous waste that cannot be reused, or recycled will be disposed of appropriately.	*C1.9*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.
Waste Transport	Waste will be securely transported from the point of arising to storage facilities and from there to treatment or disposal facilities so as to avoid spillages, windblown litter and other potential environmental problems by applying the following precautions: • The nature, composition and integrity of transport packaging and containers will be appropriate to the type and class of waste being transported.	*C1.10*	Contractor	No separate cost. Included in Construction costs.	Implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	• Transport vehicles will be appropriate for the type, class and quantity of waste being transported in terms of its composition, load capacity, covering etc. • Loading and unloading procedures to avoid waste loss will be followed. • Employees will be trained in the correct procedure to address accidents and emergencies. • All transport vehicles will be equipped with suitable materials or equipment to contain, manage and remove accidental spillages. • Vehicles carrying hazardous wastes shall be labelled appropriately. If a hazardous waste is mixed with non-hazardous waste, the entire consignment will be regarded as hazardous. A waste transfer note (WTN) system will be employed to provide evidence that all loads of waste have been taken to an approved treatment or disposal site.				

Annex D

Unplanned Events and Emergency Response Plan

D1.1 INTRODUCTION

TPL will develop an EMS that will, among other things, seek to prevent and limit environmental accidents and develop contingency procedures in case of such accidents. Given that most unplanned and emergency events have both environmental and health and safety consequences, the EMS will be developed alongside the Health and Safety Management System. This should be done within the overall framework of an Integrated Quality, Environmental and Health and Safety Management System.

D1.2 SAFETY PROGRAMME

D1.2.1 Introduction

A Safety Programme will be set up by TPL for specific use at the power plant. The Safety Programme will be based on achieving the objectives outlined in this section.

The General Manager will designate a senior member of his staff to serve as the Safety Co-ordinator. It will be the Safety Co-ordinator's responsibility to guide and direct the Safety Programme. Specifically, the Safety Co-ordinator will be responsible for the implementation of the following Programme requirements.

D1.2.2 Training, Instruction and Information

All employees will be provided with induction on the Safety Programme and given specific instructions regarding basic personal health and safety. Regularly scheduled safety meetings will be held for all employees including all contractor(s) employees. Each meeting will include instruction on a particular safety rule, procedure, tool, safety device or protective equipment, or potentially hazardous condition. Where appropriate, the meetings will utilise visual aids and demonstration gear and provide time for questions and discussion.

First Aid instruction will be provided to designated employees. Arrangements will be made with a local agency or association that is qualified to conduct First Aid instruction. Operators and maintenance personnel as well as administrative employees, where appropriate, will receive specific instruction regarding the hazards associated with substances and chemicals utilised at the Plant, the location of information and the storage requirements. Fire prevention and fire fighting instruction will be periodically conducted for all employees. Where possible, arrangements will be made with the local Fire Authority for qualified assistance in conducting the training.

D1.2.3 Inspection and Testing

A routine inspection and testing programme will be implemented for all safety related equipment and protective devices. The programme will encompass equipment such as fire fighting equipment and first aid supplies. The programme will be designed to demonstrate the correct operability of the equipment, its availability for use in an emergency and its physical condition with regard for future use. Routine walk-through inspections will be conducted through all areas of the site.

The inspections will seek out any potential or current safety hazards including permanent equipment and building features, housekeeping problems, personnel working habits, safe clearance violations, and tool failures. The inspection will also cover safety equipment, training, records and other aspects of the Safety Programme, as required by the observed conditions and accident record among other things. A site inspection may be conducted in conjunction with periodic operational audits or as an independent activity, as required.

Inspections will typically include, firstly, a General Facility and Equipment Review covering:

- fire hazards;
- safety equipment;
- housekeeping;
- machine safeguards;
- equipment warnings and signs;
- personal work habits;
- first aid supplies; and
- hazardous substance/chemical handling.

Secondly, inspections will typically include a Records Audit covering:

- safety meeting reports;
- safe clearance logs;
- insurance reviews;
- safety manual updating; and
- chemical safety information files.

All inspections will be followed by a written report of the findings and recommendations where necessary.

D1.2.4 Accident Investigation and Reporting

Thorough reporting and investigation of all accidents and near misses will be conducted to ascertain the cause and methods of preventing reoccurrence or similar accidents. Detailed accident reports and records will be prepared and maintained at the site.

All personnel accidents will be reported on an Accident Report Form together with copies of any appropriate statutory form and associated medical data and other information.

D1.2.5 Accident Report Review and Follow-Up

Introduction

All accident reports will be reviewed by the General Manager. The Safety Co-ordinator is responsible for the collection, review, analysis and follow-up of accident reports.

After review by the General Manager, reports will be classified as:

- ***Serious*** - Requiring follow-up and/or investigation; or
- ***Minor*** - Correctable on site and requiring no follow-up.

The accident Reports will then be logged and noted as serious or minor.

Summary reports of serious and lost-time accidents will be communicated to all employees for awareness raising and lessons learned purposes. Each summary will include a description of the accident, the extent of personal injuries, a statement of the cause and corrective actions.

Serious Accident Review

All accidents classified as serious will be reviewed and analysed to determine the corrective action needed. The review considerations will include:

- errors on the part of plant personnel, including safety rule violations;
- equipment failure/wear conditions;
- shortcomings in plant procedures;
- shortcomings in the safety rules;
- design hazards;
- changes in operating practices;
- communication/instruction problems;
- training programme failures; and
- personnel protection equipment failure.

The accident analysis will include, as necessary, an on-site inspection and formal recommendations for changes in equipment, operating methods, training, design and/or procedures. The recommendations will include methods for implementation of actions, when appropriate.

Minor Accident Review

Minor accidents will be tabulated periodically to determine similarities and trends.

D1.2.6 *Year End Report*

The Safety Co-ordinator will prepare a report on all outstanding serious conditions, continuing conditions or problems, and developing trends.

The Year End Report will also contain a summary of corrected conditions that have been identified through review of accident reports or during periodic on-site audits and inspections.

D1.3 *EMERGENCY RESPONSE PLAN*

The General Manager will develop a comprehensive Emergency Response Plan of response for the following conditions:

- environmental incidents;
- general natural disasters such as flooding, fire, explosion;
- individual emergencies such as injury, illness, fatality, drug reaction or medical emergencies; and
- civil disorders such as civil disturbances and strikes.

The Emergency Response Plan will be designed to permit a frame of reference for all types of emergencies and will in all cases provide for close co-ordination and co-operation with local agencies. The Emergency Response Plan will consider the following:

- an accurate assessment of the vulnerability of employees and property;
- the security of the Power Plant based on relative rather than absolute protection;
- the maximum use of existing operating structures, professional law enforcement officers, trained public safety fire fighting personnel, other emergency services, safety co-ordinators, proven supervisory and technical skills, and material and equipment on hand at the Power Plant;
- regular emergency drills will be conducted, reviewed, and revised for maximum effectiveness;
- environmental emergency procedures addressing spillage containment to minimise potential environmental impact, clean up instructions, emergency notices and specific emergency procedures;
- fire and emergency evacuation procedures; and
- contingency plans.

D1.4 FIRE PREVENTION/FIRE FIGHTING

As an integral part of the Safety Programme and the Emergency Response Plan, fire prevention and fire fighting capability will be among the top priority requirements of the Project. Employee awareness of the possibility and dangers of fire as well as the means of preventing fires will be a frequent topic of Safety Meetings. Training sessions and drills will also instruct employees in:

- emergency escape procedures and route assignments;
- emergency equipment operation or shutdown procedures;
- emergency rescue and medical assignments; and
- fire reporting, communication and co-ordination procedures with Local Fire Authorities.

The designated Safety Co-ordinator will contact the local Fire Authority to review the Project's fire procedures and plan and to establish an effective method of communication and co-ordination with that Authority.

The local Fire Authority will be invited to offer recommendations for in-plant fire response and assistance in training the Power Plant staff.

D1.5 SITE-SPECIFIC TECHNICAL SAFETY ISSUES

D1.5.1 *Overall Potential for Operational Impacts*

Major accidents that could result in hazards of concern with respect to the operation of the Power Plant are those with a potential for injury, impairment and/or damage external to the Power Plant's perimeter.

The assessment of hazards arising from major accidents associated with the operation of Power Plant considers the following issues:

- potential risk to third party premises, industry or facilities posed by the operation of the Power Plant; and
- potential risk to the Power Plant posed by third party premises, industry or facilities.

A Hazard and Operability (HAZOP) study will be conducted on the plant during the final design stage. Further assessments will be carried out on major new equipment or subsequent design modifications. The HAZOP study is a systematic structured review of the process and engineering design in order to identify potential hazards and operability problems and consequences. These assessments include consideration of the following risks:

- fire in the fuel delivery area;
- fire in the fuel oil storage tanks;
- fuel oil fire under various scenarios;
- fire in the diesel engines;
- substation fire;
- leaks of high pressure super heated steam (invisibility); and
- accidental release of hazardous chemicals (e.g. for water treatment).

With the incorporation of appropriate design measures and operational techniques into the design and operation of the power plant to prevent major accidents, major hazards are not anticipated to be a significant issue.

D1.5.2 Prevention of Contamination of Land and Water

Fuel oil will be held in above ground storage tanks, with secondary containment. There will be a limited number of oxyacetylene gas bottles on site for welding purposes, and these will be stored in appropriate areas. All chemicals will be stored in an appropriate manner incorporating the use of bunding and other measures (such as acid and alkali resistant coatings) to ensure appropriate containment. The potential for accidents, and associated environmental impacts is therefore limited.

Further measures to limit the potential for accidents are listed below:

- All oil storage and chemical tanks will be bunded to contain either 110% of the capacity of the largest tank or 25% of the combined capacity of all tanks, whichever is greater.
- All wastewater on site that is considered to have the potential to become contaminated either because it is directly used as process/contact water, or because rainwater has collected in an area such as the tank farm where the presence of contaminants is possible, will be collected, channelled and processed through the effluent treatment plant.
- Training and equipment will be in place to minimise the potential environmental impact in the case of accidents, for example, via the use of spill kits.

These measures should avoid the accidental release of materials to surface water, groundwater and land.

In order to ensure that top soil erosion down slope of the Project does not occur, runoff will be attenuated on site prior to discharge at existing greenfield runoff rates, and the drainage system will be designed to accommodate any unpredictable exceedence and take account of the agricultural plots that are located immediately down slope of the site.

D1.5.3 Plant Design

The design of the Project has been carried out by plant designers and engineering contractors who have wide operational experience with similar facilities. The assessment of safety risks that has been carried out during the design has examined issues such as:

- the use of emergency shutdown valves (ESDVs) and electrical trips;
- gas, fume, dust and liquid detection;
- fire fighting systems;
- containment of releases; and
- emergency escape.

D1.5.4 Overall Reliability

Process reliability is a key issue because of the need to supply electricity continuously. One of the main features to aid reliable Plant operation will be the implementation of a preventative maintenance regime. The frequency of the maintenance work will be based on recommendations given in the manufacturer's instructions.

In addition, regular, planned outages will allow major items of equipment such as the diesel engines and steam turbine to be inspected, maintained and repaired. This will be on a rolling programme.

This high standard of maintenance will enable Project to operate as designed and will help to minimise the probability of all types of accidents, including those with potential environmental consequences.

D1.5.5 Risk Assessments

Assessments will take into account environmental as well as health and safety hazards and will include area and task based assessments. They will be performed by trained staff and each hazard will be considered in the context of its effect upon the activities with regard to:

- materials/substances;
- equipment;
- the workplace;
- people;
- procedures; and
- the environment.

This risk assessment approach will consider the hazard, harm, potential severity, probability of occurrence, risk rating, control measures and residual risk. These assessments will also detail action dates and be reviewed on a regular basis.

TableD1.1 presents the Accidents Risk Assessment Management Plan.

TableD1.1 Accidents Risk Assessment Management Plan

The Risk			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Fuel Handling						
Spillage of HFO	Soil Air Groundwater		• Training of staff • Impervious surfaces • Routine operator checks • Clean up response team	Unlikely	Ground contamination Release of VOCs to atmosphere	Not significant
Air Pollution Control						
Fire/explosion in handling/ storage of HFO	Air	Fire/ explosion caused by HFO	• Application of manufacturer's guidance • Low inventory on activated carbon on site • Earthing of plant and equipment to dissipate electrostatic charge as possible ignition sources • Fire fighting systems	Very unlikely	Release of smoke and carbon combustion products	Not significant
Flue gas leak	Air	Overpressure, material defect, corrosion/erosion	• Design and fabrication standards • Inspection and maintenance programme • Controls and alarms for pressure • Continuous emission monitors • Prompt shutdown of equipment	Very unlikely	Release of toxic combustion products to plant enclosures and potentially to atmosphere or via stack	Not significant
Leak/ spill of water treatment chemicals	Groundwater	Storage container leak or transfer spill	• Training in unloading practices • Design standards • Impervious surfaces	Very unlikely	Potential for contamination of groundwater	Not significant

The Risk			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Steam/Power Generation System						
Leak of ion exchange regeneration chemicals (NaOH, HCl)	Air Soil Groundwater Surface Water	Storage container leak or transfer spill	• Bunded storage vessels • Routine inspection and maintenance programme. • Minimum of flanged connections • Tanks fitted with high level alarms • Design standards • Impervious operational areas indoors • Localised catchment volume • Training in unloading practices • Size of deliveries to reduce number of deliveries/unloading operations	Very unlikely	Potential contamination of soil, groundwater and surface water, and release of HCl fumes	Not significant
Spill or leak of chemical for boiler feed water dosing	Groundwater	Chemical leak or spill	• Minimum of flanged connections • Design standards • Impervious operational areas • Training in unloading practices • Reduce size/number of deliveries • Routine operator checks	Very unlikely	Potential groundwater contamination and possible odour	Not significant
Vibration from out of balance rotating machinery or mechanical failure	Installation	Transmitted vibration	• Alarm and shutdown systems • Anti vibration mountings • Routine operator checks	Very unlikely	Transmitted vibration	Not significant
Steam turbine equipment failure	Equipment	Material defects, corrosion/ erosion, fabrication defect or vibration	• Specification of equipment • Implementation of correct codes of practice • Inspection and maintenance programme • Vibration sensors, isolation valves, emergency shutdown valves • Fire detection and fire protection systems • Equipment within concrete structure • Emergency Plan	Unlikely	Disintegration of the turbine, causing further adverse consequences through damage elsewhere in the power plant	Not significant

The Risk			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Fire from ignition of lube oil leak	Air	Oil leak plus ignition source	• Use of fire-proof lube oil • Oil collector installed • Minimum of flanged connections • Design standards • Routine operator checks • Fire detection and fire protection systems • Response procedure	Very unlikely	Smoke, toxic combustion products	Not significant
Leak of lube oil/ seal oil from steam turbine equipment	Soil Groundwater Surface Water Installation	Equipment fracture or vibration	• Minimum of flanged connections • Design standards • Routine operator checks • Routine inspection and maintenance programme • Impervious surfaces indoors • Effluent drains isolate the area	Unlikely	Potential fire and groundwater contamination	Not significant
Steam leak to plant building/ atmosphere	Noise Visual	Faulty boiler tubes and connections	• Statutory design, fabrication and inspection standards for steam systems • Minimum of flanged connections • Controls and alarms for pressure • Routine operator checks	Unlikely	Noise and visible plume at leak	Not significant
Furnace/Boiler						
Overpressure in flue	Air Installation	Leak of high pressure steam into flue gases	• Design, fabrication and inspection of standards for steam systems • Statutory inspection and maintenance programme for steam systems • Controls and alarms for pressure • Routine operator checks	Unlikely	Flue gas emissions above limits; release of flue gases from plant if structure damaged; potential blinding of filters if steam condenses and equipment damaged noise	Not significant

The Risk			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Fire from ignition of fuel oil leak	Air Plant	Ignition of fuel oil leak	• Bunded storage tanks • Minimum of flanged connections • Design standards • Impervious operational areas • Routine operator checks • Limited sources of ignition • Fire fighting systems • Response procedure	Very unlikely	Smoke, toxic combustion products released to plant building, potentially to atmosphere; potential of consequential events	Not significant
Leak of Fuel Oil/Diesel for starter burner	Soil Groundwater Surface Water	Spill during delivery; leak due to faulty storage tank, burners or pipework connections	• Secondary containment for delivery and storage • Routine inspection and maintenance programme • Minimum of flanged connections • Design standards • Impervious surfaces indoors • Discharge point for attenuation ponds will be kept locked shut.	Very unlikely	Potential soil, groundwater and surface water contamination	Not significant
Pressure surge/explosion in combustion system	Air Plant	Delayed ignition of support fuel; presence of flammable material; gas cylinder explosion	• Combustion control system with interlocks • Boiler design standard • Operator training • Crane operator observation of gas bottles and backloading of rejected feedstock	Very unlikely	Flue gas emissions above limits and/or release of flue gases from plant if structure damaged	Not significant
Back flow of combustion gases up feed chute	Air	Waste ignition in chute	• suction created by ID fan or suction effect of stack if ID fan stopped • "plug" of waste in chute acting as seal • level detection/alarm in chute • extraction of tipping hall atmosphere by combustion fan • observation by crane operator CCTV and control room	Very unlikely	Combustion products released to tipping hall and potentially into atmosphere	Not significant

The Risk			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Miscellaneous						
Leak of fuel oil/diesel for vehicle refuelling	Soil Groundwater Surface Water	Spill during delivery or refuelling, or leaks	• Secondary containment for delivery and storage • Routine inspection and maintenance programme • Storage Tank fitted with high level and leak alarms • Minimum of flanged connections • Design standards • Impervious surfaces outdoors • Oil water interceptors on drainage system	Very unlikely	Potential soil, groundwater and surface water contamination	Not significant
Leak from water treatment plant	Soil Ground water Surface Water	Leaks to ground	• Concrete flooring • Regular inspection and maintenance programme	Very unlikely	Leaching into ground and ground water	Not significant
Fire in stores containing flammable materials such as paints and solvent	Air Soil Surface water Ground water	Emission of toxic combustion products	• Fire precautions • Notices and training regarding fire hazards • Training regarding fire hazards • Fire hose nearby • Only store relatively small amounts of materials • Enforce no smoking rules • Permit-to-work system • Have a fire detection system and an emergency plan.	Very unlikely	Major fire with emission of toxic combustion products and subsequent contamination of air, soil, surface water or groundwater; also potential for release of contaminated firewater	Not significant
Spillage of raw materials	Soil Surface water Ground water	Leakage from containers in storage or spillage during use	• Store only small quantities of materials • Bunded area for tanks • Designated storage areas • Storage in accordance with requirements of the control of hazardous substances • Use of spill kits	Unlikely	Contamination of soil, surface water/groundwater	Not significant

The Risk			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Equipment/part item fire	Air	Faulty electric motor, cabling	• Design and fabrication standards • Inspection and maintenance programme • Routine operator inspection • Fire detection systems and fire hoses • Response procedure	Very unlikely	Smoke, combusted products potentially released into the atmosphere	Not significant
Firewater contamination	Air Surface Water Ground Water	Ineffective firewater containment	• Containment within plant area with impervious surfaces • Containment in bunker • Drainage arrangements to waste water tank.	Very unlikely	Potential contamination of controlled water by run off through uncontaminated surface water system; potential for contamination of groundwater	Not significant

Annex E

Occupational Health & Safety Management Plan

ANNEX E: OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT PLAN (CONSTRUCTION)

E1.1 INTRODUCTION

The purpose of this Management Plan is to ensure that the Health and Safety of construction personnel is given paramount importance during the implementation of the Project.

