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Environmental Impact Assessment Study for the Proposed Construction of the New 400/220KV Isang Substation

TRANS-AFRICA PROJECTS

consulting

ENVIRONMENTAL IMPACT STATEMENT

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EXECUTIVE SUMMARY

Introduction

The proposed Isang substation project is located in the Kgatleng District, between the villages of Malotwana and Artesia along the main Gaborone to Francistown road. The proponent for the project is Trans Africa Projects / KEC on behalf of the Botswana Power Corporation (BPC), hereafter referred to as "the client" or BPC. The proposed site is located approximately 10 kilometres north of Malotwana village, and is situated in between two existing 220kV overhead power lines and the A1 road. Other developments in the area includes a railway line, an underground water pipe, a cellular phone tower and three boreholes for feeding cattle.

Methodology

The.commencement of the Isang substation project EIA began with a Preliminary Environmental Impact Assessment, submitted to the Department of Environmental Affairs (DEA) in November 2008, and correspondence in response to the document was received from DEA in December 2008, requiring a full EIA to be carried out for the project.

In compliance with the EIA Act of 2005, a scoping study was then carried out by Loci Environmental, the result of which formed the project's Environmental Terms of Reference, in order to identify the relevant Key Lines of Enquiry and pertinent issues to be included in the project EIA.

Receiving Environment and Impacts

The proposed Isang site is located in the Kgatleng District, and the distance from the district primary centre Mochudi is approximately 40 kilometres. The site is at an altitude of approximately 960 mamsl, the land is characterized by general flatness. The proposed substation site has a slope of 0 to 3%, with more than half of the site at a slope of 0 to 1%.

The hydrology at the site shows very poor aquifer characteristics due to un-fractured rock layers, ground water must therefore be considered as a valuable resource. The ground water in the study area is classified as low vulnerable.

The soils at the site are expected to be stable for construction purposes. The geology is classified at Luvic Arenosols and metamorphic rocks, which is characterized by a lack of moisture-holding capabilities. The area has 20 to 50 centimetres of top layer soils, which is sufficient for medium tree species such as *Acacia* spp.

The project area is also characterized by a number of already completed developments, including two 220kV overhead power lines, the main Gaborone to Francistown A1 road, an underground water pipeline, a railway line and three boreholes.

Objectives of the EIA

The purpose and objectives of the EIA include the following, as set forth by the DEA:

- To identify and evaluate the environmental effects, which will be caused by the proposed development.
- To examine the environmental effects of site specific or alternative development proposals for the site to be developed.

- To identify and describe procedures and measures that will mitigate the predicted adverse impacts of the development proposals, and measures that enhance the beneficial effects of the proposed activities.
- To liaise with key interested and affected parties and relevant government departments on issues relating to the proposed development to ensure compliance to existing policies, guidelines, regulations (bye-laws) and accommodate public views.
- Undertake an archaeological impact assessment.
- Develop an environmental management and monitoring plan.

Environmental Background of the Project

Prior to embarking upon this Environmental Impact Assessment, as per the EIA Act of 2005, Loci (on behalf of the client) completed and submitted a PEIA to the DEA for review. The PEIA also serves as an introduction to the project, and is considered to be a screening[1] exercise for the project. The PEIA was submitted in November 2008, and correspondence in response to the document was received from the DEA in December 2008 (DEA reference DEA/BOD 7/9 XLII (43) see Appendix A). The next step in the process was to undertake a scoping exercise and complete the environmental Terms of Reference (ToR), phase of the EIA process, as specified by the EIA Act.

Scoping is an essential part of the preparation of an EIA as it ensures that all potential and important significant impacts on the receiving environment are taken into account whilst eliminating those that are not at the earliest possible time. Scoping by its very nature will evolve with the project as design changes are made and more detailed information on environmental issues and design comes to hand. However, as an early stage tool it provides relevant information on the most important potential impacts of the project, which will be necessary to address in the EIA. The results of scoping done at this early phase of the project were submitted to the DEA in the form of the environmental ToR.

A draft environmental ToR and scoping document was submitted to the DEA on 16th March 2009 for review. The document is included herein, in Appendix B. The document includes details about the methodologies followed during the EIA process as well as specialist sections which will be included in the EIS, and the proposed personnel undertaking the specialist studies. The environmental ToR and scoping document was reviewed and subsequently approved by DEA (reference DEA/BOD 7/9 XLV I (110) dated the 29th March 2009. A copy of the approval letter has been included in Appendix B.

Environmental Parameters Identified by TOR

In order to ensure that a comprehensive assessment of the relevant bio-physical and socio-economic components making up the environment was performed, the following specialist investigations were conducted, stemming from the results of the Scoping and Terms of Reference phase of this EIA. Following the list below, are brief summaries of the existing environmental characteristics, potential impacts and mitigation measures identified within the EIA:

Specialist Investigations Carried Out

Environmental Parameter	Consultant and/or Consultancy	Relevant Qualifications
Ecology	Jeremy Burgess	MSc in Ecology and rangeland resources
Landscape and Visual	Jill R. Westra	BSc Geography, MSc Environment and Society
Archaeology	Princess P. Sekgarametso-Modikwa	BA Archaeology

[1] A process used to determine whether the project should be subject to the undertaking and completion of an EIA.

Environmental Engineering	Johannes Westra	MSc Eng.
Environmental Health and Safety	Jill R. Westra	MSc (cand.) Environmental Health and Safety
Electrical Engineering	Ron Coney, KEC	Pr.Eng. C.Eng. FSAIEE FIET GCC(F) GCC(M&W)

General Environment

A number of general environmental issues were considered during the assessment for the Isang substation. The impacts were assessed by visual observations, analysis of design details, and literature available. Due to the fact that the receptors are at relatively far distance from the site, minimal impacts were expected, and these aspects are assessed and described as general environmental impacts.

The general environmental issues identified include noise, air quality, water resources, waste and safety impacts caused by the construction and operation of the substation. Many of the existing environmental problems are caused by the road, railway and overhead power lines.

The construction of the Isang substation is expected to cause a number of negative impacts related to the above subjects. Particularly during the construction period, such negative impacts can be expected. The construction activities are expected to create noise and dust. Additional extraction of water from one of the boreholes near the site for construction purposes may also negatively impact the shallow boreholes near the site, by reducing their water yields. The safety on the A1 road will be negatively impacted by construction traffic entering and exiting the road.

The noise, air quality and waste impacts can be mitigated by implementation of mitigation measures such as maintenance, implementation of speed limits, watering for dust suppression, and collection and recycling of waste. The impact on the water table can only be mitigated by compensation of the borehole owners. It is unknown how deep the boreholes are drilled, and it can not be predicted if the boreholes will ultimately be impacted. It is recommended that the boreholes will be tested for yield and quality of water before commencement of the construction.

The safety on the main A1 road is negatively impacted during the construction period. The speed limit at the site entrance is 120km per hour, and it is recommended that in conjunction with the Roads Department, the speed limit will be reduced for the duration of the construction period. Warning signage must be placed along the road to alert the road users of the construction traffic at the site.

The predicted impacts during the operational phase are limited, it is not expected that noise, air quality or water resources related problems or impacts will be yielded on any sensitive receptors. It is recommended that the client implements a separation and recycling programme for the waste on site. Safety procedures must be implemented for on site maintenance activities.

Ecology

A specialist flora and fauna study has been undertaken for this project. During the study specific attention has been paid to pests and pest control. The existing environment was assessed based on available literature, followed by a site visit and survey.

The vegetation and flora of the area is primarily a mixed broad-leaf and *microphyllous* type bush savanna. According to Timberlake (1980) the vegetation comprises major vegetation type zones labelled A2, A5 and D3. The dispersal of the trees and shrubs is as follows:

- Isolated tall trees of 4-6m height spaced at 50-100m
- Shorter trees of 3-4m height generally clumped 10-20m apart.
- Shrubs of 1-3m height clumped microphyllous species with space between nearby shrubs 1-15m away, and broadleaved species with nearest neighbour 1-10m away.

There are no rare or endangered plant species known to occur or identified during the site data collection exercise.

Approximately 250 species of bird may be expected to occur in the project area. One species, the Cape Vulture (*Gyps coprotheres*), is considered threatened by IUCN. All other species either occur broadly within Botswana or are marginal to the eastern hardveld while being widespread elsewhere. Most are common in appropriate habitats. (Source: EIA North South Carrier, 1996).

The proximity of the main road and the manned cellular phone network tower site are likely to discourage the presence of large wild animals. The species of herbivores or large mammals that can be expected at the site area do not include any protected or endangered species. Small mammals that may be found in the area include scrub hares (*Lepus saxatilis*), ground squirrels (*Xerus inauris*) and tree squirrels (*Paraxerus cepapi*), as well as several rodent species. One species, the South African hedgehog (*Aterelix frontalis*), is listed as rare by the IUCN. Several species of lizards, snakes, and tortoises are found in the area, none listed on the IUCN Red Data List.

The impacts during the construction period include the loss of grazing area and habitat, due to the vegetation clearance at the site. Other impacts predicted include fire risks, potential spread of lifestock diseases, littering and impacts from the fencing on the cattle. Operational phase impacts on the flora and fauna are limited to spills, littering and fire risks.

A number of pests can occur during the construction and operational phase of the project. The pests can include herbaceous weeds, rodents, feral cats, birds nesting and monkeys. The pests can be mitigated by regular (monthly) maintenance and inspections, including removal of weeds and removal of bird's nests. Other mitigation measures include design considerations such as overlying conduit trenches, lighting, structures that discourage birds nests and distances between structures that discourage monkeys from climbing across.

After implementation of the mitigation measures the only residual impact predicted is the loss of vegetation.

Archaeology

An archaeological report was undertaken to present the findings of an archaeological assessment survey that was conducted at Isang substation, to the National Museum and Art Gallery, as required by the Relics and Monuments Act of Botswana.

Nothing of archaeological significance was found during this survey. However, the absence of archaeological material on the surface of some areas does not mean that they are unlikely to encounter during development when the area is excavated.

It is advised that no excavations should be done before an inspection of the area was undertaken as after vegetation clearance. An archaeologist should be on site during soil stripping and the clearing process to provide professional advice on how to handle any inadvertent archaeological discoveries.

The project contractors must be inducted on the significance of archaeological resources that might be destroyed during the course of the project. The induction is essential to sensitize the contractors on the identification of archaeological materials, their significance and the importance of reporting such material to the relevant experts. The course is essential and should precede the construction stage. Archaeological material in this area is especially precious, as little archaeological research has been done.

The contractors must keep a watching brief, and should anything of archaeological significance be found they should immediately inform the Botswana National Museum, as is required under the Monuments and Relics Act 2001. They should also be reminded that a development permit must be obtained (either by them or the developer) prior to any clearing or construction taking place.

All the above measures would be done to meet the requirements of the Monuments and Relics Act (as amended, 2001) of the laws of Botswana. This act protects all archaeological and or historic monuments and sites in the country whether they are recorded in the National Museum site register or not. The Act also recommends that upon encountering archaeological material, relevant authorities should be informed. Section 18 prohibits any alteration, damage or removal from original site any national monument, relic or recent artifact. The act also recognizes the fact that the alteration, damage or removal of monuments and relics may be occasioned through authentic developments. Section 19, therefore, provides for predevelopment archaeological impact assessment and mitigation where planned developments are likely to disturb the earth's surface.

Landscape and visual

The site proposed to be developed for the Isang substation is currently situated within a landscape that includes undisturbed lands (within the proposed site boundaries), and a semi-disturbed landscape within the general study area. This study area is one that includes some scattered masimo lands, as well as a large Orange cell phone tower, existing power lines, the A1 highway, and the Gaborone-Francistown railway line.

The individual landscape and visual impacts of the proposed Isang substation range from negligible to slightly negative, with the overall residual impact of the project expected to be slightly negative. The sensitivity of the visual receptors expected to be impacted is low, as this is largely confined to traffic moving at high speeds along the A1 road, or train passengers.

The most significant impacts predicted to occur over the life of the substation are of a cumulative nature, considering the fact that future development not related to this particular EIA will incur a number of large-scale power lines entering and exiting the substation site, which in terms of size, scale, and associated bush clearance, will be substantially more visible than the substation itself.

Socio-Economic Environment

For the socio economic environment for the proposed project, available data for the closest villages Artesia and Malotwana have been analysed. In addition this, details and statistics for the overall Kgatleng District have been considered in the assessment.

There are no residences located on or near the site, the nearest seasonal residences are at the cattle posts, which are located nearly 1 kilometre distance from the proposed site. The nearest villages to the site are Malotwana and Artesia, at a distance of approximately 10 kilometres.

The land use around the proposed site is characterized by cattle farming. Arable farming is taking place in the district, but is done closed to the villages. The nearest villages of Malotwana and Artesia offer a number of social facilities, including a clinic, primary schools, tribal courts, local police and churches. Both villages offer water reticulation and power connections, although many plots do not appear to be connected. The villages both lack a sewerage system, and rely on septic tanks and pit

latrines for disposal of human waste. The primary centre Mochudi offers a variety of additional services, including the district offices and primary hospital.

Existing social problems in the district include unemployment, lack of sanitation facilities, high rates of HIV/AIDS infection and increasing number of orphans. The statistics available suggest that the social problems in the District follow national trends.

The project is expected create the most significant impacts on the nearest villages on Malotwana and Artesia during the construction phase. The nature of the impacts depends on whether the contractor will accommodate the staff at a camp on the construction site, or in housing in a nearby village. The impacts expected during construction period include creation of employment, increased development and economic activity. The influx of workers may create increase risks of spreading HIV/AIDS.

The local socio economic impacts caused by the project are considered negligible during the operational phase. However, the improved power supply and reliability of electricity to the Gaborone area is expected to positively impact economic development. Such development may cause population growth.

Mitigation measures suggested include local hiring, the use of labour intensive methods of vegetation clearance, and extensive HIV/AIDS education and training. The only residual socio economic positive impact is the expected increased development in the Gaborone area due to the improved power supply.

Environmental Management

An Environmental Management Plan (EMP) and Monitoring Plan have been written for this project, guided by standards received from the Department of Environmental Affairs. These plans identify the potential impacts raised by the EIA, the mitigation measures which correspond to each, and actions to be taken to the various parties assigned to management and monitoring duties.