Managing the Health and Safety of personnel at construction sites is an integral part of the overall management of construction. The hazards can be considered in two broad areas:

- hazards that are typical of most construction sites; and
- hazards arising from particular features of the location (hot, arid environment), etc.

The former hazards are well known; critical steps in managing them is selecting suitable contractors and ensuring the management system employed during construction is followed by site visits, audits, training, etc.

It is strongly recommended that a series of Hazard Identification (HAZID) Reviews are undertaken prior to construction. One of the issues to be considered in these HAZIDs is the health and safety of personnel arising from particular features of the Project. Once all the hazards have been identified, appropriate studies to assess the risks and plans to manage these can be initiated.

Table E1.1 indentifies the key issues that should be included in a Health and Safety Management Plan for construction.

Table E1.1 Health and Safety Management Plan (Construction)

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
EHS Management	Occupational health and safety during construction will be managed under an EHS Management System. This involves the following: • compliance with international standards for good construction practices; • adherence to international guidance and codes of practice on EHS management during construction; • management, supervision, monitoring and record-keeping as set out in the project's EHS Management System and associated Contractor's Construction Environmental Control Plan and Environmental, Health, Safety and Welfare Plan; • implementation of EHS procedures as a condition of contract with the Contractor and its sub-contractors; • clear definition of EHS roles and responsibilities of the companies involved in construction, and their individual staff (including the nomination of EHS supervisors); • pre-construction assessment of the EHS risks and hazards associated with construction, including consideration of local cultural attitudes, education level of workforce and local work practices; • provision of appropriate training on EHS issues for all construction workers, including initial induction and regular refresher training, taking into account local cultural issues; • provision of health and safety information; • regular inspection, review and recording of EHS performance; and	*E1.1*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
	• maintenance of a high standard of housekeeping at all times.				
Supervision	It is a requirement of the Contractor that HSE responsibilities and accountabilities are defined in individual job descriptions at all levels of the organisation.	*E1.2*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Supervision	HSE reps will be responsible for assisting their Team Leaders in implementation of the HSE management system and in auditing and remedial actions. Each employee and contractor will be required to be individually responsible for taking reasonable care of the environment, their own health and safety and that of others.	*E1.3*	Contractor	No separate cost. Included in Construction costs.	During construction.
Supervision	Contractors will be selected on the basis that they are competent to perform the work and that their HSE management systems are compatible with International best practice. The Contractor and suppliers will be assessed during the contract evaluation process to demonstrate that these requirements are met.	*E1.4*	Client	No separate cost.	During procurement.
Personnel	A system will be established for selection and placement of qualified personnel to meet specific job requirements. Recruitment policies and procedures will include consideration of personal competencies and capabilities required to carry out the HSE functions of the job through the following deliverables: • individual Roles and Responsibilities Statements will be required from HSE contractor to define the HSE scope and required competencies of each position including accountabilities, main HSE tasks and hazards and relevant site specific HSE requirements; • Routine and Annual Appraisals will need to take into account applicable standards, the nature of operations and local circumstances to determine level of competence required for each position in terms of HSE related knowledge, experience and requirements; and • HSE training needs should be identified for all employees at all levels.	*E1.5*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
Staffing	The Contractor will ensure that recruiting plan provides sufficient numbers of competent staff for the facility.	*E1.6*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Training	The Contractor will develop a training programme. Recruits will be trained and continuously monitored against agreed standards. This will be a key strategy in enhancing safety and environmental protection.	*E1.7*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Competence	Key considerations of the Contractor in assessing competence will be based around safety and environmental factors including workplace risk assessment and hazard identification training, permit to work process, exposure to hazardous substances and chemicals, spill and accident reporting and waste management procedures.	*E1.8*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Training	The Contractor will educate and train employees to conduct their activities in a safe and responsible manner.	*E1.9*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
H&S awareness	The Contractor will promote the Health and Safety awareness of employees, suppliers and contractors.	*E1.10*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Workers risk	Workers will be subject to a risk assessment and then health monitoring if appropriate.	*E1.11*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Health surveillance	A health surveillance programme will be implemented for personnel working in areas where occupational exposures are close to or might exceed occupational exposure limits. Should the surveillance programme indicate any potential problems, further mitigation measures will be used to reduce exposure levels.	*E1.12*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
Emergency	First aid will be provided on site. Employees should have access to fully equipped medical facilities, access to a doctor and paramedics if necessary. Emergency response plans will be in place for large scale events.	*E1.13*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Accident Frequency and Severity	Procedures will be implemented for the investigation and reporting of accidents and incidents in accordance with the HSE standards. Records will be maintained and reported on a periodic basis. Appropriate action will be taken to minimise recurrence of such events.	*E1.14*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Accident investigation	Each accident or incident will be investigated, classified to determine the potential effect and appropriate remedial actions established. Implementation of remedial actions will be monitored.	*E1.15*	Contractor	No separate cost. Included in Construction costs.	During construction.
Accident record	Accidents and incidents will be classified according to their severity and frequency of occurrence. Records will be kept of all accidents and incidents as well as all reported near misses.	*E1.16*	Contractor	No separate cost. Included in Construction costs.	During construction.
Road Related Accidents.	Hazards to personnel associated with vehicle transportation, both on- and off-road, will present one of the most significant risk exposures of the Project. Accordingly, the Contractor shall be expected to develop and implement management systems and procedures that will provide the highest level of control over these hazards. Details are shown in the Traffic Control Management Plan (*see Annex B*)	*E1.17*			
HSE management of temporary work sites	Design and layout of all work sites including the laydown area/ batching plant location, will be reviewed from HSE perspective.	*E1.18*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Transport hazards	• Suitable infrastructure for transporting personnel, materials and equipment will be provided. • Assessment will be made of the transport risks associated with the delivery of materials and transport of staff.	*E1.19*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
Environmental conditions e.g. extreme temperatures, inside and outside buildings	Exposure of the workforce to extreme climatic conditions shall be managed through the following: • Providing advice. • Monitoring of personnel. • Provision of potable water. • Suitable clothing. • Sun screen if required.	*E1.20*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Noise	Exposure of the workforce to sources of noise shall be managed through the following: • Selection of equipment. • Maintenance of equipment. • Training for personnel. • Signage. • PPE.	*E1.21*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Vibration	Exposure of the workforce to sources of vibration shall be managed through the following: • Selection of equipment. • Maintenance of equipment. • Training for personnel. • Signage. • PPE.	*E1.22*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Manual handling	Injury of the workforce from manual handling shall be prevented through the following: • Design to avoid where possible. • Suitable lifting equipment. • Training of personnel.	*E1.23*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Injury from materials and equipment	Injury of the workforce from handling materials and equipment shall be prevented through the following: • Suitable equipment which is tested and maintained. • Work Plans. • PPE.	*E1.24*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Issue	Mitigating/Monitoring Activity	ID No.	Responsibility	Cost ($)	Timing
Slips, trips, falls	Injury of the workforce from accidental slips, trips and falls shall be prevented through the following: • Proper site set up. • Housekeeping. • PPE. • Site walk rounds.	*E1.25*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Flora and fauna	Injury of the workforce from exposure to hazardous flora and fauna shall be prevented through the following: • Identification of flora and fauna that could pose a hazard to personnel. • Advice to personnel. • PPE if required.	*E1.26*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Diseases	Injury of the workforce from communicable and non-communicable diseases shall be prevented through the following: • Identification of diseases that could pose a hazard to personnel. • Advice to personnel.	*E1.27*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Stress associated with working environment	Stress within the workforce shall be managed through the following: • Advice to personnel. • Support. • Monitoring.	*E1.28*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.
Injury or illness	• First aid and medical facilities – appropriate to likely hazards and other facilities available. • Emergency Response Plan.	*E1.29*	Contractor	No separate cost. Included in Construction costs.	Developed during Project planning, implemented during construction.

Annex F

Worker Management Plan

F1.1 INTRODUCTION

This Management Plan has been developed in order to ensure that the management of all employees (including those who are indirectly employed through contractor(s)):

- complies with Kenyan law and meets the requirements of international standards;
- optimises the benefits associated with construction employment; and
- mitigates where possible any negative impacts that might occur as a result of construction employment or subsequent retrenchment.

This Plan seeks to achieve the above objectives through clear and manageable plans and procedures, underpinned by the explicit guiding principles detailed in *Section F1.2* below.

F1.2 WMP GUIDING PRINCIPLES

TPL and their contractor(s) will implement this WMP with reference to the following guiding principles:

1. Adherence to International Standards;
2. Commitment to Transparency;
3. Commitment to Non-discrimination and Equality;
4. Optimisation of Local Content; and
5. Commitment to Health and Safety.

These guiding principles, which are outlined in more detail below, are intended to provide a first point of reference with regards to all activities associated with the management of employees.

F1.2.1 WMP Guiding Principles

Principle One: Adherence to International Standards

The WMP will be guided at all times by international best practice around labour force management. In practical terms, this means that TPL and its contractors will satisfy the requirements of IFC Performance Standard 2, and the underlying United Nations (UN) and International Labour Organisation (ILO) instruments. Where there are discrepancies between international standards and Kenyan law the more stringent shall take precedence.

Principle Two: Commitment to Transparency

TPL and its contractor(s) will commit to ensuring transparency to all key stakeholders (e.g. communities, workers' organisations, NGOs, government agencies, etc.) around the hiring process, conditions of work, policies and procedures, employment duration and related matters.

Principle Three: Commitment to Non-discrimination and Equality

TPL and its contractor(s) will ensure that at all time they do not discriminate on the basis of gender, race, colour, sex, religion, political opinion, national extraction or social origin, sexual orientation, HIV status, or disability, in the course of hiring, managing or terminating the employment of its workforce.

Principle Four: Optimisation of Local Content

TPL and its contractor(s) will seek to enhance the level of local participation in its labour force. This means that to the extent possible, they will hire workers who are in the first instance members of the communities adjacent to the Project, and in the second instance from Thika District, and third Kenyan nationals. This also means that they will, to the extent possible, transfer and develop the local skills base.

Principle Five: Commitment to Health and Safety

TPL and its contractor(s) will implement best practice with regards to health and safety for the entirety of its workforce. This will include appropriate training, procedures, safety equipment, reporting, and monitoring and improvement protocols.

F1.3 *RESPONSIBILITIES*

TPL is ultimately responsible for the implementation of this WMP.

F1.4 *LEGAL AND OTHER REQUIREMENTS*

F1.4.1 ***Overview***

The reference sources that will be used to identify legal and other associated requirements relating to the management of employees are show in *Table F1.1.*

Table F1.1 ***Reference Sources***

Source	Documents
International Finance Association	Performance Standard 2: Labour and Working Conditions
Kenyan Legislation	Occupational Safety and Health Act, 2007
	Employment Act 2007

F1.5 HIRING POLICY (RECRUITMENT AND SELECTION)

F1.5.1 *Development of Hiring Guidelines*

TPL will develop hiring guidelines designed to fill required roles on the basis of its commitment to optimise local participation in the workforce. This will be done via the following.

- Establishing clear organisational objectives around the hiring of local workers in the form of percentage targets for the employment of local workers. Such targets will be based on existing demographic employment and skills profiles of communities around the Project site.
- Clearly defining the roles required by the organisation and estimating the number of workers required in each role.
- Developing an adequate job description for each role, which should include:
    - clear responsibilities associated with each role;
    - clear physical/medical, and psychological attributes required for each role;
    - an enumeration of the minimum general skills and experience required for the fulfilment of each role;
    - general reporting lines for each role;
    - health and safety requirements for each role (e.g. safety protocols, materials handling safeguards, *etc*); and
    - an overview of the general performance metrics for each role.
- Developing general evaluation criteria under a number of categories for each role. This will include how TPL and their contractors plan to assess workforce applicants for each role.
- Ensuring hiring guidelines for each role are transparent.

F1.5.2 *Applications, Short-listing, Vetting*

TPL and its contractor(s) will ensure a transparent and accessible application and short-listing process. This will help manage expectations, ensure an equitable hiring process, enhance opportunities for members of the local population, and increase the potential pool of applicants. To this end, TPL and its contractors will ensure that:

- Advertisements for available jobs are made via the most relevant information media to the local population. This should include local newspapers, adverts on village notice boards and pamphlets to local businesses. TPL and its contractors will seek to ensure transparency and clarity around positions potentially available and the potential hiring process. They will also ensure that vacancies are advertised as consistently as possible.

- Advertisements include key information, such as:
  - general descriptions of roles available or potentially available;
  - clear instructions regarding the application process including how to apply, potential roles available and skills required;
  - clarity around potential hiring and employment timelines; and
  - minimum age requirements (18 years old).
- They maintain an updated register of positions potentially available which is communicated to local stakeholders.
- Candidates are short-listed on the basis of a consistent application of the *Hiring Guidelines* established in *Section F1.5.* This will include an evaluation of skills and experience of applicants against those required for each role.
- It maintains a running register of applicants and a skills database for all applicants for skilled roles. The register and database will be used to:
  - assist in short-listing candidates once vacancies arise;
  - help define skills and Health and Safety (H&S) training requirements;
  - identify promising candidates for longer-term during the operation phase of the project; and
  - record the results of the application process.
- All applicants are above the minimum age of 18 years of age. This will be established via verification of ID cards, birth certificates, other forms of official identification.

F1.5.3 Selection

Once applications have been received and processed into the skills register, applicants will be selected on the basis of the following:

- establishment that applicants are above the minimum age of 18 years old;
- for unskilled roles, priority will be given to applicants from the local communities;

- for skilled roles, priority will also be given to candidates from the local communities in instances where two or more candidates possess equal qualifications;

- TPL will make a judgement of each candidate's suitability for training in the required skills where skills or experience gaps exist between the best candidates and the requirement of the role;

- selection of all roles will be based on the application of the Hiring Guidelines set out in *Section F1.5.1* and the Guiding Principles of this plan as set out in *Section F1.2*;

- once applicants are selected, they will formally receive an offer of employment;

- an employment contract or card will be prepared which will include details of the job description for each role, remuneration, employment duration, and employee expectations;

- TPL and its contactors will be able to deliver a consistent and transparent message to all non-successful applicants and to any other stakeholder, the reasons for the selection of the candidates to be employed; and

- where there are concerns around discrimination or a lack of transparency of any aspect of the hiring process, TPL shall investigate the matter through the grievance mechanism (see *Annex G*: *Stakeholder Engagement Plan*), consult any relevant parties and provide a report on the investigation and any corrective actions to the owner.

F1.5.4 Engagement

Legal and Other Requirements

- TPL will ensure that it complies with all Kenyan employment legislation;
- TPL will develop a Human Resources Policy; and
- TPL will ensure that workers will receive at least a fair living wage.

Expectations Management

- All workers will be fully informed of the nature and duration of employment.

- TPL will implement the Grievance Mechanism (see *Annex G*) whereby workers can formally ask questions or voice any concerns about any aspect of their employment. All employees will be made aware of the mechanism at the time of hire.

- TPL will assist workers prepare themselves psychologically for the eventual completion of the construction phase of the project, and by consequence, the termination of employment.

- All employees will be briefed on all relevant policies and expectations at the time of hire. This will include:
    - H&S policies and protocols;
    - general conduct expected, including conduct expected of employees in the course of interaction with communities, in line with the company's code of conduct which TPL will develop; and
    - disciplinary policies.

Training Plan

TPL will establish a training plan for its workforce based on the skills register of applicants. This will aim at developing the necessary skills required for the fulfilment of roles (i.e. filling of skills gaps) and the transfer of knowledge and skills to local workers. The training plan will also aim at helping workers manage the transition process between employment during the construction phase and termination of employment post-construction. The plan will identify training requirements, numbers of workers to be trained and rough timelines for training programmes.

HIV/AIDS

TPL's Occupational Health and Safety programme (see *Annex E)* will include components on HIV/AIDS and other sexually-transmitted infections (STIs). This will include:

- the facilitation of awareness briefings on HIV/AIDS and other STIs for all employees;
- the provision of informational material on AIDS / HIV and other STIs;
- guidance on conduct within the local community by members of the workforce; and
- the facilitation of access to advice for workers on the nature of HIV/AIDS and other STIs, as applicable.

Record-keeping and Management

- TPL will maintain up-to-date records of:
    - the company's employment register. This will include numbers of employees at each role, employment status of each employee (including subcontractors) duration of employment, days and hours worked by each employee, and wages and social security contributions paid;
    - training provided to each employee;

- the skills register established in the hiring process;
- H&S incidents and concerns; and
- grievances as recorded in the grievance mechanism, including details of grievance follow-up and closeout.

Management and Monitoring

TPL shall have overall responsibility for the implementation of this Plan, but all managers will be made aware of, and sensitised to this Plan. Formal reporting mechanisms between managers shall include reporting on the implementation of the commitments enumerated in this Plan.

Annex G

Stakeholder Engagement Plan

Thika Power Limited

MSD Power Plant, Thika, Kenya

Stakeholder Engagement Plan

13th April 2011

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Delivering sustainable solutions in a more competitive world

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Thika Power Limited

MSD Power Plant, Thika, Kenya

Stakeholder Engagement Plan

13th April 2011

Reference 0124250

For and on behalf of
Environmental Resources Management Limited

Approved by: Eamonn Barrett

Signed:

Position: Partner

Date: 13th April 2011

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND TO THE SEP DOCUMENT

This document is the Stakeholder Engagement Plan (SEP) for the 87MW power plant Project being developed by Thika Power Limited (TPL) in the Thika District.

This SEP has been developed as part of the Environmental and Social Impact Assessment (ESIA) for the Project. It seeks to define a technically and culturally appropriate approach to consultation and disclosure. The goals are to ensure that adequate and timely information is provided to project-affected people and other stakeholders, that these groups are given sufficient opportunity to voice their opinions and concerns and that these concerns influence project decisions. The plan aims to define a consistent, comprehensive, coordinated and culturally appropriate approach to stakeholder engagement throughout the development of the Project. TPL is committed to undertaking this engagement in a manner which is consistent with international good practice, a summary of which is presented in *Section 2.*

The SEP is a working document, which will be updated and adjusted as the Project evolves. It has thus provided – and continues to provide – a framework to manage effective and meaningful engagement with key stakeholders.

1.2 STAKEHOLDER CONSULTATION AND DISCLOSURE

Stakeholder engagement refers to a process of sharing information and knowledge, seeking to understand and respond to the concerns of others, and building relationships based on collaboration. Stakeholder consultation and disclosure are key elements of engagement and essential for the delivery of successful projects.

In this SEP, consultation is understood to be an inclusive and culturally appropriate process, aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the decision making process. Effective consultation requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts and opportunities of the project.

This SEP concentrates on consultation and disclosure activities undertaken during the ESIA process to inform investment and design decisions. It will also include reference to consultation activities that will be undertaken by TPL as part of the later stages of stakeholder engagement during detailed design, construction and operation of the Project.

1.3 PURPOSE OF THIS PLAN

In line with current international best practice, the engagement activities outlined within this SEP will ensure *'free, prior and informed consultation of the affected communities'* (1) and conducted on the basis of timely, relevant, understandable and accessible information, in a culturally appropriate format. The primary goals of the SEP are:

- to generate a good understanding of the Project;
- to understand local expectations;
- to ensure stakeholders understand the potentially significant environmental and social impacts of the Project;
- to manage expectations and possible misconceptions about the Project;
- to assist in developing effective mitigation measures and management plans for these impacts;
- to optimise any local benefits that can be delivered throughout the Project;
- where possible, to enable affected communities to be have an influence on and be involved in Project design, construction and operation; and
- to lay a good foundation for future stakeholder engagement.

1.4 STRUCTURE

This SEP is organised in the following subsequent sections:

- ***Section 2:*** National and International Regulations and Requirements for Stakeholder Engagement;
- ***Section 3:*** Stakeholder Identification and Analysis;
- ***Section 4:*** Engagement Strategy;
- ***Section 5:*** Grievance Mechanism; and
- ***Section 6:*** Issues Tracking

(1) IFC Performance Standard 1 on Social and Environmental Assessment and Management Systems, 2006. Page 5.

2 NATIONAL AND INTERNATIONAL REGULATIONS AND REQUIREMENTS FOR STAKEHOLDER ENGAGEMENT

2.1 NATIONAL REQUIREMENTS FOR PUBLIC CONSULTATION ON PROJECTS

2.1.1 *Summary of Kenyan EIA Regulatory Requirements*

The requirements for stakeholder engagement undertaken as part of the EIA process are detailed within 'The Environmental Impact Assessment and Audit Regulations (2003)', the key requirements of which are summarised in *Box 2.1*.

Box 2.1 Kenyan EIA Regulations and Requirements for Stakeholder Engagement

Section 7

During the process of conducting an environmental impact assessment study under these Regulations, the proponent shall in consultation with the Authority, seek the views of persons who may be affected by the project;

In seeking the views of the public, after the approval of the project report by the Authority, the proponent shall:

- publicise the project and its anticipated effects and benefits by:
- posting posters in strategic public places in the vicinity of the site of the proposed project informing the affected parties and communities of the proposed project;
- publishing a notice on the proposed project for two successive weeks in a newspaper that has a nation-wide circulation; and
- making an announcement of the notice in both official and local languages in a radio with a nation-wide coverage for at least once a week for two consecutive weeks.
- hold at least three public meetings with the affected parties and communities to explain the project and its effects, and to receive their oral or written comments;
- ensure that appropriate notices are sent out at least one week prior to the meetings and that the venue and times of the meetings are convenient for the affected communities and the other concerned parties; and
- ensure in consultation with the Authority that a suitably qualified co-ordinator is appointed to receive and record both oral and written comments and any translations thereof received during all public meetings for onward transmission to the Authority.

Section 21

The Authority shall, within fourteen days of receiving the environmental impact assessment study report, invite the public to make oral or written comments on the report.

The Authority shall, at the expense of the proponent:

- publish for two successive weeks in the Gazette and in a newspaper with a nation-wide circulation and in particular with a wide circulation in the area of the proposed project, a public notice once a week inviting the public to submit oral or written comments on the environmental impact assessment study report; and
- make an announcement of the notice in both official and local languages at least once a week for two consecutive weeks in a radio with a nation-wide coverage.

Section 22

- Upon receipt of both oral and written comments as specified Public hearing. By section 59 and section 60 of the Act, the Authority may hold a public hearing.

- A public hearing under these Regulations shall be presided over by a suitably qualified person appointed by the Authority.

- The date and venue of the public hearing shall be publicised at least one week prior to the meeting -by notice in at least one daily newspaper of national circulation and one newspaper of local circulation; and by at least two announcements in the local language of the community and the national language through radio with a nation wide coverage.

- The public hearing shall be conducted at a venue convenient and accessible to people who are likely to be affected by the project.

- A proponent shall be given an opportunity to make a presentation and to respond to presentations made at the public hearing.

- The presiding officer shall in consultation with the Authority determine the rules of procedure at the public hearing.

- On the conclusion of the hearing, the presiding officer shall compile a report of the views presented at the public hearing and submit the report to the Director General within fourteen days from the date of the public hearing.

Section 29

- Information or documents submitted to the Authority by any person in connection with an environmental impact assessment together with the Authority's decision and the reasons thereof shall be made available to the public on such terms and conditions as the Authority may prescribe.

2.2 *INTERNATIONAL BEST PRACTICE FOR STAKEHOLDER ENGAGEMENT*

Standards for international best practice on stakeholder engagement can be established by reference to various documents including:

- IFC *Performance Standard 1 on Social and Environmental Assessment and Management Systems*, 2006;

- IFC *Policy on Disclosure of Information*, 2006 (1);

- IFC *Policy on Social an Environmental Sustainability*, 2006;

- IFC *Stakeholder Engagement: A Good Practice handbook for Companies doing Business in Emerging Markets*, 2007;

- AFDB *Handbook on Stakeholder Consultation and Participation* (2); and

- *The Equator Principles: A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing, 2006* (3).

(1) http://www.ifc.org/ifcext/sustainability.nsf/Content/EnvSocStandards
(2) http://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/Handbook%20on%20Stakeholder%20Consultaion.pdf
(3) http://www.equator-principles.com/principles.shtml

These Financial Institutions are all committed to community engagement that ensures the free, prior, and informed consultation of affected communities, and leads to broad community support for the Project, and to stakeholder engagement that is free of manipulation, interference, coercion, and intimidation, and conducted on the basis of timely, relevant, understandable and accessible information, provided in a culturally appropriate format. In summary international standards require:

- the *identification of people or communities* who could be affected by the Project, as well as other interested parties;

- *meaningful consultation* with project-affected or other interested parties on environmental and social issues that could potentially affect them;

- disclosure of appropriate information and appropriate notification about this disclosure at a time when stakeholder *views can still influence the development of the Project*;

- stakeholder consultation during *all project stages*, and starting *as early as possible* during project planning and preparation;

- operation of a procedure by which people can *submit comments and complaints*; and

- maintenance of a *constructive relationship* with stakeholders on an ongoing basis through meaningful engagement during project implementation.

3 STAKEHOLDER IDENTIFICATION AND ANALYSIS

3.1 INTRODUCTION

For the purposes of this plan, a stakeholder is defined as any individual or group who is potentially affected by a project or who has an interest in a project and its potential impacts (1). The objective of stakeholder identification is therefore to establish which organisations and individuals may be directly or indirectly affected (positively and negatively), or have an interest in the Project. Stakeholder identification is an ongoing process, requiring regular review and updating as the Project proceeds.

3.2 STAKEHOLDER IDENTIFICATION AND MAPPING

In order to develop an effective SEP it is necessary to determine:

- who is likely to be affected (both directly and indirectly) by the Project; and
- who else may have an interest in the Project.

As part of the stakeholder identification process it is also important to identify individuals and groups that may be differentially or disproportionately affected by the Project because of their disadvantaged or vulnerable status.

Different issues are likely to concern different stakeholders and so stakeholders have been grouped based on their potential connections to the project in *Table 3.1.* Having an understanding of the connections of a stakeholder group to the Project helps identify the key objectives for and best approaches to engagement.

A list of the organisations identified to date is provided in *Section 4,* together with a plan for their involvement in the various phases of engagement. This list will be kept up to date as new stakeholders are identified or express an interest in the Project. Contact details of the majority of the individuals/ institutional stakeholders have also been compiled by the ESIA team to enable the Project to readily communicate with each stakeholder. This information may be kept on a database for ease of use, but will not be shared with any third party.

(1) This is considered to be equivalent to the definition of "the public concerned" as discussed in the 2000 Implementation Guide to the Aarhus Convention (UN/ECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (see http://www.unece.org/env/pp/acig.pdf))

Table 3.1 Stakeholder Groups and Connections to the Project

Stakeholder Groups and Types	Connections to the Project
Government and Community Leadership	
Government – National Government – Provisional Government – District	National and regional government individuals are of primary political importance to the Project with permitting requirements that must be met by the Project.
Local Leaders (e.g. Chief, elders)	Local community leaders and religious or educational leaders, act as representatives of their local community.
Communities	
Communities in the vicinity of the proposed Project site Community Based Organisations (CBOs)	Households and communities that will receive impacts (positive or negative) as a result of the Project.
Vulnerable groups such as women, youth and elderly	Vulnerable groups may be affected by the Project by virtue of their physical disability, social or economic standing, limited education, lack of employment or housing. They may also have difficulty in engaging with the stakeholder consultation process and thus may not be able fully express their concerns regarding the Project.
Private Sector	
Business organisations Companies - potential suppliers and contractors	Individuals or organisation with direct economic interest in the project. This may be through gaining contracts with the Project or due to economic impacts caused by the Project. They may also be potential business partners.
Financial Lenders	
International financial institutions.	Multilateral, bilateral and private sectors financial institutions providing project finance for construction of the Project
Nongovernmental Organisations	
Local NGOs	Organisations with direct interest in the Project and that are able to influence the Project directly or through public opinion. Such organisations may also have useful data and insight and may be able to become partners to the project in areas of common interest.
Other	
Research/Academic Institutions Religious Organisations	Other international, regional and local groups with direct interest in the Project.

4 STAKEHOLDER ENGAGEMENT STRATEGY AND ISSUES RAISED TO DATE

4.1 INTRODUCTION

This section provides an overview of the stakeholder engagement strategy for the proposed Project, and provides a summary of key issues raised by stakeholders to date.

4.2 STAKEHOLDER ENGAGEMENT STRATEGY

For the purposes of this Project, the ESIA Engagement Strategy has been divided into five phases, each having slightly different objectives for engagement. These five phases are as follows.

- **Phase 1: Pre-Scoping (October - November 2010).** This phase of work included the consultation undertaken by Enviroplan for the Kenyan EIA and consultation undertaken by the ERM ESIA team between the 1st and 5th November. The key objective of this stage was to gain a better understanding of the scope of the Project and identify any sensitive receptors to potential project impacts. Engagement activities during this phase included a public meeting and one-to-one interviews.

- **Phase 2: Scoping (November – December 2010).** Consultation during the scoping phase aimed to identify key stakeholders, introduce the Project to directly affected stakeholders and to generate feedback on the scope, approach and key issues. Stakeholders met during the scoping visit included government officials, local community members, shop owners, school principals and NGOs. Engagement activities during this phase included one-to-one interviews and focus group discussions.

- **Phase 3: Main ESIA Phase (January-March 2011).** This phase aimed to provide information on the Project, whilst also obtaining further baseline information and consulting on the potential impacts and mitigation measures. Consultation aimed to identify any local benefits that could be delivered through the Project and ensure that measures to be implemented are appropriate to the local situation. Engagement activities during this phase included a public meeting and one-to-one interviews.

- **Phase 4: ESIA Finalisation and Disclosure (March 2011 onwards).** This phase will reflect the Project's compliance with national regulatory requirements for the public disclosure of ESIA findings as part of the ESIA approval and project permitting process. It is understood that NEMA may hold a public hearing following submission of the ESIA report, as stipulated in the Environmental Impact Assessment and Audit Regulations (2003). TPL will assist and support arrangements for a public hearing, as deemed appropriate by NEMA. This phase is shown as extending from March 2011 onwards, since NEMA has not yet determined when it may convene a public hearing.

- **Phase 5: Ongoing Engagement (ongoing from March 2011).** Ongoing engagement after finalisation of the ESIA will be taken forward within the framework of the SEP. Stakeholder participation will be fundamental to the success of Project implementation, and stakeholder feedback will be a key component in monitoring the success of mitigation measures. Engagement will therefore continue throughout the construction period, and then through the operational life of the Project.

Stakeholder engagement activities for Phase 1, 2 and 3 of the Strategy are detailed in *Table 4.1* and planned activities for Phases 4 to 5 will be detailed in the subsequent version of this SEP.

Table 4.1 ESIA Stakeholder Engagement Strategy (ERM)

Consultation Objectives	Engagement Activity	Stakeholders	Specific Discussion Areas	Timing
PHASE 1: Pre-Scoping (as undertaken by Enviroplan)				
• Gauge viability of project • Early identification of issues	Public Consultation Meeting undertaken by Enviroplan at the Witeithie Administration Police Camp on 17th October 2010	Komu Location Chief Witeithie sub-location chief EIA consultant Village chairmen Local youth, Village traders, Local women.	• Disclosure of the proposed project; • Discussing potential positive and negative impacts; • Understanding the community's expectations and any concerns regarding the proposed project.	17th October 2010
	Consultation meetings undertaken by Enviroplan for the Kenyan EIA	Coffee Farm Manager Municipal Council of Thika Mangu High School Principal Kenya Power and Lighting Company County Council of Thika Ministry of Agriculture	• Disclosure of the proposed project; • Discussing potential positive and negative impacts; • Understanding the stakeholders expectations and any concerns regarding the proposed project;	November 2010
PHASE 2: Scoping (as undertaken by ERM)				
• Introduce the project to directly affected stakeholders • Generate feedback on the scope, approach, key issues for the ESIA • Identify key stakeholders to be consulted	One-to-one interview	District Commissioner, Thika	• Introducing the project • Requesting approval to collect primary data • Requesting assistance in organising consultation meetings • Understanding of key concerns	November – December 2010
	One-to-one interview	Administrative Officer, Municipal Council of Thika	• Introducing the proposed project • Discussed potential impacts (positive and negative) of the proposed project.	23rd November, 2010
	One-to-one interview	Planner, County Council of Thika	• Introducing the proposed project • Discussed potential impacts (positive and negative) of the proposed project.	25th November, 2010

Consultation Objectives	Engagement Activity	Stakeholders	Specific Discussion Areas	Timing
	One-to-one interview	Coffee Farm Manager and Farm Assistant, Agro Tropical	• Understanding the history of the coffee plantation and recent activities. • Discussing the willing seller and willing buyer procedure • Discussing severance and worker health and safety issues	26th November, 2010 and 4th December, 2010
		Ministry of Agriculture: Environment Officer	• Introducing the Project • Discussed potential impacts (positive and negative) of the proposed Project.	26th November, 2010
	One-to-one interview	District Officer for Education	• Requesting district level statistics; • Understand the existing education system and assessing potential beneficiaries; • Discussing potential impacts.	4th December 2010
	One-to-one interview	Mang'u High School Principal	• Understanding concerns about the proposed Project; • Discussing potential benefits to the school; • Discussing potential benefits to the local area; • Community health and safety issues.	30th November, 2010 and 6th December 2010
	One-to-one interview	Kuraiha Primary School Principal	• Understanding concerns about the proposed Project; • Discussing potential benefits to the school; • Discussing potential benefits to the local area; • Community health and safety issues. • Discussing potential traffic and security impacts.	5th December 2010
	One-to-one interview	District Social Development Office and Gender and Social Development Assistant	• Overview of the proposed Project • Requesting socio-economic information and understanding district level perspective of the Project. • Requesting list of NGOs and CBOs which are functional and active within the Project area;	6th December 2010

Consultation Objectives	Engagement Activity	Stakeholders	Specific Discussion Areas	Timing
			• Discussing indigenous people and culture and heritage sites within the potential area of influence.	
	One-to-one interview	Kenya Power and Lighting Company	• Understanding the Project history; • Discussing key project updates and status of the PPA; • Understanding the history of acquiring the land through the 'willing seller willing buyer' process.	November – December 2010
	One-to-one interview	District Employment Officer and District Occupational Health and Safety Officer	• Introduction to the project • Identifying potential impacts of the proposed project. • Obtaining information regarding legal and institutional requirements for complying with national standards.	4th December 2010
	One-to-one interview	ICCOBO (International Consortium of Community Based Organisations)	• Providing an update on the project; • Learning about ICCOBO's network and activities; • Assessing their willingness to implement potential projects to be involved in the implementation of potential mitigation measures or management activities.	November – December 2010
	Focus Group Discussions (FGDs)	Women residing in Witeithie village and working with Agro Tropical Estate	• Wage, timing, occupational health, access to work and other livelihood information. • Understanding gender issues.	November – December 2010
PHASE 3: Main ESIA Phase (as undertaken by ERM)				
	One-to-one interview	Assistant Chief of Witeithie Estate	• Courtesy meeting to confirm arrangements for Public Meeting on 10th March 2011 and to provide Project Information Document posters and flyers.	9th March 2011

Consultation Objectives	Engagement Activity	Stakeholders	Specific Discussion Areas	Timing
	One-to-one interview	District Officer for Juja Division	• Courtesy meeting to confirm Public Meeting on 10th March 2011 and to provide Project Information Document flyers.	9th March 2011
	One-to-one interview	District Gender and Social Development Office and Programme Manager of ICCOBO	• Courtesy meeting to confirm Public Meeting on 10th March 2011 and to provide Project Information Document flyers • Potential for TPL to work with ICCOBO in partnership to implement community investment programme.	9th March 2011
	One-to-one interview	Agro Tropical: Coffee Farm Assistant Manager	• Provided an update on the proposed Project • Overview of coffee farm operation.	9th March 2011
	One-to-one interview	School Principal, Mang'u High School	• Provided an update on the proposed Project • Discussion regarding issues raised during previous meeting during scoping with explanations on how they are proposed to be managed.	9th March 2011
	Public Meeting	Local community members who met at the Hope of Faith Worship Centre, Witeithie Estate	• Introduced the proposed Project • Discussion regarding potential positive and negative impacts and proposed management measures.	10th March, 2011
PHASE 4: Ongoing Engagement (to be undertaken by TPL)				
• Maintain stakeholder relationships • Provide regular information on the Project • Monitor mitigation measures and achievement of mitigation objectives • Receive feedback on the effectiveness of the	TPL will build on this SEP and develop a strategy for ongoing engagement with location stakeholders during construction and operation of the proposed Project. The SEP will incorporate relevant measures that have been developed as part of the ESIA to mitigate potentially significant adverse impacts and enhance positive impacts. Below are some of the mitigation measures suggested as a part of the ESIA mitigation and enhancement strategy: • TPL and the construction contractor will clearly communicate the recruitment plans and procurement opportunities for the construction and operation phase of the Project, using methods such as adverts in local newspapers and local government bulletins, registration with the district employment department, adverts in local job centres and village notice boards and pamphlets to local businesses.			