Successful management of the predicted environmental impacts can only be achieved when the mitigation measures will be implemented fully. Regular evaluation, monitoring and coordination is required for effective management. Clear environmental responsibilities have been outlined within this report to assist the environmental management process.

Conclusion

During this EIA process Loci Environmental has conducted a thorough investigation of the proposed Isang substation project. No fatal flaws have been encountered for the substation development and associated infrastructure on any of the bio-physical or socio-economic environmental aspects investigated.

The project will result in both positive and negative impacts for the local environment. Positive impacts can be expected in the socio-economic field, and by implementing the mitigation measures the impacts can be maximised. Negative impacts are expected in some of the bio-physical environment fields, with most severe impacts expected in the ecology and socio-economic fields. By full implementation of the mitigation measures outlined in the report, it is predicted the impacts can be suitably managed.

As the Isang substation project is expected to have an operational life of at least 25 years, it can be assumed that aspects, equipment and processes of the project will change during the operational lifetime, compared to the plans and designs at the time this EIA study was undertaken. In addition to this, technical provisions have already been made for future extensions of the substation. It is

therefore recommended that the EMP will be updated as the project develops during the operational phase. Updated documents and plans must be submitted to the relevant authorities.

The EMP and monitoring plan must be reviewed on a regular basis during the construction and operational phase of the project. Review of these plans ensures that they are updated, and they are effective and efficient in managing the environmental concerns during the project.

It is Loci's recommendation that environmental approval of the Isang substation project (including the access road infrastructure) will be granted to Botswana Power Corporation, permitting that the EMP and monitoring plans will be fully implemented.

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ABBREVIATION LIST

AIA	Archaeological Impact Assessment
BDF	Botswana Defence Force
BLDC	Botswana Livestock Development Corporation
BPC	Botswana Power Corporation
CSO	Central Statistics Office (Botswana)
DEA	Department of Environmental Affairs
DEIS	Draft Environmental Impact Statement
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
GIS	Geographic Information Systems
PEIA	Preliminary Environmental Impact Assessment
SHE	Safety, Health and Environment
TAP	Trans-Africa Projects (Limited) Midrand, South Africa
ToR	Terms of Reference
UK	United Kingdom
VDC	Village Development Committee
WUC	Water Utilities Corporation

LIST OF SYMBOLS

m^3	Cubic Metre
°C	Degrees Celsius/Centigrade
Km	Kilometre
Kv	Kilovolt
m	Metre
mm	Millimetre
MW	Megawatt

1 INTRODUCTION

This document refers to the proposed development of a new substation in an area called Isang, in the Kgatleng District. The proponent of this project, Botswana Power Corporation (hereafter referred to as "BPC" or "The Client" has appointed the engineering consultants Trans-Africa Projects in association with KE Consulting (KEC) to undertake the engineering designs for the project whilst the services of Loci Environmental (Pty) Ltd were procured to carry out an Environmental Impact Assessment (EIA) study for the project.

The proposed substation will be located in an undeveloped area of the country known as Isang, which is located in between the Malotwane and Artesia villages, on the Gaborone – Francistown A1 road. Figure 1.1 and 1,2 below show the geographical location of the study area within Botswana and within Southern Africa.

The undeveloped Isang area was once recognized by the title 'Isang's ranch'. The area has a historic significance. Historic story is that the area was to be provided with a railway station on the Lobatse to Rhodesia line, during the construction of this line. The station was intended for the local chief to be able to stop and inspect his cattle on the fields in the Isang area.

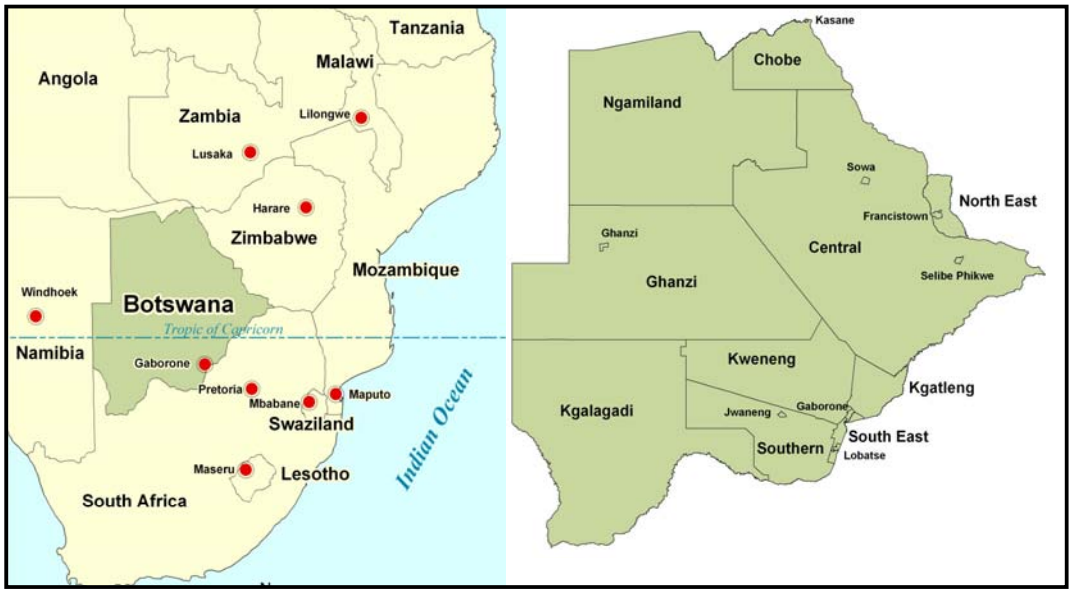


Figure 1.1 Locality Map of Botswana, Central District

Kgatleng is one of the districts of Botswana, coterminous with the homeland of the Bakgatla people. The Kgatleng Distict is one of the smaller districts in Botswana, with an area of 7,960 out of Botswana's total size of 582,000 km^2. In the south, Kgatleng borders the North West Province of South Africa, and to the east it borders South Africa's Limpopo Province. Domestically, it borders the following districts:

- South-East District – south west
- Kweneng District - west
- Central District - north

The capital of the district is Mochudi, and according to the 2001 Census the population of the Kgatleng District was 73,507 people. The Kgatleng District is not divided up into sub-districts, as most other districts on Botswana are.

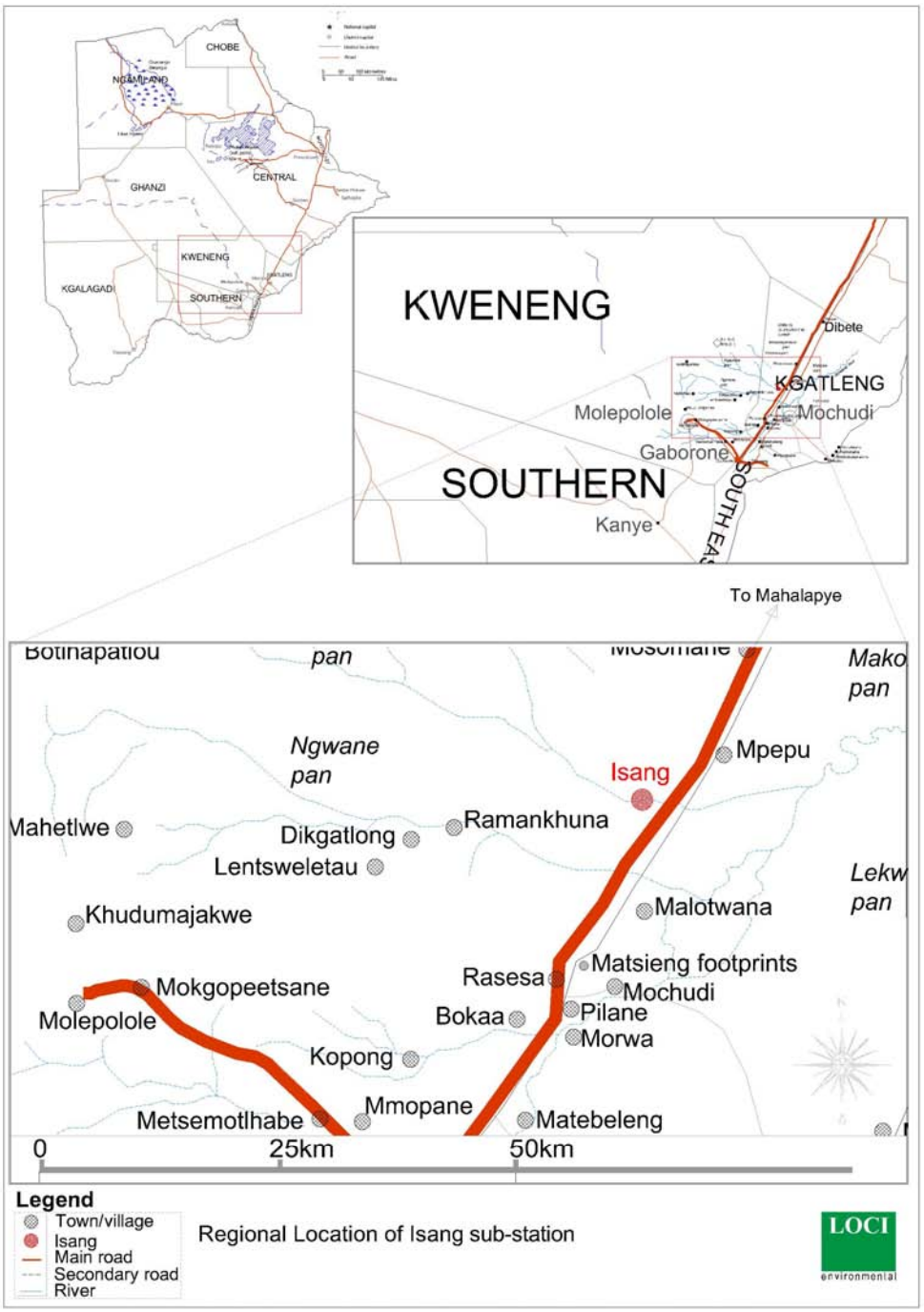


Figure 1.2 Locality Map of Study Area

While the Isang area is characterized by cattle farming, there are few residences in the Isang area, and none are on or around the proposed site. The cattle posts in the area are generally owned by people living in Mochudi, Malotwana, Artesia and Gaborone. The area was traditionally known for cattle farming, and its close proximity to the Gaborone – Mahalapye railway line made transport of cattle easy. In recent years the area has seen a number of new infrastructure developments, and

Isang is now the location of high voltage overhead power lines, the main Gaborone to Francistown A1 road, a railway line, a cellphone tower, and a number of small trasmission lines, boreholes and fencing.

The exact location of the proposed substation, in comparison to the surrounding infrastructure, has been shown on Figure 1.3 below.

Figure 1.3 Exact Isang substation location (Source: Google Earth)

The distance from both Malotwana village (to the south) and Artesia village (to the north) from the proposed site is approximately 10 kilometres. The proposed site for the substation is located in between the A1 Gaborone to Francistown road and two existing 220kV BPC power lines located parallel to the west of the proposed site. A newly constructed cell phone tower is located between the proposed site and the A1 road.

An outline of the site and geographical coordinates for the proposed Isang substation as shown in Table 1.1 below

Table 1.1: GPS coordinates of Isang substation site

Point	X	Y
A	+77888.59	+2672175.60
B	+77393.52	+2672415.09
C	+77785.60	+2673225.28
D	+78280.67	+2672985.85

The area for the proposed substation has been surveyed by the design engineers, and the location has been agreed upon between BPC and the land board. After approval of the project EIA the plot will be allocated to BPC for implementation of the project.

1.1 THE PROPONENT, IN BRIEF

The Botswana Power Corporation is the government-owned Utilities Company in Botswana responsible for the management of the generation and power supply network. The only currently operating power generation facility in Botswana is the Morupule power station, which produces approximately 30% of the total Botswana power demand. The remaining 70% of the power is being imported from neighbouring countries, mainly from Eskom in South Africa.

The Botswana Power grid consists of a large number of high voltage transmission lines, distribution lines, substations and transformers across Botswana. BPC operates and maintains this network of power infrastructure. In addition to the power transmission and distribution network, BPC is also responsible for the installation, maintenance and administration of individual connections in Botswana. Figure 1.4 below shows the currently installed power grid in Botswana.

Because of the continuously increasing power demand in Botswana, BPC have planned a large number of expansion projects. On the power generation side the BPC operated Morupule power station B extension is constructed at time of writing, and a number of privately owned and operated power stations are planned, including the proposed Mmamabula power station development by CIC Energy. After completion of these power stations Botswana will no longer need to rely on power supply from neighbouring countries, it will instead become a power exporting country.

The development of the new power generation facilities, combined with increased demand and village electrification projects has resulted in a number of proposed transmission and distribution projects and upgrades. The proposed Isang substation project as assessed within this study, forms part of this expansion for the power grid.

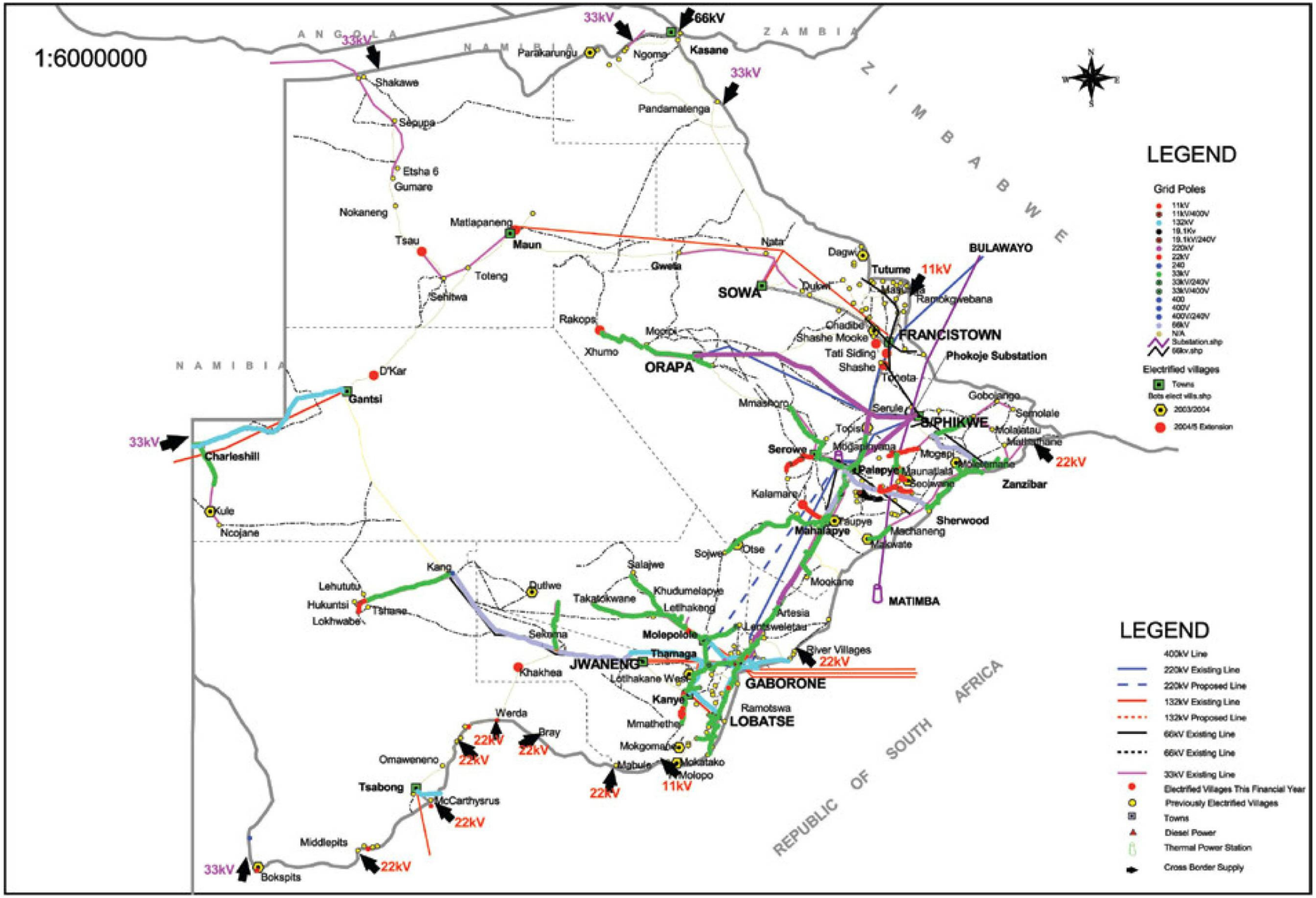


Figure 1.4 Power grid in Botswana

2 PROJECT BACKGROUND

This chapter provides a brief technical and environmental background about the project. A full technical description of the proposed project will be provided in Chapter 4. Further environmental details will be provided in the chapters following Chapter 4.

2.1 TECHNICAL BACKGROUND

In the introduction (Chapter 1) it was explained that BPC is currently undertaking a number of expansion projects, on both the power generation and power transmission side of their operations. The Isang substation project is directly related to both the Morupule B power station expansion and the future Mmamabula power station project. The substation is required to distribute the additional power generated, to power demand centres in and around the Gaborone area. The overall distribution will also require the development of a number of power lines, in addition to the development of the Isang substation. These power lines however do not form part of the scope assessed within the current study, and have been or will be assessed in separate environmental studies.

The two existing 220kV power lines situated adjacent to the proposed substation site, will be connected with the new substation as part of the current project scope. A new 400kV line will be connected to the substation, originating from the Morupule power station. The power line as already been designed as part of a separate project, and the EIA for the power line construction has been approved by DEA (Digby Wells and Associates, 2007).

The substation will be designed to accommodate future power lines coming in from the Mmamabula power station. The substation has also accommodated for future power lines to Gaborone and other areas where power demand will increase.

The proposed substation is envisaged to be the largest in Botswana in terms of dimensions. It will require a land size of 49.5ha for current and future developments. Currently, the proposed position of the substation is characterized by vegetation and an existing electrical transmitter linked to the existing 220kV lines. BPC has already been allocated an area of 4ha for this transmitter; this allocated plot will form part of the plot for the proposed substation.

The new substation plot has outer dimensions of 900 x 550 metres. This plot will include for the future expansions and feeder bays for new power lines. The outer perimeter will be fenced, but a much smaller area “inner” within the plot of 635 x 378 metres will be used for the construction of the proposed substation.

2.2 ENVIRONMENTAL BACKGROUND

Prior to embarking upon this Environmental Impact Assessment, as per the EIA Act of 2005, a Preliminary Environmental Impact Assessment (PEIA) was completed and submitted to the Department of Environmental Affairs (DEA) for review. The PEIA also serves as an introduction to the project, and is considered to be a screening[2] exercise for the project. The PEIA was submitted in November 2008, and correspondence in response to the document was received from the DEA in December 2008 (reference DEA/BOD 7/9 XLII (43) see Appendix A). The next step in the process was to undertake a scoping exercise and complete the environmental Terms of Reference (ToR), phase of the EIA process, as specified by the EIA Act.

[2] A process used to determine whether the project should be subject to the undertaking and completion of an EIA.

Scoping is an essential part of the preparation of an EIA as it ensures that all potential and important significant impacts on the receiving environment are taken into account whilst eliminating those that are not at the earliest possible time. Scoping by its very nature will evolve with the project as design changes are made and more detailed information on environmental issues and design comes to hand. However, as an early stage tool it provides relevant information on the most important potential impacts of the project, which will be necessary to address in the EIA. The results of scoping done at this early phase of the project were submitted to the DEA in the form of the environmental ToR and scoping document.

The environmental ToR and scoping document for the EIA study must be approved by the DEA, in order to provide certainty for the DEA and other stakeholders that the important issues will be addressed to the depth needed. The document also ensures the proponent that no issues will be raised later and further delay the EIA approval process. It is for this reason that the ToR and scoping document is finalized before the proponent solicits proposals to carry out the work involved. The environmental ToR then becomes the basis for the EIA, which examines the potential environmental effects (both positive and negative) of the development of Isang substation or the hypothetical “No Development” alternative, and will identify appropriate mitigation or optimization measures. Mitigation or optimization measures are those procedures or protocols that will be employed to ensure that negative effects are minimized and positive effects are maximized during the development of Isang substation. Additional options identified during the environmental assessment process may be considered as applicable. Following the assessment study, this written Environmental Impact Statement (EIS) is produced.

A draft environmental ToR and scoping document was submitted to the DEA on 16th March 2009 for review. The document is included herein, in Appendix B. The document includes details about the methodologies to be followed during the EIA process as well as specialist sections which will be included in the EIS, and the proposed personnel undertaking the specialist studies. In addition to the environmental ToR the document included details from the environmental and scoping works undertaken, including details from public and stakeholders consultations.

The environmental ToR and scoping document was reviewed and subsequently approved by DEA (reference DEA/BOD 7/9 XLV I (110) dated the 29th March 2009. A copy of the approval letter has been included in Appendix B.

A general overview of the process, as understood and followed by Loci Environmental, is illustrated below in Figure 2.1.

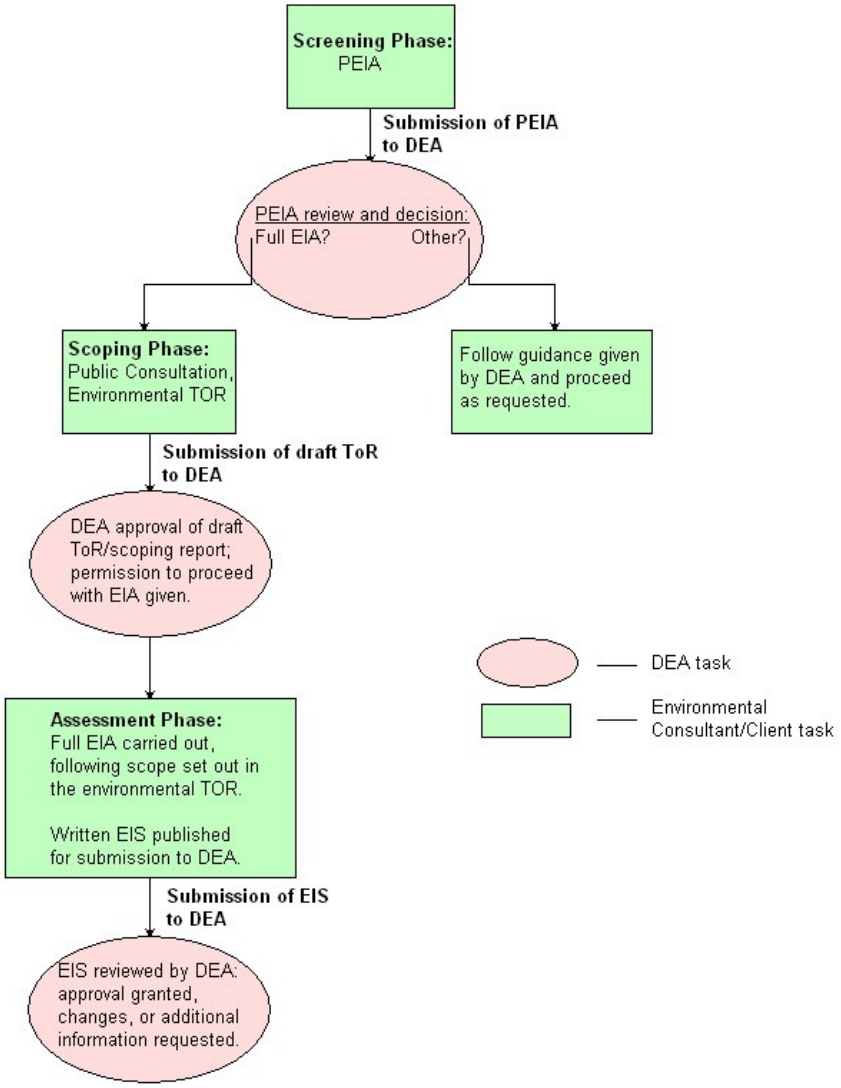


Figure 2.1 Environmental Assessment process in Botswana as guided by the EIA Act (2005)

3 PURPOSE AND OBJECTIVES OF THE EIA STUDY

The purpose and objectives of the EIA include the following, as set forth by the DEA:

- To identify and evaluate the environmental effects, which will be caused by the proposed development.
- To examine the environmental effects of site specific or alternative development proposals for the site to be developed.
- To identify and describe procedures and measure that will mitigate the predicted adverse impacts of the development proposals and measures that enhance the beneficial effects of the proposed activities.
- To liaise with key interested and affected parties and relevant government departments on issues relating to the proposed development to ensure compliance to existing policies, guidelines, regulations (bye-laws) and accommodate public views.
- Undertake an archaeological impact assessment.
- Develop an environmental management and monitoring plan.

3.1 SCOPE OF THE EIA

In a draft guidelines document received by the DEA during the course of this study (received: 2008), the following are listed as elements expected within the “Scope of the EIA”, by the DEA:

- Environmental Setting
- Public Consultations
- Assessment of Environmental Impacts and Interventions
- Mitigating Measures
- Environmental Management Plan
- Conclusion

While the above elements will be covered in detail within this document, the following table is provided to give an easy cross-reference between elements of the scope, and their locations herein. It is a notable feature of this document that several of the “Scope of the EIA” elements listed above, are relevant in more than one section of the EIS. For example, while the majority of information pertaining to the general “Environmental Setting” is addressed in Chapter 7: Environmental Setting in General, each specialist environmental parameter (Archaeology, Ecology, etc) will explore information related to the Existing Environment in depth and to greater scientific specialist detail, in the respective chapters throughout the document. For easy access to the locations of such information, refer to the table below.

Table 3.1: Locations of DEA-recommended "Scope of EIA" elements

Scope of EIA	Locations in EIA
Public Consultations	Chapter 6
Environmental Setting	Chapter 7
Assessment of Environmental Impacts and Interventions	Chapters 9 – 13
Mitigating Measures	Chapters 9 – 13
Environmental Management Plan	Chapter 14
Conclusion	Chapter 15

3.2 STRUCTURE OF THE EIA REPORT

In the same draft guidelines referred to in the previous section, the DEA recommends a "Structure of the EIA Report: the main elements of presenting the findings of the EIA into the EIS shall include" (listed as follows):

- Executive Summary
- Introduction
- Development description (development concept, plan)
- Environmental Planning and Design
- Stakeholder/Public Consultations
- Environmental Setting
- Methodology of Impact Assessment
- Assessment of Environmental Impacts
- Archaeological Impact Assessment
- Environmental Management Plan/Code of Conduct
- Decommissioning
- Economic Evaluation
- Summary of Recommendations
- Appendices

In an attempt to comply with this suggested structure, yet simultaneously cover all of the key lines of enquiry and additional information relevant to the project, Loci has expanded this recommended structure to resemble the following:

Table 3.2: Adaptation of DEA-recommended "Structure of EIA"

Scope of EIA	Locations in EIA
Executive Summary	Pg I – Executive Summary
Introduction	Pg 1 – Chapter 1
Development Description (concept, plan)	Pg 15 – Chapter 4
Environmental Planning and Design	Pg 29 – Chapter 5
Stakeholder/Public consultations	Pg 35 – Chapter 6
Environmental Setting	Pg 50, and Sections 9.2, 10.2, 11.2, 12.2 and 13.2.
Methodology of Impact Assessment	Sections 3.2, 9.1, 10.1, 11.1, 12.1 and 13.1
Assessment of Environmental Impacts	Sections 9.3-9.5; 10.3-10.6; 11.3-11.5; 12.3-12.5; 13.3-13.6;
Archaeological Impact Assessment	Chapter 11
EMP/Code of Conduct	Chapter 14
Decommissioning	Included in Chapter 14 and 15
Economic Evaluation	Refer to Chapter 113 (Socio-Economics) and Chapter 14 (EMP table)
Summary of Recommendations	Tables 9.1; 10.7; 11.2; 12.2; 13.5;

3.3 IDENTIFICATION OF LIKELY SIGNIFICANT IMPACTS

Impacts can be described in terms of quality (positive, neutral or negative), significance (imperceptible, slight, moderate, significant or profound), duration (temporary, permanent, short-term, medium-term or long-term) and type (cumulative, 'do nothing', indeterminable, irreversible, residual, synergistic or 'worst case').