Consultation Objectives	Engagement Activity	Stakeholders	Specific Discussion Areas	Timing
implementation of mitigation measures • Manage grievances	• Grievance Mechanism: The construction contractor will have a clear mechanism in place to resolve any employment and local supplier-related grievances.			

4.3 *ISSUES RAISED TO DATE*

Table 4.2 provides an overview of the key issues raised by stakeholders during Phases 1-3. This will be updated as the Project progresses so that issues can be assessed and managed as part of Project development.

Table 4.2 Key Issues Raised

Key Issue	**Description**
Noise and vibration	Stakeholders have been concerned about increased noise and vibration during construction and operation of the proposed Project. Concerns have focused on the noise from fans used for cooling within the plant, as well as from increased traffic during both construction and operation.
Air quality	Concerns were raised about decreased air quality associated with construction and operation of the plant. Specific concerns were raised about dust from construction activities on site (dust issues were already being experience from construction of the sub station) as well as increased traffic on the roads which may lead to health issues, such as respiratory problems. Impacts on soil quality as a result of air pollution were also raised as a concern.
Traffic	There were concerns about an increase in traffic associated with the proposed project. Issues raised included air quality and noise (as already mentioned) as well increased congestion, access to properties (such as the local schools) and health and safety (e.g. the potential for increased accidents, especially for school children walking to school).
Water use	Stakeholders were concerned about water use during construction and operation and the impacts on local ground water supplies. The power plant is expected to obtain water from a bore hole and local stakeholders were fearful that this may reduce the water available for other borehole users.
Influx of workers	Concerns were raised about an influx of workers who may not behave appropriately in the local area and the health and safety risks that may result from this. Security issues were also raised as a potential problem associated with an influx of workers.
Local employment	Stakeholders were hoping for good employment opportunities for local people. It was specifically suggested that this could be a good opportunity for youths in the area that were currently unemployed.
Local economy	It was hoped that the proposed Project would boost the local economy with increased spending amongst workers and supplies sourced locally, where possible. It was also thought that other industries and investors may be attracted to the area as a result of the Project.
Power supply	It was expected that the proposed Project would decrease the number of power outages currently experienced, meaning a more constant supply of electricity for users.
Local power supply	Stakeholders raised the desire for additional power to be supplied locally to improve street lighting and security in the area.

Key Issue	Description
Waste management	Concerns were raised about the management of waste from the project, particularly diesel and water waste. Stakeholders were worried that poorly managed waste may pollute local water courses and soil.
Spills	The potential for spills of diesel was raised as a concern by some stakeholders.
Ecology	Impacts on the local ecology were raised as a concern during consultation with stakeholders.
Working conditions	Some stakeholders were concerned about the health and safety of workers on site, stating that H&S culture is weak in Kenya.
Land use	Stakeholders were concerned that houses may need to be demolished as part of the proposal Project.
Security	The security proposed around the new site was seen as beneficial by stakeholders as they felt it would increase overall security in the area and discourage vandalism.
Educational opportunities	The local school felt that a new power plant could provide good education opportunities for students, through visits to the facility and work placements.
Other impacts	Stakeholders were concerned about the impacts of the project in combination with those of the substation currently under construction.

4.3.1 *Monitoring Issues*

It is important that issues raised during development and implementation of the proposed Project are recorded in a logical and systematic way. Issues that have been raised during the consultation process will therefore continue to be logged in a tracker which will form the basis of a database for managing issues raised.

5 GRIEVANCE MECHANISM

5.1 OVERVIEW

Grievances are any complaints or suggestions about the way a project is being implemented. They may take the form of specific complaints for damages/injury, concerns about routine project activities, or perceived incidents or impacts. Identifying and responding to grievances supports the development of positive relationships between projects and the communities, and other stakeholders, they may affect. Grievance mechanisms therefore provide a formal and ongoing avenue for stakeholders to engage with the company, whilst the monitoring of grievances provides signals of any escalating conflicts or disputes.

5.2 BEST PRACTICE PRINCIPLES

The IFC standards and the Equator Principles outline that grievance mechanisms should receive and facilitate resolution of the affected communities' concerns and grievances. The IFC states the concerns should be addressed promptly using an understandable and transparent process that is culturally appropriate and readily acceptable to all segments of affected communities, at no cost and without retribution. Mechanisms should be appropriate to the scale of impacts and risks presented by a project and are beneficial for both the company and stakeholders.

5.3 GRIEVANCE MECHANISM DEVELOPMENT

The management of grievances is therefore a vital component of stakeholder management and an important aspect of risk management for a project. Grievances can be an indication of growing stakeholder concerns (real and perceived) and can escalate if not identified and resolved. A Grievance Mechanism specific to the Project has been developed with TPL and is described in the following sections.

5.3.1 *Objectives of the Grievance Mechanism*

The primary objectives of TPL's approach to grievance management are to:

- build and maintain trust with community stakeholders;
- prevent the adverse consequences of failure to adequately address grievances; and
- identify and manage stakeholder concerns and thus to support effective risk management.

An effective grievance management process should include the components described in *Table 5.1*.

Table 5.1 Key Components of an Effective Grievance Mechanism

Component	**Description**
Simple Process	It should be convenient to submit complaints. There should be several, appropriate channels through which community stakeholders can submit complaints free of charge (e.g. no travel costs, free phone number) as well as the informal identification of complaints (e.g. when the TPL employees (or subcontractors) are approached at meetings with the community). The grievance management process should be communicated and disclosed so that community stakeholders are aware of the avenues available to them to submit complaints.
Simple Internal Procedure	A simple and consistent procedure is required to record grievances, identify those responsible for addressing them and ensure that they are resolved. The procedure must maintain the confidentiality of the complainant and ensure fairness (fair to the stakeholder, fair to TPL, and consistent). Transparency in how the grievance management process works; and involvement of stakeholders in developing resolutions, can help. Responses should seek to address all issues in a grievance and be clearly justified.
Staff Arrangements	Roles and responsibilities in the grievance management process need to be defined and agreed. For example, a TPL Grievance Officer (GO) will be assigned and responsible for the coordination of the grievance management process, from receiving a complaint to reporting back the response. Once received, complaints should be directed to an appropriate staff member/department for investigation and resolution, to ensure an effective response. Even where a formal system has been established, staff not associated with the grievance management process will receive complaints. Systems for managing and forwarding these should be established and all staff trained on how to respond to stakeholders and to feed into the grievance management process.
Training	The launch or modification of the grievance management process should include internal induction and/or training for operational staff and a Community Liaison Officer(s). Training should outline key components, commitments and lines of communication in the process, and roles and responsibilities.

Component	Description
A Set Timeframe	The grievance process should set a timeframe within which complainants can expect: a) acknowledgement of receipt of grievance; and b) response and/or resolution of grievance. The timeframe should be feasible, whilst respecting community stakeholders' need for a swift response and resolution. Where complaints are urgent, tighter timeframes may need to be considered.
Sign–Off	Actions planned to resolve grievances considered to be of significant concern by the Grievance Officer should be signed-off by a member of the senior management, suitably qualified to assess the effectiveness of the response. This will help to ensure standards are met and that there is accountability in the grievance management process.
System of Response	A clear system of response is required to identify who should respond to the complainant and how.
Monitoring Effectiveness	Mechanisms should be set in place for monitoring the effectiveness with which complaints are being recorded and resolved. Reporting locally on the volume and nature of complaints received, and on key performance indicators helps to maintain transparency and trust.

5.3.2 *The Process*

This process is summarised in *Figure 5.1,* with the key steps as follows:

1. **Identification of grievance** through personal communication with TPL, phone, letter, during meeting, other [1]. If the grievance is logged on a Grievance Form in Swahili, a witness will be present as the grievance is also translated into English for the database. The witness and Complainant will both sign the Grievance Form after they have confirmed the accuracy of the grievance.

2. **Grievance is recorded in the 'Grievance Log'** (written and electronic) which will be held at TPL's office. The significance of the grievance will be assessed using the criteria outlined in *Box 5.1.*

(1) The communication strategies included are based on ERM's current understanding of the channels available for community stakeholders to communicate with KPL. Steps should be adapted so that the grievance process is accessible to stakeholders.

Box 5.1 *Significance Criteria*

Level 1 Complaint: A complaint that is isolated or 'one-off' (within a given reporting period - 1 years) and essentially local in nature.

Note: Some one-off complaints may be significant enough to be assessed as a Level 3 complaint e.g. when a national or international law is broken (see Level 3).

Level 2 Complaint: A complaint which is widespread and repeated (eg dust from construction vehicles).

Level 3 Complaint: A one-off complaint, or one which is widespread and/or repeated that, in addition, has resulted in a serious breach of TPL policies or law and/or has led to negative national/international media attention, or is judged to have the potential to generate negative comment from the media or other key stakeholders (eg non-payment of compensation).

3. **Grievance is acknowledged** through a personal meeting, phone call, or letter as appropriate, with a target of 10 working days after submission (maximum time a complainant should wait for a response is 1 month). If the grievance is not well understood or if additional information is required, clarification should be sought from the complainant during this step.

4. **The Grievance Manager (GM) is notified of Level 1, 2 or 3 grievances and the Project Manager/Director is notified of all Level 3 grievances**. The senior management will, as appropriate, support the GM in deciding who should deal with the grievance, and determine whether additional support into the response is necessary.

5. **The GO delegates the grievance** via e-mail to relevant department(s)/ personnel to ensure an effective response is developed *e.g.* HR, Community Liaison Officer; Contractors etc.

6. **A response is developed** by the delegated team and GO, with input from senior management and others, as necessary.

7. **The response is signed-off** by the senior manager for level 3 grievances, the GO for Level 2 and Level 1 grievances. The sign-off may be a signature on the grievance log or an e-mail which indicates agreement, which should be filed by the GO and referred to in the grievance log.

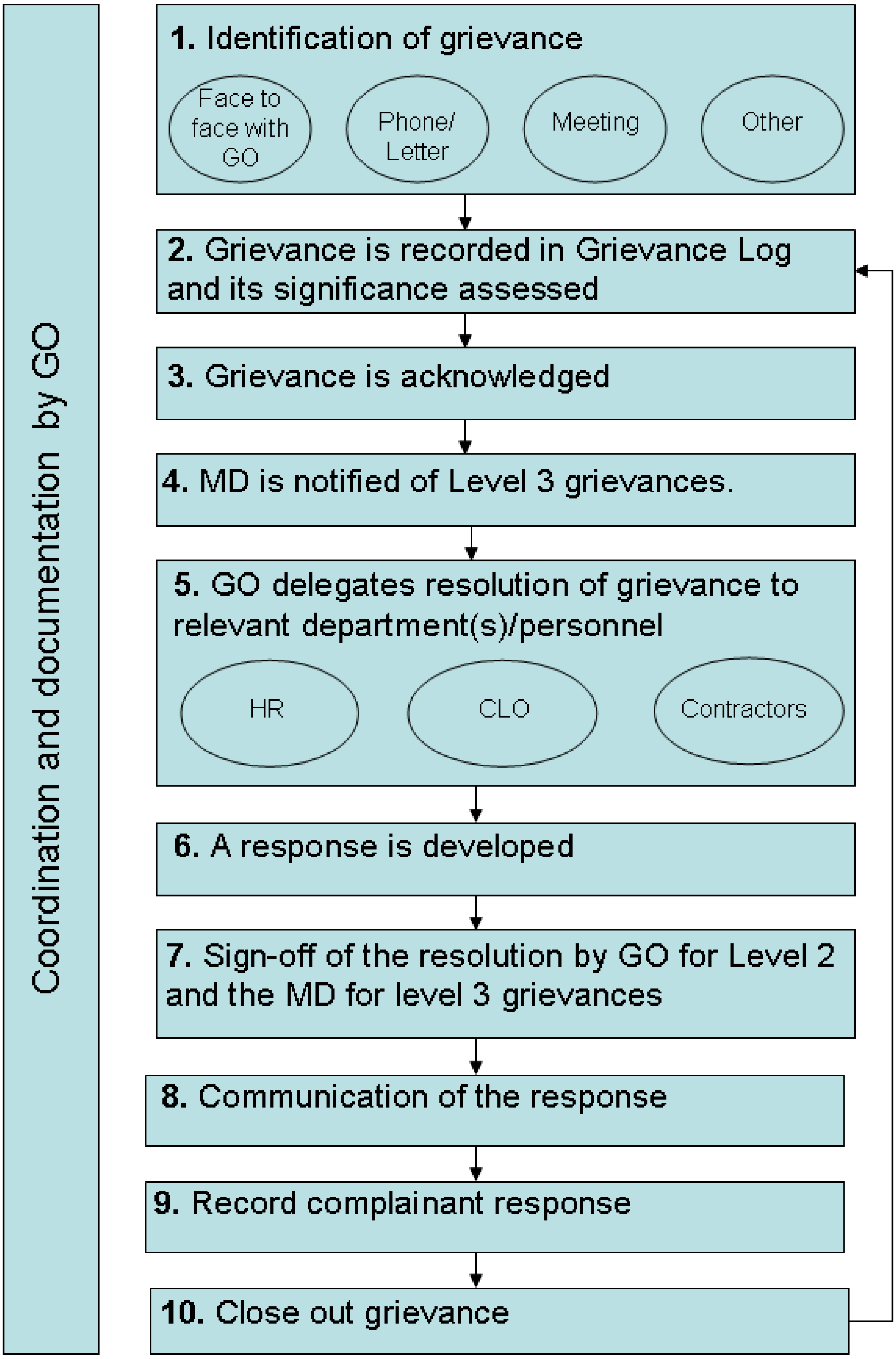
8. **Communication of the response** should be carefully coordinated. The GO ensures that an approach to communicating the response is agreed and implemented.

9. **Record the response of the complainant** to help assess whether the grievance is closed or whether further action is needed. The GO should use appropriate communication channels, most likely telephone or face to face meeting, to confirm whether the complainant has understood and is

satisfied with the response. The complainant's response should be recorded in the grievance log.

10. **Close the grievance** with sign-off from the GO. The GO assesses whether a grievance can be closed or whether further attention is required. If further attention is required the GO should return to Step 2 to re-assess the grievance. Once the GO has assessed whether the grievance can be closed, he/she will sign off or seek agreement from MD for level 3 grievances, to approve closure of the grievance. The agreement may be a signature on the grievance log or an equivalent e-mail, which should be filed by the GO and referred to in the grievance log.

Figure 5.1 *Grievance Management Process*



Note: This process has been designed to be effective through construction and operation, thus:

- The term MD ("Managing Director") is used to designate the person ultimately responsible (as will most likely be the case during operation).

During construction, this senior management function is likely to be served by the Project Director and/or Project Manager).

- At least for the initial stages of Project implementation, through a significant portion of construction, the Grievance Officer and Community Liaison Officer functions are filled by the same person.

5.3.3 Monitoring of the Grievance Process

Quarterly Reports

Quarterly reports will be compiled by TPL's Grievance Officer (GO). These reports will summarise all monitoring for the period, including trend analysis, interpretation of results, recommendations on remedial measures and relevant figures and graphs.

A tracking system will be implemented to identify:

- non-conformities;
- areas for improvement;
- remedial actions; and
- a programme and associated responsibilities for remedial actions.

Annual Reports

The quarterly reports will be combined into an annual report which will include a trend analysis, identification of problem areas, recommendations and all historical results.

6 OVERALL MONITORING OF STAKEHOLDER ENGAGEMENT

6.1 INTERNAL REPORTING

6.1.1 *Evaluation of Effectiveness*

The effectiveness of consultation activities will be evaluated against the goals and objectives of the SEP. This evaluation will examine the extent to which activities were implemented in accordance with the plan. The results and any lessons learned will then be incorporated into further updates of the SEP as the Project evolves.

6.2 EXTERNAL REPORTING

There will be a requirement for external reporting to the Kenyan Government as well as to any lenders, which is outlined in the Environmental and Social Management Plan (ESMP) for the proposed Project.

ERM has 145 offices across the following countries worldwide

Argentina	The Netherlands
Australia	New Zealand
Belgium	Panama
Brazil	Peru
Canada	Poland
Chile	Portugal
China	Puerto Rico
Colombia	Romania
France	Russia
Germany	Singapore
Hong Kong	South Africa
Hungary	Spain
India	Sweden
Indonesia	Taiwan
Ireland	Thailand
Italy	United Arab Emirates
Japan	UK
Kazakhstan	US
Korea	Venezuela
Malaysia	Vietnam
Mexico	

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Annex H

Social Investment Strategy

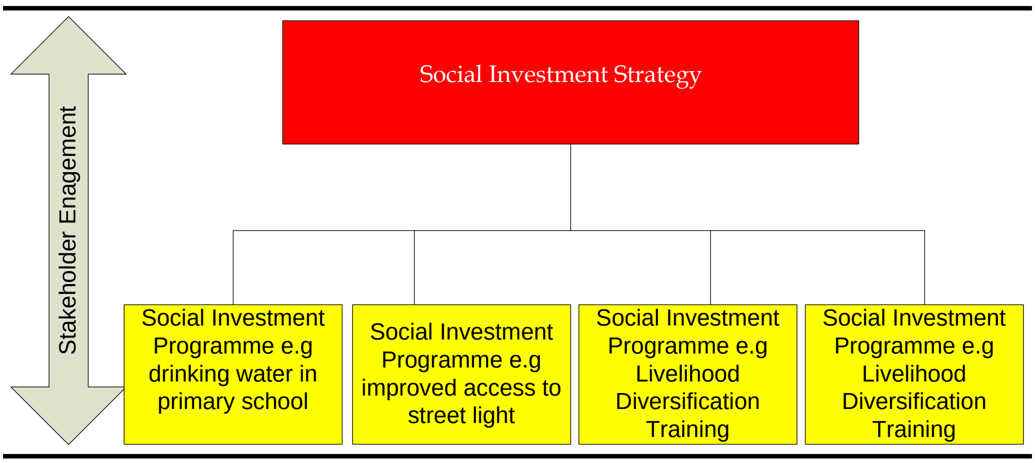
H1.1 INTRODUCTION

As a part of TPL's long-term commitment to the development of the community and the region in which it is located, the company plans to develop and implement a series of Social Investment (SI) activities in the surrounding area. The aim of these activities is to:

- improve socio-economic and health conditions in the area;
- ensure that TPL has a net beneficial impact on socio-economic conditions; and
- enable TPL to be perceived as a 'good neighbour'.