Throughout the EIA process, the following factors have been considered when determining the significance of the impacts, both positive and negative, of the proposed development on the various aspects of the receiving environment:

- The quality and sensitivity of the existing environment.
- The relative importance of the environment in terms of national, regional, or local importance.
- The degree to which the quality of the environment is enhanced or adversely affected.

- The scale of change in terms of land area, number of people impacted, number and population of species affected including the scale of change resulting from all types of impacts.
- The consequence of that impact/change occurring.
- The certainty/risk of the impact/change occurring.
- Whether the impact is temporary or permanent.
- The degree of mitigation that can be achieved.

The magnitude of the impacts (described in Tables 3.3 - 3.5) outlined by specialists in their methodologies in Chapters 9 - 13 have been developed by Loci through "best practice" and consideration of those scales used in other EIS documents for developments of a similar scale.

Impacts may be wide-ranging in nature. This includes the potential to be direct or indirect, secondary, cumulative, short, medium or long-term, permanent or temporary, positive or adverse effects. Therefore, in an effort to construct a methodology for impact assessment terminology, Loci uses the following scales when referencing ***nature and severity of impact***:

Table 3.3: Description of Scale of Change used in Impact Assessment

Scale of Change	Description of Scale
Adverse/Negative	A change that reduces the quality of the environment
Neutral	A change that does not affect the quality of the environment
Positive	A change that improves the quality of the environment

Table 3.4: Description of Severity Levels used in Impact Assessment

Severity Level	General Description[3]
Insignificant/ Negligible	Environmental parameter will remain largely unaffected by positive or adverse impact. Impact unnoticeable in general.
Slight/Low	Environmental parameter minorly affected by the positive or adverse impact, to a point whereby the impact may or may not be noticed by the receptors affected. Mitigation can alleviate all or most slightly adverse impacts.
Moderate/Medium	Development causes a degree of impact that will cause a noticeable change in the environment by a majority of receptors affected. Mitigation measures should overcome most moderately adverse impacts.
Significant/High	Potential change in the daily experiences of all receptors due to the impact caused by the development. The impact would require a significant change in management practices with associated costs. This level of impact would require considerable mitigation measures and not all adverse effects may be overcome.
Profound	Impact affects 100% of receptors, with no mitigation measures applicable. An environmental parameter may be completely

[3] General description that can be refined as per scientific discipline for specific purposes as appropriate.

	obscured, made void or invalid, or destroyed completely, due to profound adverse effects.

Table 3.5: Description of Change Duration used in Impact Assessment

Duration	Approximate Length of Impact Predicted
Temporary	Predicted to occur for approximately one year or less
Short-Term	Predicted to occur for approximately 1 - 9 years
Medium-Term	Predicted to occur for approximately 10 - 19 years
Long-Term	Predicted to occur for approximately 20 - 60 years
Permanent	Predicted to occur indefinitely
Construction Period	Predicted to occur for the length of construction phase only

Aside from basic impacts on the existing environment, additional impacts likely to be identified within this report include cumulative and residual impacts, defined as follows:

Cumulative Impact:
The addition of many small impacts to create one larger, more significant impact. Due to the fact that the proposed Isang substation is in a location proximate to other power infrastructure, each environmental parameter has been assessed in consideration of potential cumulative impacts that may occur.

Residual Impact:
The degree of environmental change that will occur after the proposed mitigation measures have taken effect.

The EIS will be written in clear terms and aims to be as understandable as possible. However, where unavoidable, any complex scientific and environmental issues addressed using necessary technical language and terms, will be defined and explained within a glossary addressing any technical words and acronyms.

Where mitigation in the form of design measures have been suggested throughout the evolution of the EIS, these have been incorporated into the scheme design as far as is possible from an engineering perspective.

3.4 SPECIALIST STUDIES

In order to ensure that a comprehensive assessment of the relevant bio-physical and socio-economic components making up the environment was performed, the following specialist investigations were conducted:

Table 3.6: Specialist Investigations Carried Out

Environmental Parameter	Consultant and/or Consultancy	Relevant Qualifications
Ecology	Jeremy Burgess	MSc in Ecology and rangeland resources
Landscape and Visual	Jill R. Westra	BSc Geography, MSc Environment and Society
Archaeology	Princess P. Sekgarametso-Modikwa	BA Archaeology
Environmental Engineering	Johannes Westra	MSc Eng.
Environmental Health and Safety	Jill R. Westra	MSc (cand.) Environmental Health and Safety
Electrical Engineering	Ron Coney, KEC	Pr.Eng. C.Eng. FSAIEE FIET GCC(F) GCC(M&W)

4 DEVELOPMENT DESCRIPTION

The scope of the proposal at hand includes the principal development, which is an substation development and associated activities or structures (e.g. infrastructure, boundary fencing) from pre-construction to closure and decommissioning. The following sections outline a brief overview of the project components. This chapter will provide history about the project, scale in comparison to other electrical infrastructure, and full technical descriptions of the equipment and activities proposed.

The technical details are provided to fully understand the scope of the project, and enable the reader to understand, review and implement the environmental impacts and mitigation measures. Some of the details have been summarized and simplified to enable complete understanding within the environmental reporting. Detailed technical information, specifications and building instructions are part of the engineering reports, and do not form part of this chapter of the EIS.

4.1 DEVELOPMENT CONCEPT

As explained in the introduction chapters of this report, the purpose of the proposed Isang substation is to provide additional electrical transmission capacity to the Botswana electricity grid. A number of electrical infrastructure projects are currently being constructed, or planned in the near future, to make Botswana self-sufficient in the area of electrical power generation. Two large developments are planned in the south eastern part of Botswana:

1. The proposed Morupule B power station expansion by Botswana Power Corporation. This project has commenced in early 2009, and will create power generation capacity of 600MW, in addition to the current 120MW from the existing Morupule power station. The Morupule B power station project is expected to be completed during 2012. (BPC/Ecosurv, 2008)

2. The proposed Mmamabula power station by CIC Energy. The planning and design for this power station has been completed, and it is expected that construction of the project will commence in the later part of 2009. The planned power station will be able to generate 1200MW at full completion, which is expected during 2013. The power station will be supplying power to BPC in Botswana, as well as Eskom in South Africa. (Digby Wells & Associates, 2007)

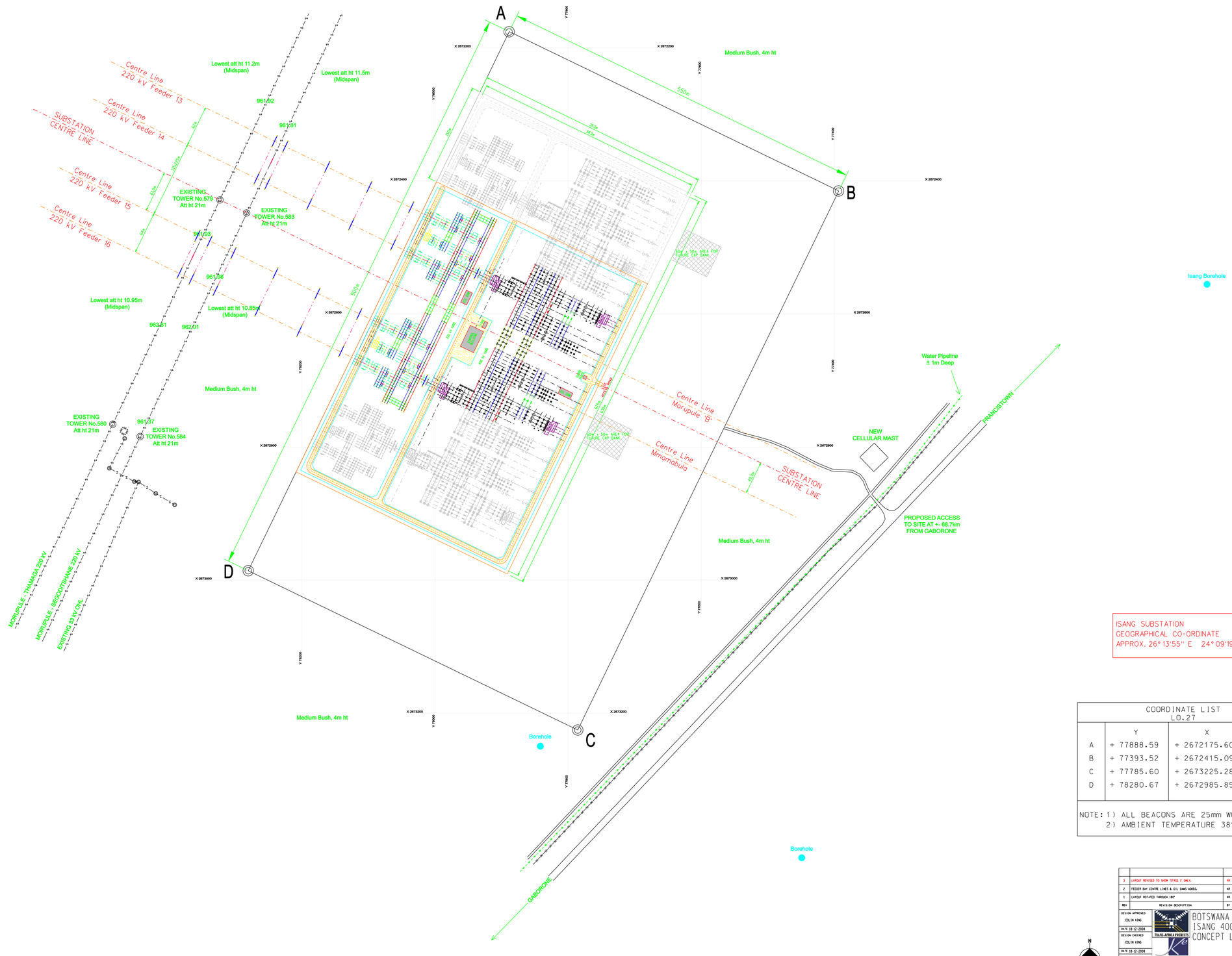
The current BPC transmission network does not have sufficient capacity to be able to transmit the additional power generated by the above mentioned power station projects. Upgrades and additions to the transmission network are therefore required, to ensure that the additional power, generated at the new power stations, is transported to areas where electricity demand is increasing.

The proposed Isang substation is part of the power transmission network upgrade. The purpose of the Isang substation is to improve the reliability of power supply to Gaborone and surrounding areas. The upgrade includes other projects, such as the construction of a 400kV overhead power line from Morupule to Isang substation, a 400kV overhead power line from Mmamabula to Isang substation, and a number of future overhead power lines from Isang substation to areas with increased power demand. The planned power lines to and from Isang substation do not form part of the scope of works for this project.

4.2 TECHNICAL DETAILS

The planned footprint for the substation is 550 x 900m. The scope of the current construction will not require the full footprint; part of the area is for allowance of future expansions.

It is proposed that the outer boundary of the plot will be fenced with a standard cattle fence. The vegetation of the area for future expansion will be left in place where possible. There will be an inner palisade fence around the actual substation equipment, as per international electricity safety standards. Figure 4.1 below shows the layout for the proposed substation.



ISANG SUBSTATION
GEOGRAPHICAL CO-ORDINATE
APPROX. 26° 13'55" E 24° 09'19" S

COORDINATE LIST
LO.27

	Y	X	Z
A	+ 77888.59	+ 2672175.60	960.87
B	+ 77393.52	+ 2672415.09	960.15
C	+ 77785.60	+ 2673225.28	961.10
D	+ 78280.67	+ 2672985.85	961.71

NOTE: 1) ALL BEACONS ARE 25mm WOODEN PEGS
2) AMBIENT TEMPERATURE 38° CELSIUS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	REFERENCE DRAWINGS
3	LAYOUT REVISED TO SHOW 'STAGE 1' ONLY.	KR	ACM		20/07/09	
2	FEEDER BAY CENTRE LINES & OIL DAMS ADDED.	KR	ACM	C KING	04/08/09	
1	LAYOUT ROTATED THROUGH 180°	KR	C KING	C KING	22/09/09	

DESIGN APPROVED: COLIN KING
DATE 18-12-2008
DESIGN CHECKED: COLIN KING
DATE 18-12-2008
DRAWN BY: K. R.
DATE 18-12-2008
1 : 2000

TRANS-AFRICA PROJECTS
Consulting

BOTSWANA POWER CORPORATION
ISANG 400/220 kV SUBSTATION
CONCEPT LAYOUT

08-005-002-004

SHEET NUMBER: 1of1
REVISION: 3

SIZE GROOTTE A0L

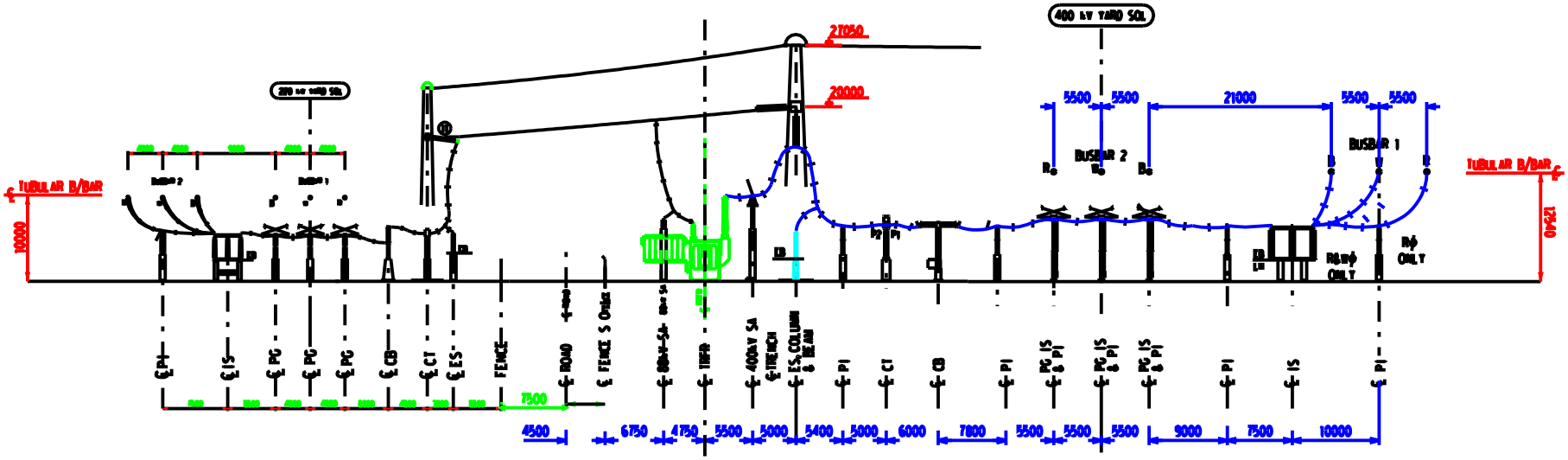
The proposed substation will convert the 400kV supply down to 220kV which can then be linked in to the existing dual 220kV power lines, which are located adjacent to the site (see Figure 4.1). The planned new 400kV power line from Morupule, will come from the eastern side of the main road to the Isang site, and after the step-down through sets of transformers, will be linked back into the existing 220kV lines.

The construction of the link between the proposed substation and the existing 220kV lines is part of the scope of works assessed. The distance between the existing power lines and the proposed substation is approximately 200 metres. This space is needed to be able to turn both power lines into the proposed substation from the Morupule direction and from the Gaborone direction.

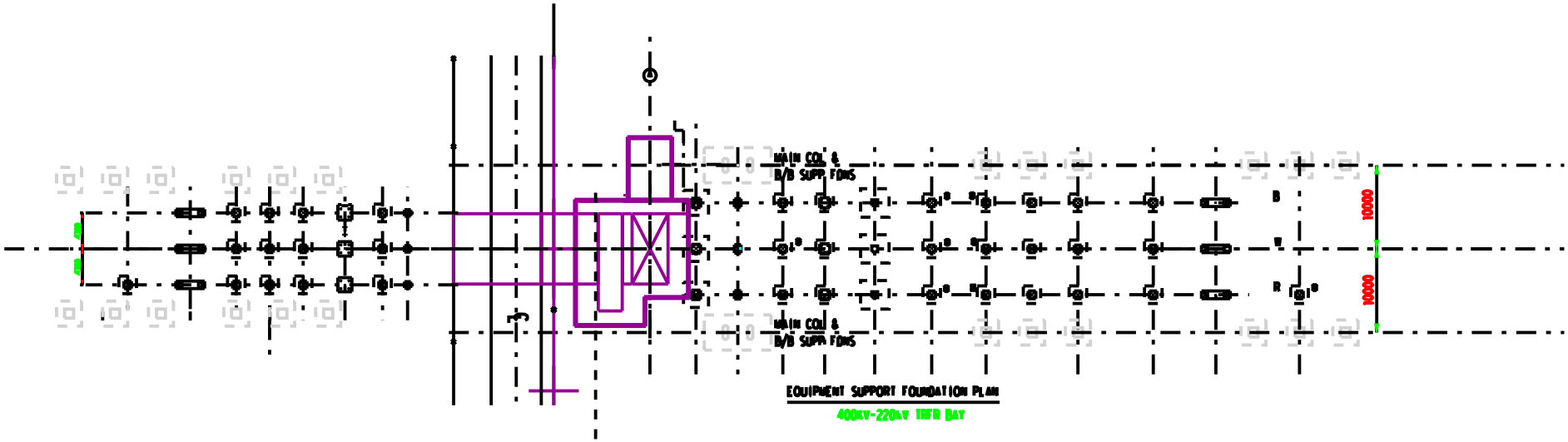
The reason for connecting the 220kV lines is to improve the electricity supply network flexibility. The incoming 220kV power will not be converted, but by having it come into the Isang substation it creates a number of additional options for further distribution, therefore improving the flexibility. Also, if there would be a failure or interruption on the incoming 220kV lines, the outgoing 220kV lines can still be supplied with power from the new incoming 400kV line.

The scope of the substation project includes the installation of 400 kV and 220 kV feeder bays for future power lines in and out of the Isang substation. These future power lines themselves do not form part of the current scope of the design and assessment; the feeder bays at the substation are the only part included under this project.

Figure 4.2 below illustrates the appearance of a typical section of a substation bay.



ELEVATION ON ELECTRICAL EQUIPMENT



EQUIPMENT SUPPORT FOUNDATION PLAN

400kV-220kV TRFR BAY

FOR INFORMATION PURPOSES ONLY

BOTSWANA POWER CORPORATION
ISANG 400/220kV SUBSTATION
OPTION 1

TYPICAL SECTION

OPTION 1

1 of 1

0

The design and construction of the project will include the following technical details:

- Construction of substations in a confined area suitably sized for the power demand. The dimensions will be approximately 900 x 550 x 24 (height) metres.
- Terrace work and drainage requirements.
- Installation of fencing.
- Installation of equipment foundations.
- Construction of buildings to accommodate secondary plant equipment.
- Installation of transformer and shunt reactor plinths.
- Construction of concrete road within substation boundaries.
- Erection of steel structures with maximum height of 24m.
- Installation of transformers and shunt reactors within oil containment areas.
- Construction of concrete access road from main Gaborone to Francistown road, approximately 400m length.

During the design of the substation standards applicable for electrical installations have been taken into account, as outlined in the Electricity supply Act, and various other standards for electrical equipment as published by BOBS. The standards included details about:

- Quality of electrical components.
- Fencing and safety.
- Procedures and qualifications.

The Isang substation will become the largest substation in Botswana when considering the size. For comparison and illustration purposes, a picture of a similar but smaller substation constructed in Phakalane (Botswana), has been included in Figure 4.3 below.

Figure 4.3 An example of a smaller substation similar in concept and appearance.

The design of the substation also includes the development of procedures to be followed during construction, including safety procedures, procedures for power interruptions and switch-overs, qualifications of personnel involved and quality checks and procedures.

The electrical consultant will also develop an operation and maintenance manual, in conjunction with the appointed contractor and equipment supplier. The manuals will include safety and responsibility procedures, maintenance schedules, qualifications of personnel involved, and emergency procedures specifically for the Isang substation.

4.3 DEVELOPMENT PHASES

An infrastructure project typically follows through four phases during its lifetime, the design phase, construction phase, operational phase and closure and decommissioning phase. The predicted environmental impacts are different in nature in each of the phases, therefore these four typical phases are used throughout the EIA report to organize predicted impacts and mitigation measures.

The proposed Isang substation project is currently at the detailed engineering design phase. The EIA is being carried out simultaneously to the engineering design, and any required changes recommended during the EIA process have been communicated with the engineers, with aim to update designs and specification where possible.

The planned phases for the project are shown in Table 4.1 below.

Table 4.1: Planned stages within the development of the project

Phase	Expected completion date
Design Phase	June 2009
Tender Phase	October 2009
Contract Award	December 2009
Construction Phase	December 2010
Operational Phase	December 2011

It is notable that for electrical engineering projects, items such as new transformers are on long delivery times. After appointment of a contractor, it usually takes a number of months before a contractor can start the actual work, due to the waiting time after procurement of this equipment.

Every proposed electrical infrastructure projects usually follows a number of typical project stages, a brief description which are provided in the following paragraphs.

Feasibility stage: During this stage the need for the development is identified by the client (BPC), a number of options are evaluated to address the requirement. Overall development context and other planned developments are carefully taken into consideration, and predicted electrical load models are used. Options for route and location alternatives are also considered during this stage.

Preliminary design stage: Usually an engineering design consultant is appointed at this stage. The consultant gathers details about the proposed site, including soil tests and surveys. Parameters used for the design are also established, based on predicted loads and requirements. During this stage alternative technical solutions to meet the requirements are evaluated.

Detailed design stage: Following the preliminary design stage, the most suitable technical solution has been identified. Detailed designs will be completed for this proposed solution, taken into account the site specific information gathered from the various surveys. The detailed designs will include construction details and specifications for the proposed equipment. The finished drawings and specifications will be suitable for tender by electrical contractors.

Tender stage: Electrical contractors are invited to tender on the proposed project. After submission the client BPC and the electrical consultant will evaluate the tenders. The evaluation will be based on technical suitability, price and qualifications and competence of the contractors.

Construction stage: After the tender stage the successful contractor will be appointed to undertake the construction works for the proposed project. The contractor will be handed over the site, and will complete the construction works within an agreed timeframe. Due to the fact that some electrical components usually installed at substations, are on long delivery times, the contractor might not start works on site immediately after hand-over. During the waiting / delivery period the contractor submits equipment drawings to the client for approval.

Testing and commissioning stage: After completing of the construction works, the installations are tested before operation. On a large substation as Isang, the testing and commissioning is likely to be done in sections of the overall substation. After successful completion of the testing and commissioning the project will be handed over to BPC for operation.

4.4 THE DEVELOPMENT CONCEPT AND ACTIVITIES

The construction of the substation will include two separate construction aspects:

- Civil construction works.

- Electrical construction works.

Both aspects of the construction works require their own specific equipment, skills, qualifications and procedures. Descriptions of the expected scope of works for each aspect are included in the following paragraphs:

4.4.1 Civil construction works

The civil construction works expected for the construction of Isang substation include, but are not limited to the following activities:

- The erection of **temporary contractors camp** for construction workers and for storage of construction equipment. Due to the distance from the nearest village in can be expected that in addition to site offices and materials storage, some on site accommodation will be required during the construction period.
- **Temporary fencing** of the construction site and construction camp. The temporary fencing will be done with either hoarding or fencing materials, or a combination of both, depending on the contractor's preference.
- **Bush clearing**, earth works and top soil removal or import, depending on results from geological tests. It has been described in Section 4.2 that the overall site is larger than the site required for the footprint of the substation proposed under the current scope. It is anticipated that only the area required for the substation footprint, the access road, and an area for the construction camp will be cleared. This is the area mainly within the inner fence of the project. The remaining vegetation between the inner fence and outer fence of the proposed substation will remain in place for the time being, and will act as a visual buffer.
- **Levelling and terracing** to required levels. Although the topographical survey has shown that the site is very flat, some levelling works are expected to meet the required levels for construction. Terracing of the substation equipment is required to ensure that in the event of local flooding the electrical equipment will not be effected. An example of these construction works are shown in Figure 4.4 below.

Figure 4.4 An example of clearance and earth levelling works at a similar site.

- The **fencing** works of the project will include the erection of two separate fences. There will be an 'outer' fence on the outside boundary of the plot. The fence will be a standard cattle-type fence. The 'inner' fence will be around the installer substation equipment, and will be in accordance with all relevant legislation and safety requirements. The 'inner' fence is expected to be a balustrade type fencing, with access gates for access and maintenance purposes.
- The **construction of equipment bases** will be required, some of the electrical equipment and transformers are heavy in weight, and require the construction of suitable foundations for installation. The exact dimensions and requirements for the bases and foundations depend on the type and manufacturer of the equipment.
- Within the site **storm water drainage systems** will be installed. Due to the scale of the site and the overall flatness of the area, flooding during heavy rainfall is likely. The terracing of the substation, as described earlier, will ensure that electrical equipment will not be effected. A storm water drainage system with sub-surface drains will drain the water from within the site. It is expected that a soak away area may need to be constructed for drainage of the storm water, due to the lack of natural falls in the area.
- A **control building** and transformer and shunt reactor plinths will be constructed within the substation. The control building will be a permanent brick type building. It will accommodate the control panels and equipment for the substation. It will also include communications equipment and an office area. Toilet and changing facility will be included within the building, the toilet will be drained into a newly constructed septic tank.
- An **access road,** from the main Gaborone to Francistown road to the substation will be constructed. The access road will be approximately 290 metres long, and will be constructed to bitumen standard, as per the Botswana Roads Manual. The location of the access road is shown in Figure 4.1.
- In addition to the access road, **internal roads** within the substation will be constructed. Due to the weight of some of the equipment, it is expected that some of the internal roads may need to be constructed with concrete. Surfaces within the substation boundary, which are not used for internal roads or equipment, will be covered with gravel.

Many of the civil construction works will need to be completed before the electrical construction works can start. It can be expected however that there will be some overlap, especially when considering the overall size of the proposed Isang substation. The programming of the construction works is the responsibility of the contractor.

4.4.2 Electrical construction works

The electrical construction works for the project include the assembly, installation, connection and testing of the electrical equipment. The electrical construction works include, but will not be limited to the following:

- The installation of steel support structures, required for the electrical equipment. It is expected that most of the structures will be prefabricated off-site, and will be transported and assembled at the substation site. Some final cutting and welding activities can be expected during the installation of the steel structures. The use of mobile lifting cranes will be required during the construction, it is not expected that a permanent overhead crane will be constructed.
- The assembly and installation of electrical components such as transformers, shunt reactors and switch gear. The electrical components will be purchased and manufactured outside of Botswana, and transported to the construction site. Heavy mobile lifting equipment will be required to put the transformers into position.

Figure 4.5 Installation of transformers at a similar (Phakalane) substation.

- The installation and **stringing of electrical lines** within the substation, connecting the various elements. The stringing will be done by specialist personnel qualified to undertake the works.
- The installation of **fire prevention and oil spillage systems**. The systems will be installed in compliance with safety standards in accordance to the engineer's designs.
- The **connection of the existing 220kV** lines to the new substation. As described in Section 4.2, the connection of both existing 220kV lines is part of the scope of works. The 220kV lines will be 'broken up' with a flying isolator and the sections from the Morupule direction will be turned into and connected to the Isang substation using steel gantry structures. The section from the Gaborone direction will also be turned into the substation, and will be the outgoing line. The connection of the existing lines is shown in detail in Figure 4.6 below.