This document presents an outline Social Investment Strategy to guide the work of TPL (and of other organisations such as CBOs with whom it may partner) through the development of a Social Investment Framework and Plan. Further, it will inform the development of individual Social Investment projects and activities, and ensure effective engagement of communities through all stages, from identification of activities through to monitoring and *ex post* evaluation. The over-arching position of the SI Strategy, and the cross-cutting role of stakeholder engagement through the entire process, is shown in *Figure H1.1.*

Figure H1.1 Social Investment Framework



The SI Strategy will be aligned to the various management plans presented in these *Annexes* to the ESIA and ESAP.

H1.2 *DEVELOPING THE SOCIAL INVESTMENT FRAMEWORK*

H1.2.1 *Key Success Factors in Social Investment*

Experience from Social Investment strategies being undertaken worldwide demonstrate common factors in more successful SI initiatives. These include:

- commitment and involvement of senior management in developing and monitoring the SI process;
- identifying Key Performance Indicators at the beginning and reviewing the project against these periodically;
- use of partnerships with local NGOs or CBOs, rather than doing everything in-house;
- strong emphasis on building capacity of CBOs and other local groups in implementation; and
- extensive consultation and communication, and enabling meaningful participation by stakeholders.

H1.2.2 *Responsibilities for the SI Framework*

TPL has initiated discussions with a Thika-based consortium of CBOs, with the objective of this group taking a lead role in implementing social investment for the Thika Power Project.

When agreement is reached with the CBO consortium, and/or other SI partners as appropriate, their first role will be to develop the Social Investment Framework. This will be the strategic document used to manage and guide the implementation of SI activities. Specifically, it should set out:

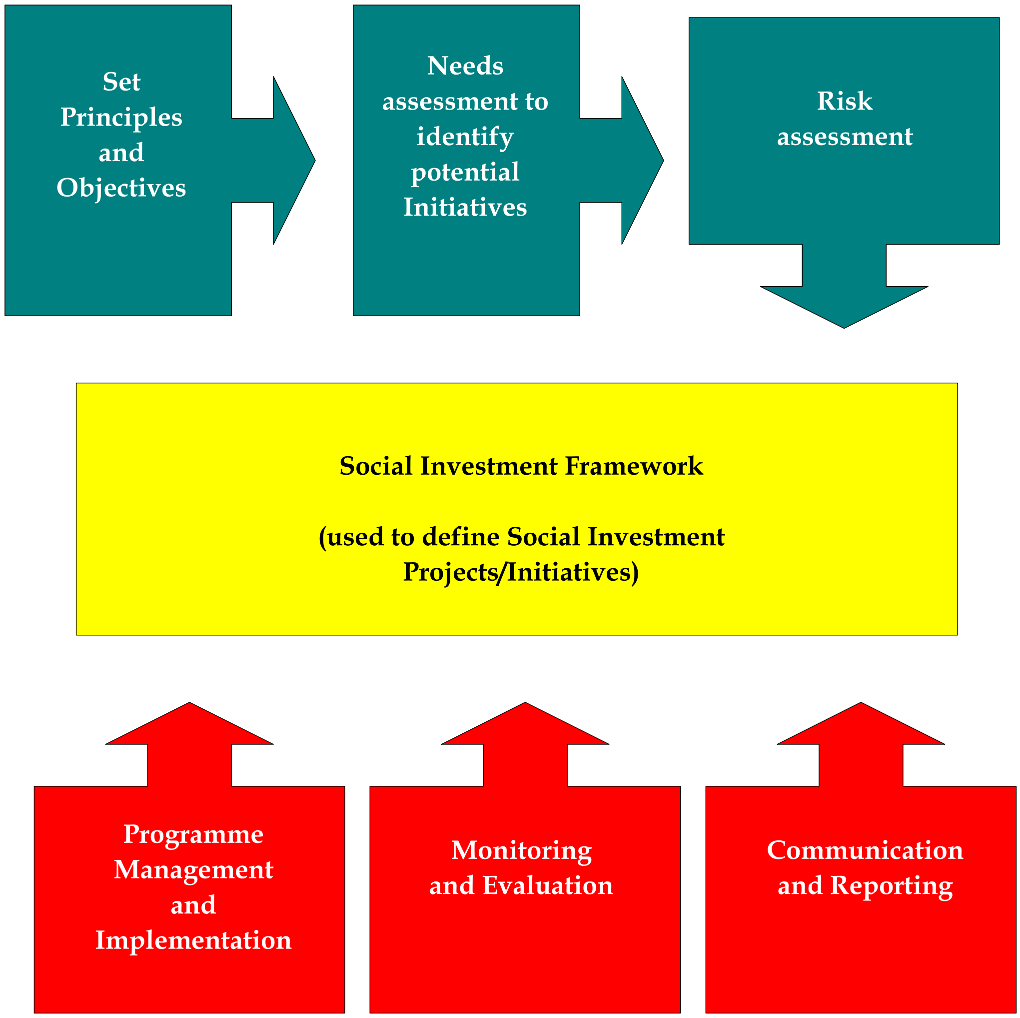
- the objectives and key principles to be adopted;
- a preliminary needs assessment (to be updated and detail added on an ongoing basis);
- a risk analysis (also subject to review and update on an ongoing basis);
- an initial set of social investment initiatives, directly linked to the needs assessment;
- the framework for SI programme management and implementation of individual activities;
- procedures for effective engagement with stakeholder communities (for

identification of target initiatives, and participation in prioritisation of projects and implementation);

- monitoring and evaluation (M&E) procedures (including reporting, and definition of community's role in M&E).

The process for developing the SI Framework is defined in *Figure H1.2.*

Figure H1.2 Process for Developing the Social Investment Framework



H1.2.3 *Setting the Principles and Objectives of SI*

Principles

TPL management should define the key principles, based on best practice, for its SI processes. These could include, but should not be limited to, the following.

- **Close linkage with the business objectives:** (for example, a project with a livelihood and employment focus, especially during the operational phase).

- **Sustainability:** projects should be designed to allow TPL to exit at a future date, without risk to the future performance of the project. There should therefore be a strong focus on building the capacity of local communities, as well as CBOs /NGOs, and government agencies, to manage and maintain projects after TPL's support has been withdrawn.

- **Transparency:** the process should be open to external scrutiny, such that communities and other stakeholders have trust in what the TPL is doing.

- **Linkages with existing government schemes:** where possible, projects should leverage and be linked to existing government schemes provide support that is missing or is required. A key reference point will be the Thika District Development Plan (currently for 2008-2012) which outlines the future government programme.

- **Replicability:** projects should be replicable, to reduce implementation time and costs, as well ensuring that lessons are learnt.

The first draft of the principles and objectives should be circulated for review, and revised as necessary based on feedback from relevant stakeholders.

Once these over-arching principles have been set, the remaining elements of the SI Framework (as set out in *Section H1.2.*1) will be developed by TPL and its CBO partner(s).

H1.3 DEFINING AREAS FOR SOCIAL INVESTMENT

Individual initiatives should be identified, developed and selected according to the rigorous, structured process that will have been defined in the SI Framework. However, it will also be necessary for TPL to identify some "quick wins", to establish and build the basis for a strong relationship with its neighbours (in essence, initially to gain its "social licence to operate"). Whilst not taking precedence over SI projects that are identified as the result of the needs assessment that will be undertaken under the SI Framework, the ESIA consultations have identified several potential "quick win" opportunities, as follows (note: other candidate SI project opportunities may be identified very quickly, and might be as promising as those listed below).

- **Provision of street lighting in Witeithie:** This would respond to a widely-expressed request for lighting, to reduce crime and so increase security in TPL's closest community.

- **Provision of basic waste services in Witeithie:** TPL could provide waste containers around the community, and at little incremental cost arrange for waste contractors visiting the site also to collect from Witeithie. If a small charge were made, this could become a business opportunity for a local enterprise.

- **Skills training for local persons:** either to equip them to become part of the construction workforce, or to have improved skills to offer into the local employment market.

- **Business skills training:** to foster a culture of service provision amongst small businesses, allowing them to take the opportunity of a construction workforce "market" over the coming two years. The training should include basic skills such as book-keeping, and additionally a component on identifying new markets and diversifying into them, to prepare businesses for the need to evolve in order to sustain themselves beyond the construction period.

Annex I

Meeting Minutes

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
33 St Mary Axe
London EC3A 8AA

Telephone
Facsimile
Email

Subject/Ref	Discussion Regarding TPL power plant Project
Venue	District Commissioner's Office
Date of Meeting	3rd November 2010
Present	Mr Semaan Semaan (TPL), Mr Bhavin Vyas (ERM), Mr Eamonn Barrett (ERM), Mr. Wilson Njega (Senior District Commissioner)
Distribution	
Date	

Eamonn Barrett gave an introduction about the project. Bhavin Vyas followed with introducing the team and explained the purpose of the visit.
The objectives of the meeting were:

- To receive approval to collect primary data;
- Requesting assistance and safety while carrying out stakeholder consultations; and
- Providing high level overview and vision of the district and how the project will help to achieve that.

Mr. Njega replied in brief welcoming us and the project. However, he requested us to provide an official documentation (letter) from the Kenya Power Limited Company (KPLC) providing overview of the project and ERM's role in it.

He also suggested that we review the Thika District Development Plan and Vision 2030 document.

TPL agreed to co-ordinate with KPLC and organise the introductory letter for ERM.

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
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Telephone
Facsimile
Email

ERM

Subject/Ref: Discussion Regarding TPL power plant Project

***Venue*:** KPLC Office, Nairobi

Date of Meeting: 7th November 2010

***Present*:** Mr. Bhavik Patel (TPL), Mr Semaan Semaan (TPL)
Dr. Peter Kuria Ndiba (Enviroplan), Mr Bhavin Vyas (ERM),
Mr Eamonn Barrett (ERM),
Mr. John Guda (KPCL)

Distribution:

The meeting opened with introductions and an outline of the purpose of the meeting including list of the data that we need to understand the land acquisition process by Mr. Bhavin Vyas.

This was followed by an introduction by Dr. Eamonn Barrett introducing ERM, discussing the key issues regarding alignment and integration of the ESIA process both at national (NEMA) and international (IFC) levels.

Mr Bhavin Vyas (ERM) than provided a brief background on NEMA's and IFC's requirements regarding involuntary resettlement and land acquisition.

Prof Njoroge and Dr Ndiba responded on behalf of Enviroplan, briefed the meeting on the status of their work and planned future activities (Enviroplan progress report handed over to ERM) . They agreed that close collaboration with ERM would be mutually beneficial.

It was agreed that the following information would be shared:

- Method statement for Enviroplan's baseline data collection;
- Update on progress and Enviroplan's planned next steps;

Action: Enviroplan to transmit to ERM

- ERM response to method statement, with specification of additional requirements to meet international standards;
- Structure and Table of Contents for International Scoping Report;
- Stakeholder list, for discussion during next ERM visit (end November-early December).

Action: ERM to transmit to Enviroplan

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
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Telephone
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Subject/Ref: Discussion Regarding TPL power plant Project

Venue: Mang'u High School, Principal's Office

Date of Meeting: 30th November 2010

Present:
Mr Bhavin Vyas (ERM), Mr. Henry M. Raichend (Principal)

Distribution:

The meeting opened with introductions and an outline of the purpose of the meeting, including a background to the Thika Power Project by Mr. Vyas of ERM.

When asked about the key concerns the High School has regarding the project, Mr. Raichend responded with four key points:

- Increased traffic can block the school entrance;
- Staff quarters are vulnerable to decreased quality of air;
- Increased dust can lead to respiratory disease;
- Increases in the level of air, waste and water pollution, as well as increased potential for oil spillage are of particular concern of the school management.

Mr. Vyas probed further about school information; Mr. Raichend provided a brief background about the school and provided a school map and school report for further information.

Mr. Raichend reported that Mang'u High School is one of the most prestigious state schools not only in Nairobi but within the Kenya. The school has produced some famous and successful leaders and celebrities. There are approximately 100 people visiting the school every day in spite of the school being a boarding school.

The peak visiting hours for the school are 7am and 6pm. The school management is not particularly concerned with the noise of the road traffic considering the classes and accommodation are reasonably away from the main road.

Mr. Raichend showed the layout of the school and highlighted that 16 staff quarters and 20 classrooms are close to proposed power plant. ERM acquired a copy of the school layout.

Mr. Vyas asked what the school would consider the key mitigation measures that Thika Power Limited (TPL) would need to undertake to reduce the severity of perceived impacts.

Mr. Raichend replied with the following:

- TPL should encourage the Kenya Transport Authority to prepare an underpass for student to cross the road rather than a footbridge.
- The ground should be wetted while transporting material during the

construction phase.

- Sponsoring a 'school warning' sign post on both sides of the road to alert drivers of the school and pupils' presence.
- Sponsoring a two day training for school teachers and key community representatives to manage community health and safety issues during construction and operation of the project.
- Allowing students to visit the plant and having some provision for student placement.
- Improving the safety of the local neighbourhood and developing an integrated and joint safety programme.
- Use other sources of the water rather than boreholes.
- Ensure waste water is treated before disposal.
- Continuous disclosure of key information to school management. If possible, organising an open house.

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
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Subject/Ref: Discussion Regarding TPL power plant Project

***Venue*:** Kuraiha Primary School

Date of Meeting: 5th December 2010

***Present*:** Bhavin Vyas (ERM), Purity Ngure (Quality Assurance and Standards Officer, Thika West), and Karanja Irachu (Head Teacher, Kuraiha).

Distribution:

The key baseline information regarding the Kuraiha Primary School is as follows:

Mr. Irachu provided a brief background about the school;

- It is a primary school that caters to pupils in classes 1 – 8 (Age group 5 to 14).
- There are 1,250 students 26 teachers and 4 support staff, resulting in a 48:1 student to teacher ratio.
- The school is 57 years old and apparently the only primary school in the area.
- The school is located close to Mang'u High School on Thika – Nairobi highway.
- The school begins at 7 am and closes at 5 pm. The majority (90%) of students are from Witeithie village and the remaining is from Nyacaba Village and Coffee farm.
- The villages where the students come from are on the other side of the highway from the school which increases the risk of traffic accident.
- The school has a high drop-out rate since it is a public school and parents are vulnerable to income poverty and may not have enough savings to support their children to study during secondary and university.
- The main problem that the school is facing is the poor school infrastructure and lack of access to clean drinking water.

Mr. Vyas then provided a brief background about the project and requested the attendees to share their concerns about the proposed Thika Project.

- The biggest concern is the safety of the students considering the existing Thika – Nairobi highway has to be expanded. According to the Head Teacher, in the last three years, 4 students have died due to road accidents. He also added that within the last year, 5 students were injured due to road accidents.
- The school management is also concerned about the increased traffic and associated noise increases that may have an impact on the concentration of students while attending class.

When asked about what Thika Power Limited (TPL) should do to mitigate the perceived impacts or how to support the school operations as a part of their Community Investment Plan, the school management provided the following recommendations:

- TPL should prepare a traffic management plan and should consider building noise screening infrastructure, especially during the construction phase.
- If TPL invest in borehole, TPL should provide the school with access to clean drinking water for the students.
- The school management is already communicating with the Nairobi-Thika Highway Improvement project team to build a footbridge across the highway. School management recommend that TPL endorse and make a provision for a dedicated footpath for school children and their parents to cross the highway.

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
33 St Mary Axe
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Subject/Ref: Discussion Regarding TPL power plant Project
***Venue*:** District Office, Thika

Date of Meeting: 6th December 2010

***Present*:** Bhavin Vyas, (ERM), Andrew T. Mwaura (District Social Development Officer), Aishah Wohamed (Gender and Social Development Assistant)
Distribution:

ERM

The meeting opened with introductions and an outline of the purpose of the meeting, including a background to the Thika Power Project by Mr. Bhavin Vyas of ERM.

The general introduction was as follows: The MATLEC Power Generating Company is proposing to construct a Heavy Fuel Thermal Plant in Thika. As one of the key lead agencies, it is required by the national Environment Management Coordination Act 1999, Environmental Impact Assessment (EIA) and Environmental Audit Regulations 2003 and the Equator Principles to incorporate your views and concerns in the project planning, implementation, operation and decommissioning phases. The objective of the consultation is to discuss the views, concerns, and opinions regarding the proposed project. In addition, the objective of this consultation is to discuss openly the community's apprehensions and perceived risks and impacts of the project.

This introduction was followed by introducing ERM and discussing the key stakeholder engagement requirements of the ESIA process both at national (NEMA) and international (IFC) levels.

Ms. Aishah Wohamed provided a brief background and introduction about the activities of the Gender and Social Development Department, including the key social and gender issue that the district is facing and the key programmes undertaken by the department.

Ms. Wohamed provided a brief overview of the institutional and geographical distribution of Thika District. The entire district has been divided into four divisions named; Gatanga, Ruiru, Thika West and Thika East.

Ms. Wohamed provided the list of the NGOs and CBOs that are operating the Thika District.

The department has also offered its support to ERM, if required, during disclosure of the final deliverables. The department has strong links with the communities in Thika and wants to ensure they are engaged in this process.

Mr. Andrew T. Mwaara told ERM that he is part of the board which manages the International Consortium of Community Based Organisations.

The final outcome of the meeting was an endorsement to support the process of data collection and ensuring the Department is part of the disclosure meetings. The department also provided ERM with a list of NGOs and CBOs operating in the area. A meeting will be arranged between ERM and the Programme Manager of ICCOBO (Mr. Charles Waithaka) who runs the network of NGOs and CBOs in the Thika District.

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
33 St Mary Axe
London EC3A 8AA

Telephone
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Subject/Ref: Discussion Regarding TPL power plant Project

Venue: Thika West District Education Office

Date of Meeting: 4th December 2010

Present: Bhavin Vyas (ERM), Fridah Chahale (District Education Officer, Thika West)

Distribution:

The meeting opened with introductions and an outline of the purpose of the meeting, including background to the TPL by Bhavin Vyas of ERM.

This was followed by an introduction by Fridah Chahale who introduced her team, main functions and provided a background of the education department.

Mr. Vyas than provided a brief background on NEMA's and IFC's requirements regarding a stakeholder engagement plan. Mr. Vyas then provided background information about the project, its location and sensitive receptors around the proposed project area.

Mr. Vyas also acknowledge the fact that ERM is considering Mang'u High School as one of the key sensitive receptors and will be going to consult with them. Mr. Vyas opened a discussion regarding identification of other schools on the Thika Highway which may be affected by the project.