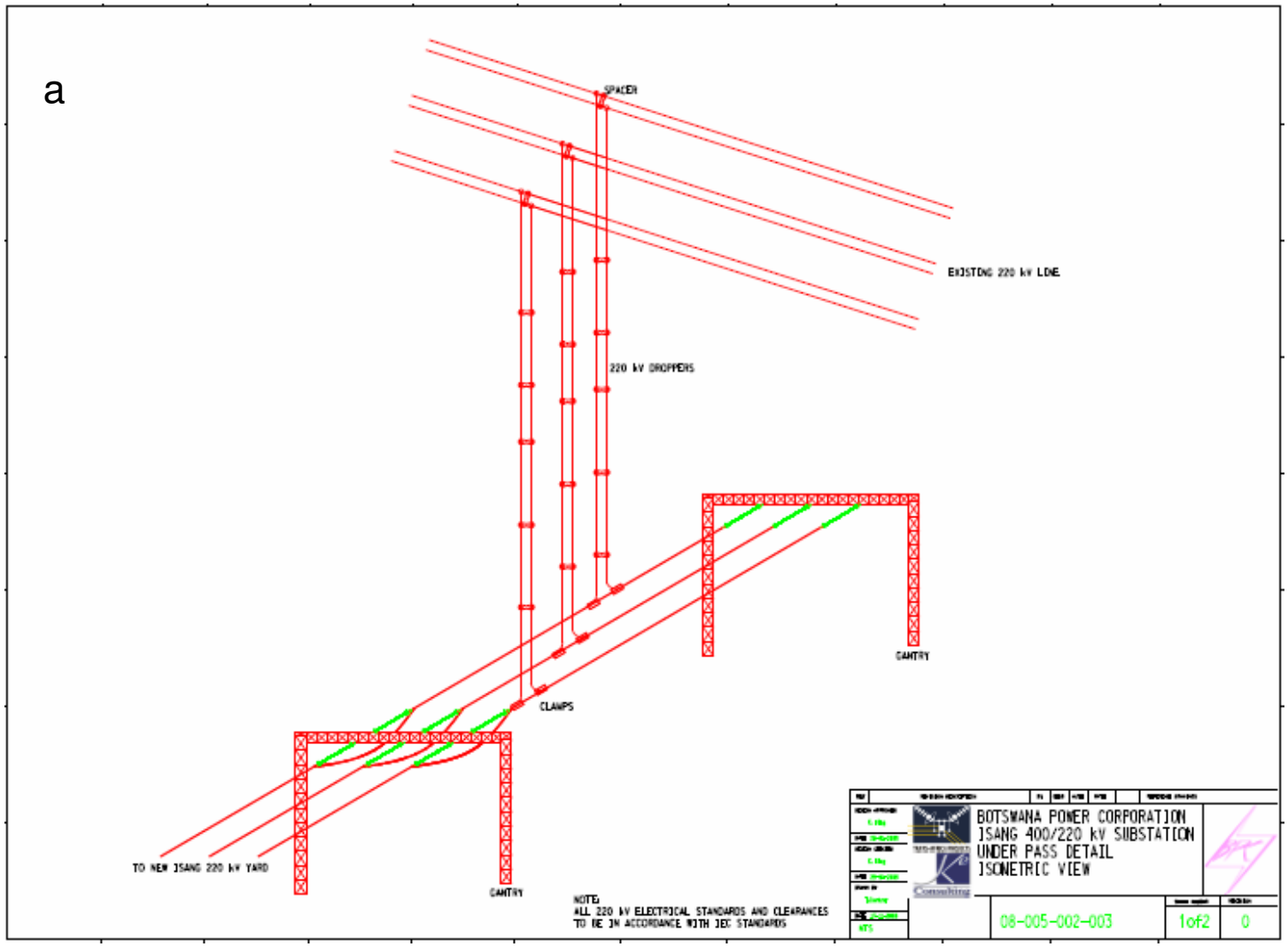


Figure 4.6a Connection of the 220kV lines to the Isang substation.

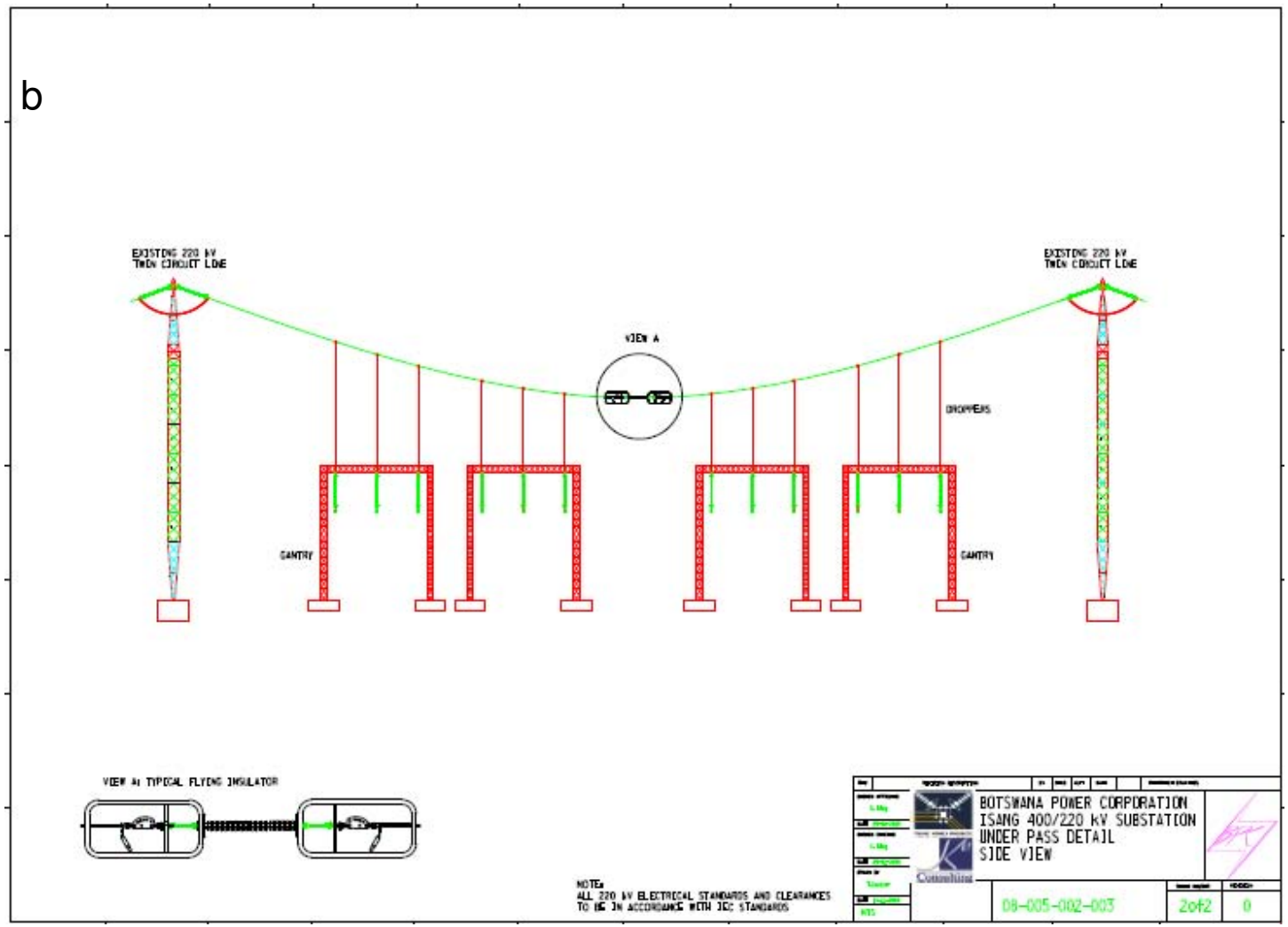


Figure 4.6b Connection of the 220kV lines to the Isang substation.

At the completion of the electrical construction works, all elements of the project will be commissioned and tested thoroughly. The consulting engineers and the client will be present at the final testing to ensure all equipment is functioning as required. Once all testing is completed, the project will be handed over to the client for operation.

4.5 ASSOCIATED DEVELOPMENTS

To appreciate the full scope of the electrical infrastructure upgrade, related to the Isang substation project, other projects associated are as follows:

- Morupule B power station expansion by BPC, details as described in Section 4.1.
- Mmamabula power station project by CIC Energy, as per the details provided in Section 4.1.
- Construction of a 400kV overhead power line from Morupule to Isang substation.
- Construction of a 400kV overhead power line from Mmamabula to Isang substation.

The construction of the overhead power lines does not form part of the current scope of works, as explained in previous sections. However, the combined impacts of both the power lines and the substation will need to be considered. For example: the landscape and visual impacts of the combined future and existing power lines will ultimately marginalize those of the substation, due to the transmission towers being higher than the top of the substation structure.

Figure 4.7 below shows the route for the proposed new 400kV overhead power line from Morupule, in relation to the existing 220kV power lines and the Isang substation. As can be seen in the figure, the proposed 400kV power line will be on the opposite side of the Gaborone to Francistown road compared to the two 220kV power lines.

It is expected that a future 400kV overhead power line from Mmamabula will follow the 400kV power line route from Morupule, and traverse parallel to the Isang substation. The EIA studies for both power lines were completed in 2007. (Digby Wells and Associates, 2007)

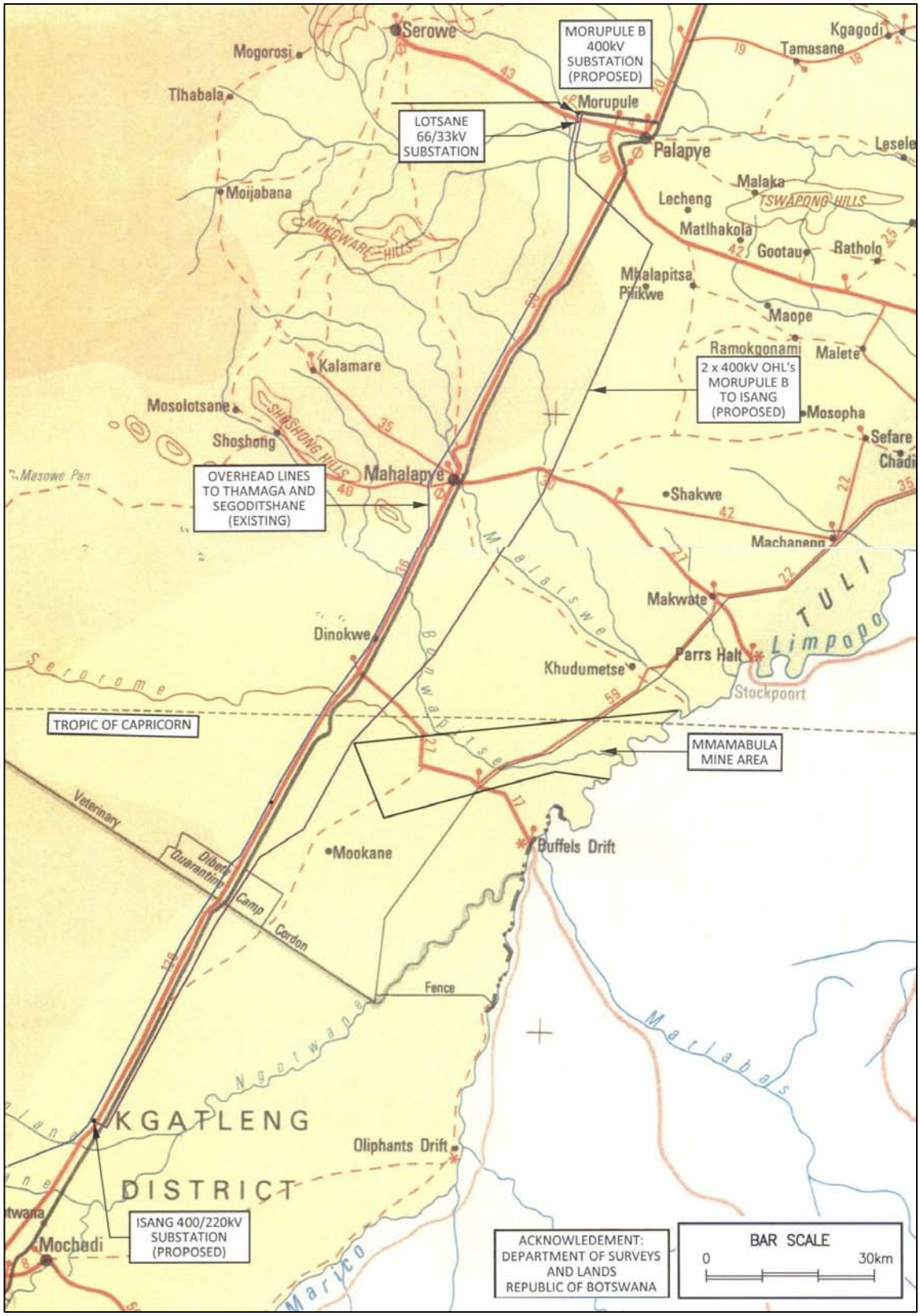


Figure 4.7 Regional Map showing Isang and related power infrastructure (Source: Merz and McLellan, 2008)

The proposed 400kV overhead power lines are specified to be constructed with 'Guyed-V' type transmission towers. A drawing of a typical 'Guyed-V' tower is shown in Figure 4.8 below.