Ms. Chahale agreed with the concerns that Mang'u High School will have. However, she was equally concerned about Kuraiha Primary School, which has more than 1200 primary school pupils (aged 5-12) and is located next to Mang'u High School.

Mr. Vyas discussed the potential positive impact of employment generation during both the construction and operational phase and explored the possibility of having local technical institutes or universities providing the skill sets and expertise that may be required from TPL.

Ms. Chahale responded saying there is the Thika Technical Institute within the town which could provide some new technical graduates and there is also Jumbo Kenyatta University which has a programme in Engineering that could provide the skills and expertise from the local market specially graduates.

Ms. Chahale also added that considering the fact that Thika is an industrial town with high in-migration and a high population density, finding both skilled and un-skilled labour should not be difficult.

Ms. Chahale also provided a list of schools in the district and all the key statistics on education.

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
33 St Mary Axe
London EC3A 8AA

Subject/Ref	Mang'u High School
Venue	Mang'u High School Principal's Office
Date of Meeting	9th March 2011
Present	Mr Raichena (Principal), Mr Eamonn Barrett (ERM), Miss Paula Hazell (ERM), Mr Mburu Gikonyo (Enviroplan)
Distribution	
Date	16th March 2011

ERM

Introductions and overview of the process undertaken since last meeting.
Discussion and response to concerns raised in previous meeting around five key areas:

- Traffic: currently situated in an area with a changing situation because of the highway upgrade project. Thika Power Limited (TPL) is currently in discussions with the highway authority to try to avoid project traffic passing school entrance/grounds with the suggestion to use an intersection past the school to get to the site. Once the highway is complete we understand that there should be an underpass which can be used for people however the exact details are yet to be confirmed.
- Additional measures will be implemented i.e. signs/warning notices, all contractor contracts will stipulate strict driver training practices, speed limits, consequences/enforcement will be in place for not following these practices, if appropriate, TPL will consider supporting a road safety training programme in schools (annually) to improve awareness of the dangers and promote safe behaviours, construction workers should be bought to site in buses to avoid interaction with road and school children.
- The neighbouring primary school is more vulnerable than the high school. Approach to traffic management needs to combine TPL, roads authority and road contractor, KPLC. Current activities onsite i.e. sub station work has resulted in teachers complaining about dust already - they can't dry clothes outside. Also drivers related to construction work are not being careful on the road (trucks).
- Air Quality: dust issues require dewatering and dust control, good management practices to be implemented and followed. The project can control its contribution through these measures.
  We have conducted air dispersion modelling to ensure that the design is sufficient to avoid high concentrations of pollutants at the school which is of particular concern because the prevailing wind is from the project site to the school.
  This assessment has followed international standards so that the school is not affected any more than if this plant was to be built in Europe.
- Installation of a monitoring station on the school compound i.e. at teachers accommodation with information provided to school.
- Noise: Principal had noticed monitoring activities to ascertain background noise in teachers accommodation. Early indications seem to demonstrate that noise won't increase in this location because fans from the radiators are located at the bottom of slope, therefore the slope will act as a barrier.
- Currently disturbed by noise from the road. Short term noise – understandable/ acceptable. Long term noise – is a concern.
- Pollution: There will be little wastewater from the project because the radiators are air cooled and any process water will be circulated in the treatment plant until it meets

required standards before being discharged. Sludge will be collected onsite and removed by a licensed contractor and disposed of elsewhere.

- Water supply – the project does not need a large amount of water. TPL have looked into sourcing options and a borehole is considered to be the best option. A license has been obtained from Water Resources Management Authority. It was determine that the project will not require enough to depress the yield in the area given the recharge of the aquifer to be used.
  School operates on a borehole however they think now that they may need to be connected to the municipal piped supply. As the school cannot provide adequate storage and during electrical outages they have no pumps running which can lead to no water. The school is in the process of discussing connection to the mains with Thika Water however, this would not be to use 100% of time but only in times of need.
- <u>Security:</u> During construction the movement of employees will be required. Concern regarding security at the High School boundary to the north – can this be enhanced?
- There is likely to be commercial opportunities for the local communities i.e. providing lunch but concern that this might lead to other types of services for workers which may be inappropriate around the school.
- Steps to be taken will include contractor obligations for contractors, local staff to be employed so no housing intended at site and night security will be provided.
- TPL to collaborate with school to manage any issues of concerns and work out measures together to stop site becoming a honeypot of activity as far as possible and to ensure separation of the project and the school.
- Timeline: Earthworks – within 1 month, Construction – approximately June

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
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Subject/Ref	Agro Tropical Coffee Farm
Venue	Outside Coffee Farm Staff Housing
Date of Meeting	9th March 2011
Present	Joseph Gathuru (Coffee Plantation Assistant Manager), Mr Eamonn Barrett (ERM), Miss Paula Hazell (ERM), Mr Mburu Gikonyo (Enviroplan)
Distribution	
Date	16th March 2011

Introductions and overview of the process undertaken since last meeting.

- The farm has been in operation since colonial times – Agro Tropical have owned the plantation for 14 years.
- The plantation is 180 acres in total and 20 acres of this was sold to KPLC.
- Reported that 51 people are currently employed by the farm.
- Workers are primarily from Witeithie, Juja and Goyingwa with casual workers mostly being required in November/ December for harvesting. In December the coffee is delivered to the millers (in lorries) who are based in Thika. Workers are mostly women, there are some men employed however, they are considered to be less reliable.
- There has been a period of drought (i.e. a period when irrigation has not been possible) recently caused by the road construction contractors who accidently cut through the irrigation pipes. The plantation is hoping to have this fixed within the next week and the contractors are not providing any assistance.
- Had goats and cows on the land but these have been moved because of drought.
- The farm has no electricity at all and they would like this.
- Currently growing tomatoes/onions as well.

In a brief discussion with the Coffee Farm Manager he reported that there are 8 permanent employees, 51 current casuals at the moment for land clearing and preparation work and that there can be up to 200 casual employees during the harvesting period if necessary.

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
33 St Mary Axe
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Subject/Ref	Other Meetings Held During Site Visit in March 2011
Venue	Various
Date of Meeting	9th March 2011
Present	Mr. Eamonn Barrett (ERM), Miss Paula Hazell (ERM), Mr. Mburu Gikonyo (Enviroplan) as well as those named below.
Distribution	
Date	18th March 2011

Mr. Peter Mwangi (Assistant Chief of Witeithie Estate)

- Courtesy meeting to confirm arrangements for the public meeting to be held in Witheithie on 10th March 2011.
- Primary concern was children using the highway to get to school but also keen to stress the need for street lighting in estate.

Mr. Mohamed Abdi (District Officer for Juja Division)

- Courtesy meeting to confirm arrangements for the public meeting to be held in Witheithie on 10th March 2011.
- Primary concern was ensuring local recruitment of people i.e. from the 'local' area which he considers Thika is outside of.

Mr. Andrew Mwaura (District Gender and Social Development Officer) & Mr. Charles Waithaka (Programme Manager of International Consortium for Community Based Organisation (ICCOBO)

- Courtesy meeting to confirm arrangements for the public meeting to be held in Witheithie on 10th March 2011.
- Disucssed the possibility of ICCOBO working with TPL on Social Investment Strategy implementation.
- Mr. Waithaka is willing to consider a partnership between TPL and ICCOBO to implement projects in local area moving forward with the fund idea. Need to continue discussions going forwards.

Meeting minutes

Environmental Resources Management

2nd Floor, Exchequer Court
33 St Mary Axe
London EC3A 8AA

Subject/Ref	Public Meeting
Venue	Hope of Faith Worship Centre Church – Witeithie Estate
Date of Meeting	10th March 2011
Present	Panel members: Mr. I Muchui Muiruri (Chief of Witeithie), Mr. Peter Mwangi (Assistant Chief of Witeithie), Mr. Semaan Semann (TPL), Mr. Paul Doumet (TPL), Mr. Eamonn Barrett (ERM), Miss Paula Hazell (ERM), Mr. Mburu Gikonyo (Enviroplan) Attendees: approximately 80-100 people from local communities, approximately 2:1 men to women ratio
Distribution	

Introduction of panel members and brief introduction by EB and PD on the Project including Kenya's need for power, government plan to make Thika a more industrial hub, requirement for international funding triggers certain environmental and social standards, ERM's role, TPL's commitment to a responsible project.
A number of previous meetings/discussions/FGD's have been held in the area to try to understand the concerns of the local communities
EB outlined key elements of the project – potential positive and negative impacts:

- Potential employment opportunities during construction (up to max 300) with preferential recruitment for Witeithie as the closest residential area to the project
- Potential for Witeithie to act as market centre and provide goods and services for workers
- TPL will establish a fund to assist with project's in the community. It is considered that decisions for allocation of the fund will be made by a committee (comprising key individuals/representatives of the community i.e. pastor, school principal, administration representative, TPL etc). The details of the fund i.e. amount etc are currently unconfirmed. Potential projects will be chosen from suggestions by community members which will be evaluated by the committee i.e. street lighting on main road for security improvement
- The project is likely to lead to some disturbance/nuisance in the area particularly during the construction phase however, TPL will do everything possible to limit this
- Traffic – the project has no responsibility for traffic related to the highway upgrade. All project traffic will be strictly controlled and where possible, project traffic will avoid areas heavily used by people. When the highway upgrade is completely, project traffic should completely avoid completely the intersection and highway to site. Strict rules for driving and enforcement.
- TPL plan to support training and awareness raising campaigns particularly for more vulnerable road users i.e. primary school children, and will consider providing extra signage on the roads for both drivers and pedestrians in high risk areas
- During construction, design and management measures will ensure that stormwater is neither contaminated nor that it causes any damage to current agricultural plots immediately down slope of the site. It will be drained and channelled appropriately.
- No construction worker camps are required during construction of the project.
- During operation the site is expected to receive up to 12 fuel trucks per day. TPL are in

discussions with the railway authority on the potential for delivery by railway however this will be a long term option only if possible.

- Waste from the project will be treated and disposed of by licensed contractors to strict international standards and Kenyan regulations. No hazardous chemicals or materials are required for construction or operation of the project.
- The expected life span of the project is 20-30 years (minimum)
- Air quality is being modelling to ensure that emissions from the plant meet the appropriate air quality standards.
- Noise emissions from the plant should not be very high. Given the current dominance of the highway between the project and Witeithie, the objective is to achieve little/no higher level noise than the current noise levels experienced.
- Monitoring for air and noise pollution will be undertaken to ensure that our estimates from modelling are correct. If any problems are identified, measures will be put in place to rectify them.
- Water consumption for the Project will be minimal and is likely to be from borehole abstraction. The project already has a permit from the Water Resources Management Authority to abstract water and the borehole will be located onsite.
- Tanks containing Heavy Fuel Oil onsite will be contained within a retaining wall that will prevent any pills or leaks. Good management procedures and practices in line with international standards will be implemented for the handling and storage of all fuel.

To finish: the process for communication between TPL and the community is an ongoing process. TPL will continue to engage and provide information to local communities throughout the life of the Project. The Project Information Document has contact details listed for any one to provide comments and feedback.

Opened floor up to questions from attendees:

1.) Will there be a perimeter fence around the site? How will we be affected by air/noise pollution/vibration? What about the high voltage transmission lines over our land?

- There will be a secure fence and a guard at the site gate so that no unauthorised personnel can enter.
- Scientific studies have been carried out to understand the air and noise pollution issues and these results will be validated through monitoring.
- The project will use a large engine which vibrates however, underneath the engine will be a spring box down to the foundation which will absorb any vibration. The engine will be an isolated unit so that there is no transfer of vibration.
- The transmission line is the responsibility of KPLC and is part of their substation/ring project; it has nothing to do with TPL.

2.) Usually only a few people end up being hired locally during construction despite companies saying it will be more, how will you make sure this doesn't happen?

- TPL is committed to the local community, we want people from the local area. Approximately 500 employees will be needed during construction in total, of this, approximately 300 will be local people (non skilled). Contractors will have strict instructions to employ from the local communities where possible.
- TPL need labour for the project to succeed and it is better for the project if the labour is from local sources – causes less difficulties and local support for the project is needed to succeed.

3.) What happens if people get injured whilst onsite from project activities, how responsible will you be for this?

- TPL will have a Health and Safety Plan which will comply with international standards. TPL will have very strict policies on H&S and this will include a full health & safety orientation for all employees, onsite first aid facilities and ambulance and communication with local hospital. Construction activities will be undertaken to a strict standard and all employee levels will have a safety briefing. Accidents do happen, but there will be training and all contractors will be insured so that all employees will be covered for medical treatment related to project injuries. Appropriate PPE and procedures will be in place and enforced at all times.

4.) What will be the system of payment for employees?

- The majority of employees will not be employed directly by TPL but by the project contractors so further discussion will be needed to clarify this. TPL plans to pay employees monthly, but paying weekly could probably be arranged without too much trouble.

5.) How will the project affect power needs and current interruptions in power in Witeithie?

- The project will generate power which will be delivered to the KPLC substation and ultimately distributed using the KPLC transmission line, neither of which are part of the TPL project. We understand that KPLC will distribute approximately 90% of the power to the local area i.e. Nairobi and the wider Thika area and so cannot comment on whether this will affect power supplies in Witeithie.

6.) What about female empowerment and employment in relation to the project?

- The project will employ women where possible and the design of facilities includes separate facilities for females. There will be opportunities available for women i.e. in the kitchen, in secretarial roles, cleaners etc.

7.) Explain the advantages of going for diesel?

- The project will not use diesel as this is expensive, but Heavy Fuel Oil which is cheaper. Renewable energy production in Kenya is not steady or reliable and is currently expensive to build and difficult to locate. The project will be efficient, reliable and relatively quick and cheap to build.

8.) Is this TPL's 1st experience of building such a project in country such as Kenya?

- It is TPL's 1st plant in Kenya however not their 1st project in Africa. TPL are working with a technical partner in Germany who have extensive experience in this type of project.

9.) Is this the only project you are involved in, or are there others around here? How long will the positive impacts last for, and can people be trained so that they can get more skilled jobs?

- It is the only project that TPL are involved with in Kenya.
- In order to make sure that the positive benefits from the project last longer than the construction phase, TPL are planning to establish a fund that will exist whilst TPL is present i.e. at least 20 years. Training for local people will be one of a range of options to be considered. The fund will need to operate around a system that will ultimately looks after itself i.e. be self sustaining and involve local NGO's to help use their experience. Support training to promote local SME's may also be a possibility however no firm decisions have been made yet.

10.) There is a concern that the project will make power and then distribute it elsewhere?

- The distribution of power from the project will be the responsibility of KPLC and has nothing to do with TPL.

11.)Who is funding the project?

- The project will not be financed by any Kenyan sources so there is no possibility of the project being used in political fields.

12.)Can you help provide 1st aid etc to cover the village?

- This would not be sustainable. Onsite medical facilities will be quite small but enough to cover employees onsite, the project will not have the capacity or the equipment to cover the whole village. It would be difficult to open up the project facilities as there would be difficult decisions on who could be treated. With the project fund, there may be the potential to improve and support facilities in village which can support themselves i.e. not focus on industrial accidents which is what the project will concentrate on providing for rather than issues like disease etc.

13.) I am excited about the project however people currently own land that is going to be used for posts, have a transmission line across it etc. What is the situation with using this land that people own?

- KPLC is fully responsible for the siting of posts/towers for the transmission line and for the location of the line itself. It has nothing to do with TPL.

14.)What about the crash in oil costs in Middle East, how will this affect the project?

- There are fixed costs associated with the construction and operation of the plant, however, fuel will be purchased and supplied by KPLC to TPL. They will supply fuel to TPL so that we can supply power to them, therefore if oil costs go up then all prices go up due to the knock on effect.
- The Kenyan Government have an Energy Policy which decided to use this type of fuel fuelled plants as a focus going forward to bridge the current energy gap. The project has no control over fluctuating prices and potential world changes, we will just have to accept whatever happens. The risk is being taken by TPL and not the government so there is no risk to Kenyan finances if it doesn't work.

15.)How big is 80mw? What does it mean in terms of size?

- The capacity of the plant can be put into comparison by considering that houses in the village use around 1kw each, so the plant size is equivalent to approximately 100,000 houses.

16.)Is the plant for emergency times only i.e. when hydropower is short?

- The plant is for use all the time. It will always be running on average at 85% efficiency.

17.)Where will the supply of materials come from? Will the government supply them? Might it be possible for us to provide some construction materials i.e. cement? I do not understand the benefits to us other than direct employment, please explain other opportunities.

- The wages from employees should help to stimulate growth in the area through spending power thus creating a general economic benefit to the local area which may in turn stimulate further economic growth.
- General construction materials will be from Kenya where possible. Anyone who can put together an offer to provide materials to the project will be considered fairly against other bidders therefore please let us know who to speak to about this and we will get in touch with them to see what can be done.

Meeting was closed with wrap up comments from the Chief and thank you's to all.

Annex J

Project Information Document English & Swahili

Thika Power Project

- Project Information Update -

This Document

This document has been prepared by Thika Power Limited (TPL) to provide an overview of the proposal to develop a power station in Thika District, near the Witeithie Estate south of Thika town. The document summarises:

- *the activities involved in building and operating the power station;*
- *the ways in which construction activities, and then operation, will be managed to avoid unnecessary negative impacts and maximize positive benefits;*
- *how TPL will work with communities and enterprises to maximise the benefits to the neighbouring area;*
- *the schedule for the proposed construction, and the start of operation; and*
- *the ways in which you can get information on the development, ask questions, and provide comments and feedback.*

The Project: Headlines

As is well known, Kenya is very short of electricity. Additional generation capacity is needed to provide more power for commercial and domestic use: to stimulate Kenya's economic development; and to help improve the living standards of Kenya's people. Diesel-fuelled power stations such as this one near Thika, which can be built and operating in a short period, are a vital part of the Government's energy strategy.

The key features of the Project are:

- Construction planned to start in the first part of 2011, and will finish at the end of 2012;
- Site clearance, to prepare approximately 10 acres of land for construction, is already under way;
- Limited construction traffic (average five lorries per day) will be required to bring materials and equipment. Work will be during daylight hours;
- Up to 500 people will be employed in construction, with a preference where possible for local people: local contractors will advertise jobs;
- The Project's structures will include a power house (with the diesel engines, and a single chimney, probably 65-70 meters high); boilers and condensers; diesel tanks; switchgear; water treatment and pump house; and ancillary buildings;
- The power station will generate 80 Megawatts of power (over 5% of Kenya's capacity at present);
- Connection to the electricity transmission network via the substation which Kenya Power and Lighting Company (KPLC) is already building on the site;
- Total project cost is being raised by TPL, and the Government does not have to contribute to the construction cost;
- When operational, the plant will run continuously;
- 40-50 permanent employees when operational;
- 12-15 vehicle movements a day;
- Decommissioning more than 30 years in future.

Project Benefits

Economic growth:

As well as direct employment, the Project will have a range of economic benefits for the economy of Kenya the local region including:

- Spin-offs from the increase in available power, to benefit the economy and society in general, and contribute to Thika's development as an industrial "hub";
- TPL's commitment to local procurement, where possible, of materials and services will support local enterprises;
- Wages spent in the local economy to purchase goods and services provided by local businesses by construction and operational workers.

Community Enhancement:

TPL takes very seriously its responsibilities in the local community, which are more than just providing jobs. TPL will consult with local community representatives, to identify Community Projects, using the consultative procedure described in this document to identify projects which will benefit local communities the most.

Project Impacts and Mitigation

Like all projects, construction and operation of the Thika power station will have some impacts. TPL is taking all reasonable steps to reduce or eliminate these by careful project design, and through the mitigation and enhancement measures aligned with international good practice and Kenyan law, that TPL implements.

- ***Construction impacts*** **(traffic, wastes, workers' interactions with communities, etc) will be controlled through careful planning and management, codes of practice, and contractual restrictions on the contractors appointed for the works. Engineering design and management plans will ensure that immediate neighbours (coffee farm, nearby houses, vegetable plots) are not disturbed by noise, water run-off from the construction area; construction will be in the daytime.**
- ***Noise and air quality impacts during operation have been investigated using modelling techniques:*** **where necessary, design modifications are being made to safeguard community health. Water will be accessed from sustainable underground sources, and will be properly licensed by the authorities.**
- ***Diesel tanks:*** **are being designed to prevent accidents, or pollution of soil/water.**

Project Development Schedule

This diagram shows the schedule of activities to build the Thika power station:

As part of the preparation activities which are under way, TPL is assessing potential impacts and benefits and developing appropriate measures to manage them, and

As part of the environmental and social studies a consultative process has been developed, to inform communities and other stakeholders about the project, and to provide opportunities for comments and questions. As part of this process, public meetings will give people the chance:

- **to listen to TPL and their consultants explain the plans;**
- **to understand what they will mean for local communities, for the region, and for Kenya; and provide an opportunity to ask questions, express concerns, and discuss the project.**

The consultations in March 2011 will only be the first of a continuing process of TPL's engagement with its neighbouring communities, demonstrating the company's commitment to *"sustainable development for Kenya's economic growth"*. Regular communications will be made with communities and other stakeholders, and a procedure is now in place so that anyone in the community can raise issues at any time *[see contact details below].*

How Can I Comment?

As well as the consultation processes, TPL has established a procedure which is open to everyone, to allow members of the public to submit complaints, comments or questions about the project. This will ensure that everyone who comments will receive a response and TPL will use the information from this procedure to review, and where appropriate adjust, the way that it operates.

The key contact details for making Comments, Feedback or Complaints are as follows:
Telephone number (Voicemail): **0702153114**
Address: **Thika Power Limited, P.O. Box 45931 – 00100, Nairobi.**
Comment Boxes: **Will be set up at the site entrance, addressed for attention of Mr Paul Doumet**

MRADI WA STIMA: THIKA

- Maelezo ya Mradi -

Maelezo Haya

Maelezo haya yametayarishwa na Kampuni ya Thika Power Limited (TPL) Kupeana muhtasari wa mradi huu wa nguvu za umeme unaokusudiwa kujengwa wilayani Thika Karibu na Kijiji cha Witeithie Kusini mwa Mji wa Thika. Mhutasari wa Maelezo haya:

- Shughuli zinazohusika katika ujenzi na utekelezaji wa mradi huu;
- Jia za ujenzi, Utekelezaji, na vile zitasimamiwa ili kuepukana na madhara yoyote na vile manufaa yaweza kuongezeka;
- Vile hii kampuni itakavyofanya kazi na wenyenji na wafanyi biashara ili manufaa yaongezeke kwa wenyeji na Majirani wao;
- Ratiba ya ujenzi huu, na uanzilishi wa operesheni hii ; na
- Jia ya kualifiwa kuhusu maedeleo, kuuliza maswali, na Kuasiliana.

Mradi Huu: Vichwa

Kama Ijulikanavyo, Nchi ya Kenya huwa na upunguvu wa stima. Uongezaji wa uzalishaji wa wa nguvu za stima inahitajika ili kutoa nguvu zinazohitajika kwa viwanda na utumizi wa kinyumbani: kuwahamasisha Maendeleo ya uchumi nchini; na kusaidia kuimalisha maisha bora kwa wakenya. Mradi kama huu hapa Thika, wenye unaweza jengwa ni wa manufaa zaidi katika shughuli za serikali za kuimalisha Nguvu za stima.

Vipengele vya Mradi huu:

- Ujenzi una kusudiwa kuanzishwa mwaka wa 2011, na Kumalizika mwisho wa 2012;
- Utayarishaji wa sehemu ya mradi na kuandaa karibu ya ekari 10 ya ardhi ya ujenzi yanaendelea;
- Takribani magari tano kila siku yatahitajika kuleta virago vya ujenzi; Kazi itafanywa mchana.
- Takribani watu mia tano wataanjiriwa, na wakaazi watapendekezwa kuajiriwa katika huu ujenzi ;
- Sehemu za mradi huu ni pamoja na nyumba ya uzalishaji wa nguvu yenye ina injini ya mafuta na chimney ya urefu wa takribani mita 65-70 urefu; sehemu ya kuchemsha na kipoesha; matangi ya mafuta; sehemu ya kuashia; pahali pa maji kutibiwa; na nyumba zinginezo;
- Mradi huu utakapomalizika, unauwezo wa kutoa nguvu za umeme kiasi cha 80 Megawatts, zaidi ya asili mia tano ya stima nchini kwa sasa;
- Kushikanisha na mradi wa shirika la nguvu za umeme nchini (KPLC) unaoendelea karibu na sehumu ya mradi huu;
- Pesa zitakapotumika katika ujenzi zinatolewa na Kampuni ya nguvu za umeme Thika. Sheriakali haitangharamiwa katika ujenzi huu;
- Utakapomalizika mradi huu utaendelea bila kusimama;
- Takriambani watu 40-50 wataajiriwa kundumu, mradi utakapomalizika;
- Takribani magari 12-15 yatakuwa yakifanya kazi kila shiku;
- Kufungwa kwa mradi kutafanyika takribani mwika 30 baadaye.

Manufaa ya mradi

Kuendeleza Uchumi

Bali na kuajiriwa kwa watu katika mradi huu, itakuwa pia na manufaa zaidi za kiuchumi nchini na kijiji hicho: pia:

- Uongeshakaji wa nguvu za stima katika sehemu hio na kuezesha ukuzi wa viwadi Thika.
- Kampuni inayojenga huu mradi pia itasaidia katika shughuli za ununuzi nchini yenye itakua na manufaa kwa wafanyi biashara sehemu hio na nchini kwa jumla;
- Malipo ya wafanyakazi yanamanufaa zaidi kwa uchumi juu yatatumika katika ununuzi wa bidhaa na huduma zinazotolewa na wafanyi bisahara katika sehemu hio.

Ukuaji wa wakaaji:

Kampuni inayojenga huu mradi TPL inatilia maanani shughuli zake kwa wakaaji bali na kutoa makazi.

Kampuni hii itashirikiana na viongozi wa sehemu hio ili kutabua miradi ya jamii yenye ni ya manufaa zaidi kwa wakaaji. Katika shughuli hii taratibu inayofaa itafuatiliwa ili kutabua miradi hio.

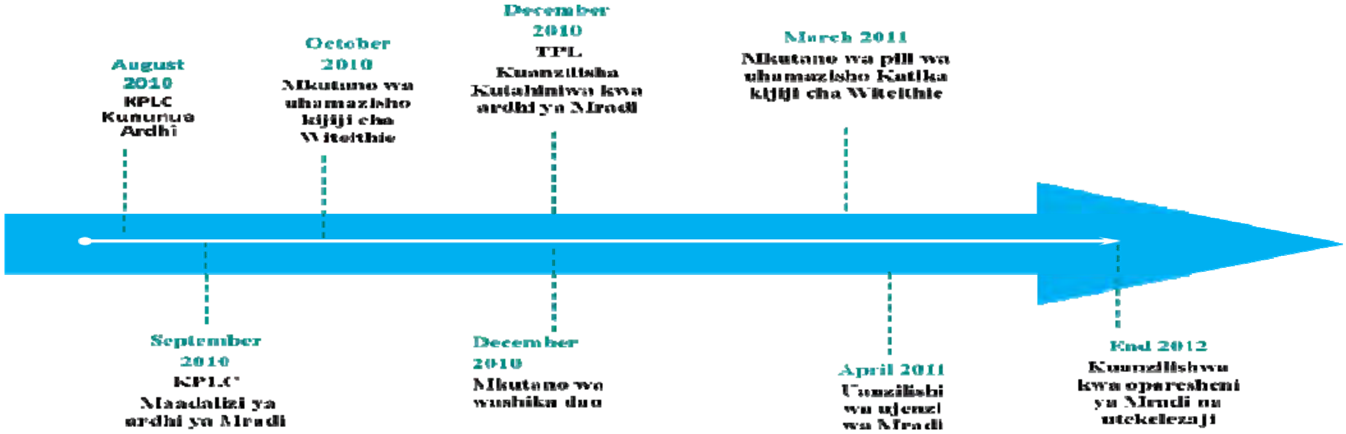
Madhara ya Mradi na Uzuizi

Mradi huu wa Thika kama miradi nyinginezo huwa na madhara na faida zake. Kampuni hii imechukulia jukumu sana ili kujaribu kuyapunguza madhara yale kwa kutumia technologia ya hali ya juu katika uchoraji na utekelezaji wa mradi huu na kuyafuatilia maanani maagizo ya kiulimwengu ya kufanya kazi vyema na kufuatilia sheria za nchi ya Kenya..

- ***Madhara wakati wa ujenzi*** **(Msongamano wa magari, Takataka, Wafanyikazi katika mradi kuingiliana na mambo za kijamii wanaoishi karibu, na mengineo) Madhara kama haya yatapunguzwa kwa kutumia mpangilio mzuri wa mradi kwa kutumia utawala unofaa na sheria za kazi kwa jumla. Mchoro wa mradi na utawala mzuri utaimalisha maisha ya wanaoshi karibu na mradi huu kwa kuzuia uharibifu wa maedeeleo yaliomo hapo kama ukulima wa kahawa, manyumba na wakulima wengine wanaoishi hapo karibu. Kelele itapunguzwa na maji yatazuiliwa kumwagika mashambani yao. Kazi ya ujenzi itafanywa usiku.**
- ***Kelele na madhara ya hewa*** **wakati wa utekelezaji wa mradi huu yametahiniwa kwa kutumia jia za hali ya juu wa kupima hewa. Madhara yanaangaliwa kwa makini hata sasa katika uchoraji huu wa hali ya juu ili kuhifadi afya ya wakaaji. Maji ya ujenzi yatapatikana kwa jia ya ubomoaji/utoboaji kwa kufatilia sheria zinazofaa.**
- ***Matanki za mafuta yanachorwa kwa technologia ya kisasa ili kuzuia uhalibifu wa maji na mchanga na pia madhara zinginezo.***

Taratibu Za ujenzi

Picha hii inaonyesha taratibu zinakapofuatiliwa kuujenga huu mradi



Huku kanampuni hii ikiendelea kujiandaa katika ujenzi, inaendelea pia na kujaribu kayaangalia madhara zinginezo na pia faida zinginezo zinazoweza patikana na kujaribu kunufaisha faida za huu mradi.

Jia ya kuasiliana imeimalishwa kama mojawapo ya wakaaji kuwezeshwa kuyatoa maoni yao kaitika mradi huu. Mkutano wa wakaaji wa kijiji hiki imeadaliwa ile kuwapea nafasi ya kuasiliana na:

- **Kampuni inayofanya ujenzi na wataalamu wa uchoraji;**
- **Kuelewa maana haswa ya mradi kwa jamii inayoishi karibu, na wakaaji na nchi ya Kenya kwa jumla.**
- **Kupeana nafasi ya watu kuuwlewa mradi huu.**

Mkutano huu wa kuasiliana ni mojawapo wa kazi inayoendelea katika huu ujenzi. Yanaonyesha vile kampuni hii inayofanya ujenzi huu inavyoyatilia maanani nambo ya jamii na ukuzi wa uchimi wa nchi. Mawasiliano yataendelea na mfuatilio huu utafanywa kwa kupitia jamii na washika dao wa mradi huu ili kuyasikia maoni yao.

Nita yatoaje maoni yangu?

Kama mojawapo ya mawasiliano, kampuni hii imepeana taratibu ya kutoa maoni kuhusu huu mradi. Hii itawezesha kupokelewa kwa maoni yao na kujibiwa napia maoni haya kutumiwa kuyatekeleza mambo Fulani kama inavyowezekana.

Numberi na jinzi ya kuasiliana:

Number ya simu (**sauti): 0702153114**

Anwani: **Thika Power Limited, P.O. Box 45931 – 00100, Nairobi.**

Sehemu ya kujibiana: **itawekwa katika kiingilio cha Mradi huu na itatumwa kwake bwana Paul Doumet**

Annex K

Review Comments on the Draft Final Report by Lenders and Independent Engineer, and Responses

Meeting minutes

Environmental Resources Management

Eaton House
Wallbrook Court
North Hinksey Lane
Oxford OX2 0QS
Telephone +44 (0)1865 384809
Facsimile +44 (0)1865 384848
Email eamonn.barrett@erm.com

ERM

Subject/Ref	Thika Power ESIA: Review of Lenders' comments and actions to finalise ESIA report
Venue	Telephone conference call
Date of Meeting	10th August 2011
Present	Nicholas Holdcroft (IFC) Richard Egobi (IFC) Harvey Van Veldhuizen (World Bank) Rhoda Mshana (African Development Bank) Sandra Gebhardt (African Development Bank) Rachel Aron (African Development Bank) Paulo Branco (ABSA) Franca Sandham (ABSA) Walter Rymarczyk (Sargent & Lundy) Andreas Szechowycz (Sargent & Lundy) Samer Nasr (Thika Power) Paul Doumet (Thika Power) Eamonn Barrett (ERM)
Distribution	Above and Mrs Siala Awatef Fourati (AfDB); copied to Annex in Final ESIA Report
Date	12th August 2011

	ACTION
Note: The conference call was convened to consider the comments on ERM's Draft ESIA (April 2011) for the proposed Thika Power Plant, Kenya. Comments had been received at various dates since issue of the draft from each of the lenders (IFC, World Bank, African Development Bank and ABSA Capital) and from Sargent and Lundy (the Lenders' Independent Engineers).	
1. After discussion on various points, the lenders indicated satisfaction with the ESIA, subject to the following actions being taken: ➢ ERM to supplement the Environmental and Social Management Plan to include indicative costs for the mitigations and management measures described therein, which will also meet African Development Bank's requirement for an Environmental and Social Action Plan (ESAP) to be included; ➢ ERM to include these minutes, the Lender' and Independent Engineer's comments, and Thika Power/ERM responses, in an Annex to the Final ESIA report; ➢ Text of the ESIA will be amended to reflect the ESIA finalisation process, including lenders' and independent engineers' comments, TPL responses, and subsequent discussion to arrive at consensus on the ESIA Final Report content.	ERM
2. ERM will then issue the final report, so that it may be disclosed as appropriate by the lenders to meet their respective procedural environmental and social due diligence requirements.	ERM/Lenders
3. Thika Power Limited will supply a copy of the international ESIA to NEMA, as a courtesy and for information.	TPL

IFC comments on Draft ESIA, MSD Power Plant, Thika, Kenya (April, 2011)

1. The World Bank's comments are endorsed and the comments below are provided in addition to those. Noted.
2. Clarity is required on the linkages between the ERM ESIA process and that associated with the local EIA i.e., what is / was the disclosure process for both, are stakeholders aware of the differing processes and the objective thereof, how was this explained to them, to what extent will the ESIA be used by the authorities in the decision making. See response to World Bank comment. Further to this, stakeholders were made aware at the time of consultation meetings for the international ESIA that this was a different, parallel process to the Kenyan EIA; the same was not done within the Kenyan EIA consultations, as these had been completed prior to the start of ERM's work to prepare the international ESIA.
3. The ESMP indicates that monitoring plans are to be compiled in accordance with the World Bank EHS Guidelines. However, clarity is required on the scope of these monitoring plans, specifically those related to air quality, environmental noise and ground water e.g., the extent / frequency of ambient air quality monitoring – construction and operational phases, which sensitive receptors will be targeted, similar for noise, proposed location of ground water monitoring boreholes. In ERM's experience (including with World Bank/IFC) this level of management plan detail would be expected during the follow-on work to complete the specific component management plans that will be contained within the overarching ESMP. Providing significant further detail at this stage was not possible due to the accelerated schedule for the ESIA's preparation, and the fact that in many instances further detail on ongoing design work will be required to finalize those component plans. As this level of detail is within the range of that we would normally expect to be acceptable to a lender at this stage, and given the client's commitment to develop and implement those plans, ERM feels that the overarching plans with outline of the components within them to be appropriate at this time.
4. The SEP provides no information on future engagement. Based on the findings of the ESIA, at a minimum a summary of the proposed approach should be defined. We are not clear on this comment: the SEP builds on engagement to date, and provides a robust framework within which future engagement will take place, also taking into account the grievance mechanism, etc. The "stakeholder engagement strategy" included within the SEP is consistent with the level of detail that we would usually expect to provide at this stage of a project's development: we do not feel it would be meaningful to set dates, times, formats, etc for future engagement – we feel this is best done by the person who will have responsibility for implementing the project SEP (ie the stakeholder/community liaison function) when they are appointed, to foster their "sense of ownership" of the stakeholder process. Thika may, of course, request external consultancy support to this person, and the SEP process, in the early stages.
5. No consultation has been undertaken with individuals engaged in agricultural practices on the plant's north-eastern boundary. Consultation with these individuals must be undertaken prior to construction and the structure thereof should be defined in the SEP. Groups containing some of these individuals was conducted within wider consultative groups, but they were not consulted as a group per se, due to the accelerated schedule and the timing of ESIA preparation with respect to planting seasons, etc (specifically, as those tending the plots were not present at the times of ERM's visits, which were determined to accommodate a range of needs relating to preparation of the ESIA within the timeframe agreed with Thika Power and the lenders). It would, of course, be possible to undertake specific consultation at a future date.