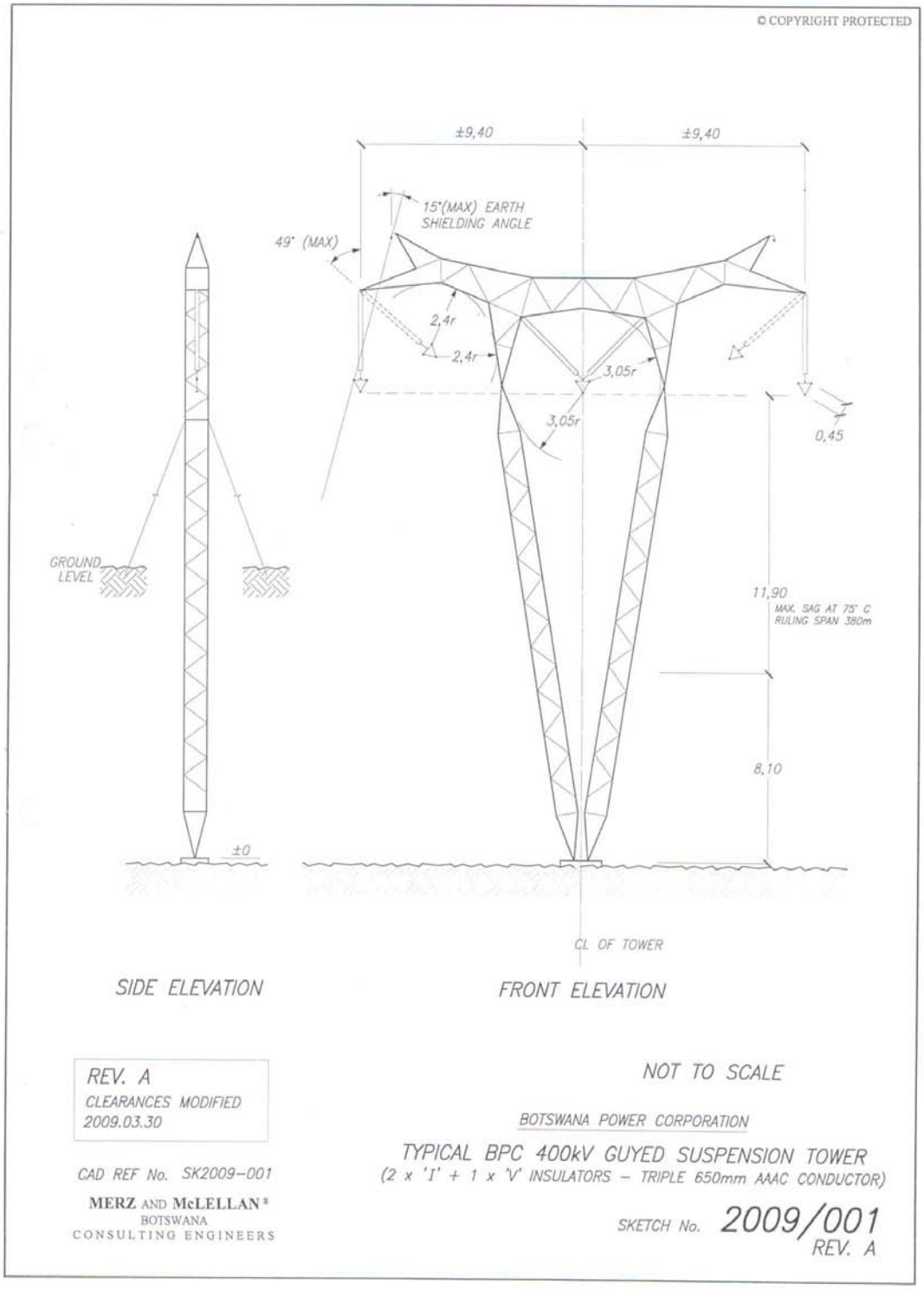


Figure 4.8 Typical Guyed-V transmission tower, as proposed for the 400kV power lines.

In total provision is made for eight 400kV lines into or from the Isang substation. Currently only one 400kV line from Morupule will supply the substation. The other power lines are expected to be installed at a future date.

4.5.1 Other non-related developments

Two other developments, not related to the power infrastructure upgrade, may have an impact on the substation development.

4.5.1.1 North-South Carrier Pipeline

The substation location is close to the North-South Carrier Pipeline (NCS), which runs alongside the main A1 road, and comprises a 1.2m diameter steel pipeline in the relatively deep sandy soils found between the Serorome Valley and the hills immediately to the south of Rasesa. It is not known whether there will be any interference from EMF output as the 400kV line crosses the NSC. Additional information here is that the NSC will soon be doubled up with the construction of the NSC2 pipeline project expected to start in 2011. This work may impact to some extent on the construction of the substation, but is expected to have more significant impacts on the 400kV power line construction.

4.5.1.2 Cell phone tower

A new cell phone tower has been constructed between the proposed substation site and the Gaborone to Francistown road. The cell phone tower is operated by Orange Botswana, to enhance the coverage of their cellular phone network.

The substation will not be affecting the signal quality or strength. Studies by Eskom have shown that there is no impact between substations and cell phone towers, and at a number of sites in South Africa cellular phone towers have been installed on top of electrical substations.

The access road into the substation will improve accessibility to the cellular phone tower. The tower does however limit the options for connecting overhead power lines into the substation, as safety distances must be observed.

4.6 INPUTS, OUTPUTS AND RESOURCES

The construction process required a large number of inputs and resources, the inputs include, but are not limited to:

- Construction materials, such as gravel, concrete, bricks, cement and asphalt. It is expected that the materials will be sources locally, from licensed sources. Opening of borrow pits for the project is not foreseen.
- Structural materials, such as steel structure, additional power towers (for connection of the 220kV lines, busbars and fencing materials.
- Electrical equipment, including transformers, shunt reactors, control panels, switchgear and cabling.
- Fuel for machines on site.

The resources required for the construction of the substation include, but are not limited to:

- Labour, both general labour as well as qualified and specialized labour is required for the construction works.

- Equipment and machinery: the equipment required included heavy earth moving equipment, general building equipment, concrete and asphalt mixing equipment and heavy lifting equipment. It may be expected that the contractor will erect a small concrete batching plant on the site for the duration of the contract. On site diesel storage can also be expected.

The outputs that can be expected include:

- Dust from the construction activities.

- Noise from the construction activities.

- Firewood from the clearance works.

- Possible soil, which is unsuitable for construction purposes.

The outputs listed may have significant environmental impacts, and will be further discussed in this EIS document.

4.7 SUMMARY OF PROJECT COMPONENTS

A summary of the project components has been provided in Table 4.2 below.

Table 4.2: Project Components

Proposed Phase	Associated Activities and Features
Construction	Clearance of substation plot and access road for inspection and maintenance.
	Construction of substation, including foundations, fencing, installation of electrical equipment, construction of buildings and testing.
Operation	400/220kV substation at Isang, with associated line bays and high voltage transformers. This substation will provide electricity supply to the proposed Gaborone and surrounding areas. The substation will create opportunity for connection to the proposed Morupule B, Mmamabula and other future powerstations
	Maintenance and clearance of the plot will continue to ensure minimum clearance requirements are adhered to.
	Routine maintenance and inspections will be undertaken for the substation.
Transport	A new access road (concrete) will be constructed from the main Gaborone to Francistown road to the substation.
	The use of vehicles will be employed in transporting supplies to and from site.
Surface Structures	The substation will included a steel frame with a maximum height of 24 m. All installed transformers and switchgear will be lower than this. The existing 220kV lines and the new 400 kV line from Morupule B will be connected into the substation.
	The substation will initially be partly equipped , but is expected to have an ultimate maximum footprint of 900 x 550 meters. The substation structures will include perimeter fences, transformers, shunt reactors and switchgear, lattice steel gantries and control buildings.
Closure	Closure of the project site.
Decommissioning	Decommissioning of the structures and reclamation of the project site.

5 ENVIRONMENTAL PLANNING AND DESIGN

The following chapter describes environmental planning and design issues in further details. It includes a section describing the project alternatives considered.

5.1 THE PURPOSE OF THE PROJECT

It has been explained in Chapter 1 and 2 that the proposed Isang substation project is part of an overall power infrastructure upgrade. The upgrade is needed because of the increased power generation at Morupule B and proposed Mmamabula project. The purposed of the overall increase in power generation and network upgrade is:

- Cater for the increased power demand in Botswana.
- Reduce the dependence on power supplied from neighbouring countries, particularly South Africa.

The Isang substation is a very vital element in the overall upgrade, should the Isang substation be realised, the following benefits are predicted:

- Improved power supply to Gaborone and surrounding areas, capable to deal with the expected increased power demand.
- Increased transmission options for power transmission to Gaborone and surrounding areas, and therefore improving the power supply reliability.
- Creation of future power transmission and distribution opportunities, by installation of additional future feeder bays at the substation.
- Support of a power transmission network that enables the increased power generation at Morupule and Mmamabula. Both of these projects are of national importance, and create significant employment opportunities, and contribution to GDP.

5.1.1 African Context

Botswana has a number of coal fields that are considered economically feasible for mining and power generation. Currently the only power generated in Botswana, is at the Morupule BPC power plant, with coal provided as a fuel from the Morupule Colliery. The Morupule power plant generates approximately 30% of the current Botswana power demand; the balance of the required power is supplied from neighbouring countries. Eskom in South Africa has been supplying most of the power to Botswana, but due to rising demands in South Africa, Eskom are unable to continue supplying the quantities of power to Botswana. Recently renewed contracts have agreed a gradually stepped down supply of power from Eskom.

Other supply of power is being provided from Namibia and Zimbabwe. Outlying areas of Botswana such as Kasane, Ghanzi, Shakawe and Tsabong are not connected to the Botswana power grid (see Figure 1.4). These areas are supplied with distribution lines from across the respective borders.

The proposed exploration of the Mmamabula coal field by CIC energy would make Botswana a power exporting country. In addition to exporting power, there are also opportunities for exporting coal to other countries. This situation would eliminate Botwana's dependence on neighbouring countries for power supply, and create the opposite position with neighbouring countries relying on Botswana for supply of power and coals.

In addition to the Morupule and Mmamabula projects, there are a number of other international power projects proposed, namely the ZIZABONA interconnector project and the Western Corridor Power Project.

The ZIZABONA project is planned to connect the power grids from Zimbabwe, Zambia, Botswana and Namibia. Additional power would be generated at the Hwange power station in Zimbabwe, and distributed to Victoria Falls (Zimbabwe), Livingstone (Zambia), Pandamatenga (Botswana) and Katima (Namibia). The project entails construction of new high voltage transmission lines and substations. The connection of the power grids creates an opportunities of trading of power between the countries under a Southern African Power Pool (SAPP).

The proposed Western Corridor Power project includes the construction of a hydroelectric dam in the Democratic Republic of Congo. Power would be distributed from the dam to countries within Southern Africa. The distribution will require upgrade of existing transmission lines, as well as construction of new transmission lines.

5.1.2 National Context

The Isang substation will improve the power supply and reliability to Gaborone and surrounding areas. Power cuts and load shedding currently experienced in the capital city, has significant financial implications. The Isang substation alone will not solve this problem, but it is an important element in the power infrastructure needed.

Reliable power supply does not only solve current load shedding problems, and economic impacts caused by this problem. It can be expected that the improvement will contribute to the attractiveness for (foreign) investment to Botswana, and specifically Gaborone. Increased and reliable power supply will encourage new and increased industrial operations and initiatives, and therefore job opportunities.

In addition to the internationally orientated power projects mentioned above, Botswana has also started to investigate alternative methods of power generation. Traditionally power is generated by coal-fired power plants in Southern Africa, and Morupule and Mmamabula power station are proposed to be developed along the same principle. Coal-fired power plants are to add to the depletion of natural resources, as well as generating greenhouse gases. A number of non-coal bases initiatives are taking place:

- An agreement has been reached with an independent power producer for exploration and power generation from gas fields at the Mmashoro area, Central District.
- Feasibilty studies and testing are done on gas resources in the Central Kalahari by Saber Energy.
- Feasibility studies are being undertaken by BPC for the construction of a solar powered power plant.

An improved transmission and distribution network will be able to support the initiatives mentioned above.

5.2 ALTERNATIVES CONSIDERED

A very important process during the impact assessment is the assessment of alternatives. Some alternatives can incur major differences in both financial and environmental impacts, if implemented in place of the original design or concept. The alternatives considered have been described in the following paragraphs, organised by category. In the end of the alternatives section a summary table will review all alternatives considered.

5.2.1 Site location

The Isang site is ecologically uniform in the context of alternative sites, as the vegetation and land system of the site is represented widely around the proposed site.

A possible reason for relocating the site will be the visual and aesthetic component of having a very large 400kV line crossing the main Gaborone-Francistown A1 highway and possibly the location of the cellular phone telecommunications tower which will be located very close to the 400kV line as it crosses the main road. Additionally, there is the risk of interference with the cellular phone signal due to EMF output from the 400kV line.

Although possible alternative sites have not been reviewed for this specific study, the alignment of the 400kV to the east of the Gaborone to Francistown A1 road could give cause to consider an alternative location for the sub-station at a site close the Morupule – Gaborone 220kV line slightly further south. This would enable the 400kV to be linked to the 220kV line without having the 400kV line crossing the A1 road. However, the plan is to link both existing 220kV lines to the substation, and relocating the substation would mean crossing the second 220kV line over the road twice. Another aspect when considering the site location is the planned NCS2 pipeline, the power lines in and out of the substation may affect the pipeline operation through EMF.

Close cooperation between BPC and the local landboard has established the identified site for the Isang substation. The reason for selecting the substation was the close proximity to the existing 220kV power lines. In addition to this, a 200 x 200 metres site at the proposed location had already been allocated to BPC for a transformer / communication device related to the 220kV lines.

Alternative selected: Proposed site as shown in Figure 1.3.

5.2.2 Project scale alternatives

When considering the scale of the development, the client has the option of constructing a substation to the size and scale that is sufficient for the current demand, or developing a substation with provision for future bays and incoming / outgoing power lines.

It can be expected that power demand will only increase in the Gaborone area in the future, due to the expected population growth of the city and surrounding areas. The substation is therefore designed to cater for these future demands and extensions. By including this in the current design, future expansions can be done more cost efficiently, quicker and technically optimal.

Alternatives selected: Substation technically designed to include future extensions.

The footprint of the substation as proposed for Isang under the current scope, is much smaller than the 550 x 900 metres plot that BPC has allocated for the project. This large plot is required for future extensions and incoming or outgoing power lines. As an alternative BPC could have applied for a plot which is exactly as per the dimensions of the required footprint for the current substation, and extend the plot boundaries when required in the future.

It has been decided to apply with the local land board for the large plot of the Isang substation at this time, to ensure that the required space is available when future extensions are required. Many other projects are being developed in the area, such as cellular phone tower, the NCS2 pipeline and possible road projects. Land in the area is therefore expected to be in demand, and could be allocated to other projects in the future if it is not allocated to the substation at the time. This could result in a situation where the substation can not be connected to future power demand areas.

Alternative selected: Large footprint to provide space for future connections and expansion.

5.2.3 Technical Alternatives

A number of technical alternatives have been evaluated by the client:

1. Overhead stringers versus tubular bus bars. The tubular bus bars are more cost effective and have less visual impact due to lower steel structures. Technically both solutions are comparable

   Alternative selected: tubular bus bars.

2. Indoor substation versus outdoor station. An outdoor substation is far more cost effective, and indoor station would also create technical complications for connection of power lines, and less flexibility for future connections.

   Alternative selected: outdoor substation.

3. Breaker and a half scheme versus the current single feeder bay. The breaker and a half scheme not as per the standard BPC substation layouts in the national grid, and therefore not a feasible project alternative.

   Alternative selected: single feeder bay.