6. Confirmation is required of Thika's proposed approach to the management of environmental and OHS during the operational phase e.g., is the company planning to implement any certifiable management systems (e.g., ISO 14001, OHSAS 18001). If so, this should documented in the report. Thika Power will implement management systems which are aligned with the principles of ISO 14001 and OHSAS 18001.
7. The validity of using the met data from the airport for the air quality study should be qualified. The extent to which it is valid could have a bearing on the air quality monitoring program. See response to World Bank comment.

World Bank Comments on April 2011 Thika ESIA

Section 1.2: Are there any substantive differences between the EIA being prepared for the Kenya authorities, and the ESIA being prepared for IFIs? Will both be disclosed locally for consultation? We hoped this was clearly stated in our report. Unless TPL now plans otherwise, international ESIA will not be disclosed locally: there is no established mechanism/process to do so.

Section 1.6: Primary area of study is stated as a 2 km radius. How does this radius "fit" downwind with the modeled emissions plume (see Section 6.2.4 and Table 6.6 for indications)? 2 km was used as a rule of thumb on the ground, but of course any impacts further afield (eg emissions to air) were considered for the distance required to gain sufficient assurance that the potential impacts had been understood.

Section 2.2.7: Although the purpose of Chapter 2 is to recite the legislative framework and not necessarily provide a finding of compliance, I think on this particular issue it should be noted if the project is compatible with the District Development Plan. We have reviewed the DDP, and discussed the matter with the District Development Officer as an important stakeholder/consultee. In ERM's opinion, the project is compatible with plans for the development of the District. It should be noted that the changes in administrative structures that are currently being implemented slightly complicate matters, but there is no reason to suppose that this would affect the compatibility of the project with development plans/objectives.

Section 2.6: The Kenyan EIA process appears to be almost completed. Please provide here a summary of the consultation/disclosure process that was carried out for nearly completed EIA, and (as per Section 1.2), clarification of how the Kenyan EIA and ERM's ESIA for IFIs will be "integrated" into both public consultation and decisionmaking processes. Thika Power made the decision to issue separate contracts for a Kenyan consultancy and ERM to prepare the Kenyan EIA and international ESIA separately. ERM has to some extent drawn upon information presented in the Kenyan EIA (which slightly preceded ERM's work), and has provided a summary of the progress through the Kenyan process towards processing. There has, however, been no "integration" with respect to public consultation and decision-making. Please note that the ERM ESIA is to international standards and is in some respects more comprehensive than the EIA required under the Kenyan regulations (for example, NEMA did not require modelling of noise and air quality impacts to inform the impact assessment).

Section 3.6.1 (see also Section 6.2.1): How far away is the Nairobi airport (as the source of baseline meteorological data)? Are there significant topographic or other features that might question the validity of these data as reasonable baseline for the project site (or, the converse—are there good reasons for accepting these data as baseline for the project site)? Although ERM's air quality team considers data from Nairobi airport to be quite representative, and its use to be quite in keeping with international good practice in AQ modeling, they investigated the potential to use date from a closer source (ie Thika). These data were not of sufficient quality, coverage (of relevant parameters), nor did they provide the uninterrupted five-year time series which is required for robust AQ modeling.

Section 4.1.3: Are the existing boreholes tapping shallow groundwater, or deep? The following extract is taken from the Geocon Limited report prepared for Thika Power, which is referenced in Section 4.1.3:
"The average depths of the boreholes are in the order of 198.8m. with quite a huge range of striking depths, there are different penetrations of the aquifer zones, differences in geology and differences in the quality of borehole construction and completion.
A borehole drilled in the study area will have no interference as the other nearest location is more than 1 km away as discerned from the above table; borehole yields vary greatly.
The low yields depict poor construction works or inadequate penetration of the aquifers."

The eight boreholes mentioned in Section 4.1.3 as being within 5 km of the project site are at the following depths: 188m, 166m, 110m, 98m, 211m, 217m, 200m, and 245m (source:Geocon Limited report).

Section 6.2.1 (and Table 6.2): Does the project design have 65 m high stacks? Air quality modeling was performed using 65m stack height as an input parameter. The resulting assessment is based on this stack height.

Section 6.4.2: Need to state in the baseline that shallow aquifers have high salinity (ref. p. 6-38), and on what basis this is known. If it is highly saline, the risk assessment of contamination of this shallow aquifer needs to be adjusted accordingly. Noted: NB, also, that mitigation os alreadsy specified on p 6-38: "it is essential that the upper aquifers should be completely sealed during construction to prevent contamination of fresh water".

Section 6.4.3: What range of depth are the seven existing boreholes within 3 km of the power plant site? See above note that Section 4.1.3 specifies eight boreholes within 5 km.

Section 6.7.3: Recommend the use of directed lighting, to reduce level of off-site glare. Noted: this is in line with ERM's recommendations in the "landscape and visual" sections for the ESIA. We understand these will be taken into consideration by Thika Power during further detailed design work.

Section 7: **The only key gap I saw was the lack of preliminary cost estimates in the ESMP. (By key gap, I mean a missing piece of analysis that the Bank would need in order to disclose this as a DRAFT ESIA.)** The only cost info I saw in the ESMP for construction or operations was for the construction program, and that merely said (to paraphrase), "it will be included in the construction cost." For a Category A project, the Bank policy requires preliminary cost estimates for the ESMP for both construction and operations, even if only preliminary estimates. The purpose is to make sure that (a) there is a reality check between what the ESIA estimates and the construction contractor offers in the bid, and (b) operators (in the Bank's case, usually Government borrower) are able to budget in advance both as part of capex and O&M costs. This could be done, but apart from the comment that a number of costs will be included in construction costs (and are therefore expected to be part of contractors' commercial offers to Thika Power), we have not specified costs because we did not consider them to be a significant increment over and above the existing likely project costs.

ABSA Comments on the Thika Power Draft ESIA (April 2011)

Please find comments from ourselves on the ESIA with respect to the Thika project:

- The report is comprehensive and has the plans required to adress the identified risks. There is further comfort that the ESIA will meet AFDB (African Development Bank) and IFC (International Finance Corporation) standards. Noted.
- Page 1-4 states that the exact land division between KPLC and TPL has not been legally agreed as yet, and will be finalised in TPL's lease agreement for the Project site, expected to be signed in April 2011. Please will you enquire on the status of this agreement. Thila Power to provide update.
- The project is located in an area that, although predominantly agricultural, is considered by government authorities as suited to industrial development. Page 1-8 states that in August 2010 KPLC obtained a 'Change of User' approval from the County Council of Thika which states a re-designation from 'agricultural' to 'electrical substation' land classification. A further change to include "power station" as a permitted land use is in process. Please remember to ensure that the change of use permit has been obtained (this should be coverered in the required permits and licences covenant). Thila Power to provide update.
- Page 2-11 Although TPL have received an 'approved as noted' communication from NEMA providing an indication that it had no significant concerns with the project; TPL expected to receive official NEMA approval for the Project in April 2011. Please obtain confirmation of this approval. The normal covenants in terms of all the required licences and permits should cover this though. Thila Power to provide update.
- Page 3-9 Various limitations are shown on the social baseline data e.g potential groups that are not represented in the final data, focus on nearest communities (1-2km's), no engagement with local farmers downslope of the site. Although this is a concern, the Stakeholder Engagement Plan should address any issues that may arise. See response on IFC comments
- Various plans have been proposed by ERM e.g. Construction Management Plan , Traffic Management Plan etc. Please ensure that the contract includes the relevant covenants which ensure that TPL will implement the respective plans and provide feedback to lenders as appropriate. Thila Power to provide update.

Thika ESIA Draft Comments from Sargent & Lundy Consulting (supporting IFC)

Response to comments by Thika Power Limited (with support from ERM)

1. The ESIA indicates the land for the plant is in the process of being rezoned from 'electrical substation' use to 'power station' use. Has this rezoning been completed?

   Yes, by letter from Thika County Council of 2nd August 2011.

2. The MAN stack emissions for NOx reported in the technical specification exceeds the WB guidelines, 2,000 mg/Nm3 vs. 1,850 mg/Nm3

   The approach used by ERM in the ESIA is in accordance with the IFC General EHS Guideline, Section 1.1, page 4, which specifies that it is appropriate to assess potential AQ impacts by:
   "Applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources".
   As reported in the Draft ESIA (opening sentence of Section 6.2.2 – page 6-8):
   "The IFC has been consulted regarding the appropriate standards to be used in the assessment and has agreed that the primary standards to be used are the European Union (EU) air quality standards. In addition, consideration will be made of the draft Kenyan air quality standards; however, it is acknowledged that these are in draft format and are not yet legally binding within Kenya."

   Table 6.8 *(Summary of Impacts due to Process Emissions)* indicated that the emissions as modelled are insignificant with respect to both EU and draft Kenyan standards.

3. The ESIA indicates that the baseline air quality date was 'limited in scope and quality' and concludes that 'there are likely to be only low concentrations' of SO2 and NOx. However, the 'limited' maximum one hour baseline SO2 was 644 ug/m3 vs. and EU standard of 200, and a one hour baseline NOx concentration of 448 ug/m3 vs an EU standard of 350

   A review of baseline data was undertaken and detailed within the ESIA. The review identified that there was extremely limited local baseline information and that the data that were identified were not suitable for use due to doubts around the validity of the monitoring techniques that were utilised and the monitoring locations that were selected. Instead a qualitative assessment of the potential baseline conditions was made within the assessment, with due considerations of the local sources of emissions around the development site, these being primarily emissions from traffic using the road. On this basis, the data presented in the query above do not appear to be feasible for the vicinity of the Thika development site, due to the small number of emission sources in the locality, and ERM is of the opinion that it is inappropriate to use baseline air pollution concentrations which are so unfeasibly elevated.

   For comparison, in the review of baseline, data on SO2 concentrations in industrial areas in Nairobi were identified:
   In Ref. 1 SO2 concentrations of 175 µg/m3 were identified (minimum 24.4µg/m3)

In Ref. 2 SO_2 concentrations of 85 μg/m3 were identified
In Ref. 3 NOx concentrations of 159μg/m3 were identified at a heavily congested roadside site adjacent to a major junction

The concentrations identified in industrial areas and immediately adjacent to heavily congested roadside sites from Nairobi, suggest that the baseline data identified above are entirely unrepresentative of conditions in the vicinity of Thika where there are no industrial emissions, a single road source and a small number of other emission sources.

Ref. 1: Kollikho, Pius Wamaketa (1997) Sulphur dioxide measurements in Nairobi http://www.researchkenya.org/?ID=2811&search=Makadara%2C+Nairobi%2C+Kenya
Ref. 2: Wafula, Godfrey Angoe (1999) Measurement of some air pollutants in selected areas of Nairobi and its environs, and in selected industrial sites http://www.researchkenya.org/?ID=5215&search=Pollutants
Ref. 3: Odhiambo G. et al.(2010) Motor Vehicle Air Pollution in Nairobi, Kenya Research Journal of Environmental and Earth Sciences 2(4)

4. Calculated air quality impacts are for the TPL plant only. Cumulative impacts with the baseline levels was not addressed

   Quantitative cumulative impacts were not addressed as the baseline data were considered to be particularly poor and not representative of local conditions (see response to previous comment). However, the predicted impacts of the emissions from the proposed plant allowed a substantial 'headroom' between the Process Contribution and the air quality standards to allow for the existing baseline. On this basis, whilst the baseline was not quantitatively identified and included in the assessment, the plant design parameters were set such that there was sufficient headroom allowed to take into account a reasonable baseline.

5. No quantitative analysis of construction-phase air quality impacts was presented, only qualitative arguments. Page 4-8 states that baseline concentrations of PM are expected to be elevated. In spite of this, the ESIA states that no significant impacts are expected. The EPC contractor is expected to use watering for dust mitigation and control of offsite releases.

   It is not clear what kind of quantitative analysis of construction impacts is being suggested, as temporary construction dust emissions are most commonly assessed in qualitative terms in ESIAs. In any case, although dust emissions will inevitably arise as in any construction project, they were assessed as having a negligible impact with correct implementation of the mitigation measures as outlined in the ESIA. Within the ESIA, commitment is made to a number of measures including the use of watering where required on site to mitigate dust emissions, and cleaning of off-site highway surfaces where required.

6. The primary source of water for the project will be onsite wells. The ESIA indicates that municipal water is a contingency plan, but does not address the adequacy of the municipal system.

Under Section 5.9 *Analysis of Alternatives*, Section 5.9.3 (*Piped Water)* summarises the potential limitations if the Project were to engage with the municipal authority on the use of municipal supplies. Given the information available, it is anticipated that the Project will be able to use groundwater and therefore further assessment of the municipal system's adequacy will not be necessary.

7. The ESMP indicates that 'it is likely that temporary drainage channels will be created and divert surface water away from the TPL site, away from the down slope agricultural plots'. S&L has not seen any plans for water discharge control, retention and testing

   At the time of drafting the ESIA, no formal plans existed in relation to site drainage. Annex A (*Construction Management Plan)* details the requirements for construction of site drainage measures to be developed and finalised by TPL and the EPC contractor prior to construction, as part of the full and final Construction Management Plan. As indicated in the ESMP section of the ESIA document, this is a process that TPL plans to undertake in collaboration with KPLC with a view to ensuring that the best site drainage solutions are put in place for the whole site.

8. The noise level at the sensitive receptors due to plant operation is reported to 55dBA. This exceeds the Kenyan noise limits for residential areas (day and night) and the night time for commercial areas. No noise level data at the plant fence line was reported.

   The purpose of the noise impact assessment is to establish the location of the nearest noise sensitive receptors and to predict a significant noise impact at these locations. Since there are no properties on the boundary of the site, the site boundary is not a noise sensitive receptor. Therefore, noise level baseline data were collected at the nearest noise sensitive receptor to the site rather than at the site boundary in order to provide a more accurate basis for understanding the current noise levels at this receptor.

   Section 6.3.2 of the ESIA provides a rationale for the approach adopted for predicting significant noise impacts in light of the difference between the IFC and Kenyan standards. We understand that the levels set out in Kenyan standards are viewed by Kenyan regulators as a threshold of potential noise impacts above which further liaison is required with the local regulators rather than them being absolute limits on a development. This is compatible with the noise levels being set to extremely low levels compared to other standards, and this approach has been confirmed by Kenyan noise consultants, who were engaged by TPL (according to a brief prepared by ERM) to collect baseline data for use by ERM in the impact assessment. Also, the standards do not take into account the ambient noise, which is, in our professional view, an important factor in determining if a particular noise level will result in a noise impact. This section also outlines proposed mitigation measures and commitments by TPL which should result in a residual impact of minor significance.

9. The ESIA indicates that oily sludge will be disposed of offsite by licensed contractors. However, the contractors and appropriate disposal sludge is not confirmed.

   At the time of drafting the ESIA, the contractor for sludge disposal had not been finalised. Section 5.1.6 (Overview of Emissions & Wastes) stated that:
   'For sludge disposal, TPL is currently in discussion with a licensed contractor that undertakes sludge disposal for another HFO power plant in Kenya'.

   It is most commonly the case that at the time of preparation of an ESIA these types of waste disposal contracts have not been finalised. TPL has already provided a profile of the potential contractor, which is licensed under the relevant Kenyan regulations and, as stated in the ESIA and reproduced above, this contractor is already providing sludge disposal services for a similar power plant in Kenya.

10. The ESIA indicates that sewage will be disposed of during construction in septic tanks. It is not clear if this disposal method will be used during operation, or if municipal sewers will be used

    Section 5.1.6 (Overview of Emissions & Wastes) confirms that the same method of disposal for both construction and operation:
    'Domestic effluent from temporary facilities during construction (e.g. toilets) and permanent facilities during operation (i.e. toilets, showers, kitchen, etc.) will be collected and contained in a septic tank on site: a temporary one during construction, which will be replaced by a permanent one for operation.'

11. The adequacy of the bridges on the highways between Mombasa and the TPL site for transport of the MAN engines has not been addressed.

    Section 6.5 (Traffic & Transport) makes reference to the work commissioned by TPL entitled 'Bridges along various routes Mombasa to Thika, Inception report' undertaken by Terms Kenya Limited and Union Logistics Limited dated January 2011, and provides a summary of the report findings. We believe that this is as much information as would normally be expected to be provided in the ESIA report; further relevant information on the bridge assessment has already been provided to S&L by TPL. As is also reported in the ESIA (Page 6-57):
    "The specific mitigation measures proposed [in the final transport routing study] *will be presented to the Highway Authority for consideration during the process to secure a Transport Permit."*

12. The design of the highway turn off for fuel trucks need to be addressed. This also applies during construction for the delivery of equipment.

    TPL has already provided further information and drawings for the highway intersection to S&L. No additional modification of the current highway upgrading, or additional permit, will be required for TPL site traffic to enter or leave the public road to reach the site access road.

    The information presented in the ESIA is of the appropriate level for the assessment, and was considered sufficient for ERM to conclude that after deployment of the mitigation measures described (many of which relate directly to ensuring road safety) there will be only minor negative residual traffic and transport impacts.

Thika Power Limited
9th August 2011.

Annex L

Reference List

ANNEX L: REFERENCE LIST

AP-42 Section 1.3; Compilation of Air Pollutant Emission Factors, United States Environmental Protection Agency, 2010

AP-42 Section 13.2; United States Environmental Protection Agency 1995 Authorisation to Construct Works for the Use of Water, WRMA/30/KBU/3CB/10135/G, dated 3rd March 2011

Bridges along Various Routes Mombasa to Thika. Inception Report, Terms Kenya Limited and Union Logistics Limited., January 2011.

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Environmental Impact Assessment Study for the Proposed 80MW Thermal Power Plant at Thika, Enviroplan & Management Consultants, December 2010

Environmental Noise Assessment Report Proposed Thika Power Plant, SGS Kenya Limited, February 2011

Guidelines for Landscape and Visual Impact Assessment:2nd Edition; The Landscape Institute and Institute of Environmental Management and Assessment; 2002

Guidelines for the Assessment of Road Traffic; Institute of Environmental Assessment (IEA); 1993

http://databank.worldbank.org/ddp/home.do?Step=2&id=4&DisplayAggregation=N&SdmxSupported=Y&CNO=2 ; (World Bank Group Development Indicators & Global Development Finance databank)

http://safaricom.co.ke/foundation/fileadmin/template/main/downloads/Kenya_VISION_2030-final_report-October_2007.pdf ; (Kenya Vision 2030, Government of the Republic of Kenya, 2007)

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Mulaku and Kariuki (2001) Mapping And Analysis Of Air Pollution In Nairobi, Kenya International Conference on Spatial Information for Sustainable Development Nairobi, Kenya 2–5 October 2001

Nyatwang'a et al., 2010

Odhiambo, Kinyua, Gatebe and Awange (2010) Motor vehicles air pollution in Nairobi, Kenya Research Journal of Environmental and Earth Sciences 2(4)

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