4. Connecting the existing 220kV lines vs no connection. The connection of the existing lines creates flexibility in incoming and outgoing transmission routes. Leaving the existing lines outside of the scope of works reduces the opportunity for improvement and reliability of the power transmission network.

   Alternative selected: connection of 220kV lines.

5. Gravel or unpaved access road vs bitumen access road. It is expected that the substation will need to be accessed regularly in case of maintenance and failures. To minimize power interruptions to Gaborone, the access should be easy. In addition to this it can be expected that access with heavy machines will be required, the bitumen alternative presents the more reliable solution.

   Alternative selected: bitumen paved access road.

6. Water supply on site from existing boreholes versus new borehole or external supply. The water will be required for construction purposes and for supply to office and toilet facilities during operation. There are 3 existing boreholes around the site, which are currently used by farmers to provide water for the cattle. The water from the boreholes has been tested, and one borehole provides satisfying quality and quantity for the proposed substation. The rights of use are being negotiated with the borehole owners, and use of the borehole would avoid the need for drilling an additional borehole.

Alternative selected: Use water from existing borehole.

5.2.4 'No Development' Alternative

The 'No Development' alternative alludes to the possibility that the Isang substation would not be developed, thus the proposed site would remain untouched. The farmers would continue to use the area for their cattle post activities, and power would not be transformed or transmitted from the site.

It has been described that the Isang substation development forms part of a much bigger upgrade of power infrastructure, including power stations and overhead transmission lines. The proposed Isang substation is an important element in the overall infrastructure upgrade. Without a substation, it will be difficult to distribute the power generated at the power stations to the power demand areas.

The substation does not only contribute to the increased power supply to Gaborone and surrounding areas, but also creates flexibility for transmission between incoming and outgoing lines for BPC, therefore increasing the power reliability. The 'no development' alternative jeopardizes this improvement, and the overall benefit from the proposed power station developments. It would contribute to Botswana's reliance on power supply from neighbouring countries.

Alternative selected: Development of the Isang substation.

5.2.5 Summary of Alternatives

The following table summarizes the alternatives considered for the development of the Isang substation, as described in the previous paragraphs.

Table 5.1: Summary of alternatives considered for the Isang substation

Aspect	Design Element	Alternative Considered	Selected option
Site	Site location	Isang site identified	X
		Alternative site on the opposite side of the Gaborone to Francistown road	
Size	Technical design	Design to include opportunities for future extensions	X
		Design to cater for current power requirements only	
	Plot size	Allocated plot size to allow for future extension	
		Allocate plot size for footprint of current scope only	X
Technical	Substation structure	Overhead stringer design	
		Tubular busbar design	X
	Substation concept	Outdoor substation	
		Indoor substation	X
	Electrical design	Breaker and half scheme design	
		Single feeder bay	X
	Power line connection	Connect existing 220kV power lines	

		Leave existing 220kV power lines unconnected	X
	Access road	Paved bitumen road	X
		Unpaved gravel road	
	Water supply	Use of existing borehole	X
		Drill new borehole	

5.3 CLOSURE REQUIREMENTS

The Electricity Supply Act (further described in Section 6.3) does not provide any specific requirements for closure of electrical sites, similar to the Mining and Minerals Act for closure of mines and borrow pits. Even though closure of the substation is currently unforeseen, and it is expected that further expansion will take place instead, provision for closure and rehabilitations must be made.

The closure of the site should see a full removal of the installed infrastructure. The most important aspect is that all electrical equipment is disconnected, and to ensure the site is safe. Specifically in a period between closure and before decommissioning, maintenance on fencing must be kept up. Further recommendations will be outlined in the project EMP. If any future legislation about closure of electrical sites will be introduced before closure of the Isang substation, this legislation needs to be considered during the closure as well.

6 STAKEHOLDER AND PUBLIC CONSULTATIONS

While Public Consultation is a specific requirement of the EIA Act, and concrete guidance is given under the Act with which to carry consultations out (e.g. advertisement must be made in the local press no less than 21 days prior to a consultation taking place, etc.), IAP consultation is more or less left up to the environmental consultant to organize and carry out in a manner conducive to "best practice" during the EIA process. This includes exhaustive communications with various District, Sub-district, Local, Tribal, and any other administrators as well as private companies and a myriad of other stakeholders whom the proposed development could affect in any way.

Aside from the human aspect of project discussion, another stream of consultation involved in producing a comprehensive EIA, involves the consultation of relevant policies, plans and legislation that exists in print. Such publications may have a bearing or impact on the proposed development, and DEA requirements are such that these must be discussed within the EIS. This also relates to any planning and implementation approvals which will be needed from Central and Local Government Authorities.

6.1 PUBLIC CONSULTATION

The EIA Act requires that a public consultation be carried out during the second phase of the EIA process: the Scoping stage. This Chapter provides the details of the stakeholders and public consultation exercise at length.

That which has been done to date in the interest of EIA scoping is outlined and discussed within this document. Continued consultation and cooperation specifically with local farmers, and authorities working on the project is anticipated throughout the length of the EIA study.

A public participation meeting was conducted at the *kgotla* in the village of Malotwana. The meeting was held on the 16th of February 2009 and the attendance was satisfactory as many of the local residents turned up to attend the *kgotla* meeting. The names of the attendees were recorded in an attendance register which shows that nearly 70 residents attended the meetings.

21 days prior to the meeting date, an advertisement for the public meeting was placed in the *Mmegi* newspaper, in compliance with the EIA Act. It is the EIA Act's regulation that an advertisement must be placed in the local newspaper at least 3 weeks before the date of the meeting. A copy of this advertisement can be found in Appendix B. In addition to the advertisement, posters were displayed in Malotwana and surrounding villages to raise awareness about the meeting.

The public participation meeting was facilitated by the representatives of Loci Environmental Mr. Johannes Westra, with the interpretation support of Loci Environmental consultant Mr. Eric Mohale. The client TAP/KEC was represented by Mr. Norman Ford and Mr. Ron Coney, and representing the Botswana Power Corporation (BPC) was Mr. Chere Mabiletsa, who provided technical answers to the questions raised.

The key comments and concerns raised during the meetings are outlined in the paragraphs below.

6.1.1 Summary of the presentation

"The EIA Act was legalised in the year 2005 in consideration of the environment, to assist in the development of infrastructure in the country of Botswana. There are several stages that are followed in the EIA process, one of which is Scoping, under which public consultations are undertaken. The eventual report produced from the EIA process is a document called an Environmental Impact Statement (EIS).

The BPC intends to develop a substation in Isang, which is located on the between Malotwana and the village of Artesia. The footprint of the substation will measure 500 x 900m. The perimeter will be fenced off with 2 fences placed strategically. There will be an inner and an outer fence which will secure the substation equipments and also prohibit livestock and unauthorised persons from entering. The substation will connect with transmission lines from Morupule power station, as they continue on to connect to locations such as Gaborone and in future, neighbouring villages.

It has been established that the development of the substation will bring about positive and negative impacts on the natural environment and social environment. Loci and BPC have considered carefully, these impacts on the environment and are determined to establish the necessary mitigation measures. The positive impacts that are foreseen from the substation development include improved power reliability in neighbouring locations, creation of temporary jobs for the residents of Malotwana and the provision of firewood from the removal of vegetation according to the layout of the designs.

The negative impacts of this development will include the loss of grazing land for the livestock within the vicinity, the blocking of paths used to traverse the area, the visual impact due to the substation intruding upon the existing landscape and construction impacts such as creation of dust. Despite the negative impacts, there is need to recognise the positive impacts of the development for country as a whole. Mitigation measures will be implemented to minimise the negative impacts.

We are here today to obtain your views and opinions on the matter, due to these potential local impacts."

6.1.2 Primary Issues Raised During public Consultation

Following the presentation, questions were solicited. The main issues raised during this session included:

- Construction commencement: The people are keen on knowing when the project will begin and are anxious to have it commence in no time. It was explained that work is expected to begin in 2010.

- Security measures: Issues about efficient security were raised in order to find out if the livestock and the public within the area will be safe from the power in the substation. Of which it was announced that 2 types of fences will be erected to keep trespassers out.

- Expected construction period: Due to complaints about the period of most construction jobs being too short for good employment, the public were eager to know how long the project will take from start to finish. The people were informed that the length of the project will be 12 to 15 months.

- Compensations: The people asked if there will be compensations from the government, to people who might lose their lands due to this construction. The people were then explained to that the land that is being acquired is virgin land that belongs to no one.

- Labourers: It was mentioned by the people that sometimes during construction works, authorities do not source the skill of the local labourers to improve rural development but instead come with workers from elsewhere. The answer given was that BPC has a strict policy of encouraging rural development by hiring local workers where construction is taking place.

6.1.3 Results and conclusion from public consultation

The people welcome the proposed development and expressed their gratitude towards BPC, as they will now have improved livelihoods due to sufficient power from the substation. They desire that the project proceed as soon as possible so that they may start enjoying the benefits now.

Issues about HIV/AIDS were raised as concerns that might impact the society during construction. Therefore people must exercise caution to protect themselves.

Concerns by other individuals, regarding the welfare of the livestock in the area, were brought up and it was noted that a separate meeting will be conducted with the farmers' syndicate for the Isang cattle posts. The meeting will iron out any issues involving the safety and wellbeing of the livestock within the proposed substation vicinity.

It was further elaborated that an Environmental Management Plan will be drawn up so that strict measures are followed in ensuring that positive impacts are enhanced and negative impacts minimised. One of the ways of ensuring this will be successful is to carry out inspections for compliance during construction.

A detailed review of the official public consultation was included within the environmental ToR, approved by the DEA. It is also included within this document in Appendix C.

6.2 STAKEHOLDER CONSULTATION

Stakeholders in the local area were briefed individually about the project and their comments and views were recorded. The interested and affected parties that were reached are included in the list below.

Table 6.1: Interested and Affected Parties

No.	Name	Organization	Designation
1	M. Lentswe	Tribal Administration	Chief Mochudi
2	I. Mabiletsa	MP's Office	Kgatleng East MP
3	R. Modipane	MP's Office	Kgatleng West MP
4	R. M. Kedimotse	Landboard	Board Secretary
5	M. Lepina	District Office	District Officer
6	Rev. M. Moruakgomo	Kgatleng District	Council Chairman
7	J. Nsala	Kgatleng District	Council Secretary
8	K. Ntapu	Kgatleng District	Council Physical Planner
9	M. Segokgo	Kgatleng District	Council Environmental Officer
10	M. Mutaoriwa	Kgatleng District	Economic Planner
11	D. Aniku	Department of Environmental Affairs	Director
12	G. Matlapeng	National Museum	Archaeologist

13	S. El-halabi	Department of Public Health	Director
14	M. Motlhatlhedi / Madisa	VDC	Chairman
15	W. Seone	Department of Water Affairs	Station Manager
16	T. Tuelo	Department of Roads	Senior Technical Officer
17	K. G Maselesele	Department of Tourism	Director
18	H. Mhotsha	Department of Lands	Board Clerk
19	M. M. Senombe	District Agricultural Office	District Co-production Coordinator
20	D. Ntwaagae	Botswana Railways	Director Engineering Services
21	T. S. Molefe	Department of Forestry and Range Resources	Coordinator
22	M. Debele	Orange Cellular Service Provider	Network Planning, Maintenance
23	N. Lebotse	Cattle Posts Syndicate	Chairlady

The comments and queries of the stakeholders were recorded and are depicted in the paragraphs below. However, consultation with the cattle posts syndicate is still ongoing and the results of the entire interviews will be discussed and analysed during the EIA phase of the project.

6.2.1 Primary Issues Raised During Stakeholder Consultation

Subsequent to the consultations, the following comments and queries were raised:

- Vegetation clearance: The consultation revealed fears from the stakeholders, about the amount of vegetation that might be lost in the process of creating space for the substation.

- Loss of farmland: The stakeholders raised concerns that, with vegetation being cleared, there will be a loss of farmland and livestock might suffer in feeding.

- Visual amenity: The presence of the substation and its transmission lines will bring about aesthetic intrusion on the natural environment. Concerns were raised by the stakeholders that the substation might interfere with the landscape around the Orange transmission tower.

- Effects of substation: The stakeholders were curious to know how the following effects: vibrations, sound, heat and radiation, which might occur from the substation, are going to be mitigated. There were no fears from the Orange stakeholders, about interference of the substation with the existing Orange transmission tower which is located near the proposed substation.

- Livestock concerns: Concerns about the well being of the livestock and wildlife found in the in the vicinity of the substation were also raised, as the stakeholders feared that the substation might be secured with an electric fence/line.

6.2.2 Results and conclusion from Stakeholder consultation

Overall the stakeholders welcomed the project and warned that the above mentioned issues must be taken seriously to avoid disastrous situations on the natural environment and human environment. As mentioned previously, consultations with the farmers in the Isang area are still ongoing and the results will be incorporated in the EIA phase of the project.

6.3 LEGISLATIVE CONTEXT

This section is intended to identify all policies, legislation, regulations, plans, guidelines, etc. which impact on the proposed planning, development and operation of the proposed mine project. The key pieces of legislation that have a direct bearing on the successful implementation of the proposed Isang substation development are highlighted below.

6.3.1 Land use

6.3.1.1 Tribal Land Act (revised)

Land administration in rural Botswana is governed by the Tribal Land Act of 1968. The Act governs access, use and disposal of over 70% of land in Botswana. It provided for the establishment of Land Boards whose functions involve the grant of customary land rights. Part III of the Act states that the powers vested in a Chief under customary law in relation to land include:

- The granting of rights of use of any land
- The cancellation of any grant of any rights to use any land
- Hearing of appeals from, confirming or setting aside any decision of any subordinate land authority
- The imposition of restriction on the use of tribal land

The above shall be vested in and performed by a Land Board. In essence the Tribal Land Act transferred powers previously vested in the chiefs to the Land Boards. In accordance with the conditions of this Act, the project proponent must be granted legal surface rights for the land on which the mining operations are to take place. Following the completion of the application process by the project proponent, the Land Board will issue surface rights for a fixed period. The process will require the project proponent to:

- consult the land overseer
- consult the affected local community
- consult and obtain consent from the existing land rights holders and at least three neighbours
- submit the application form to the Land Board.

It must be noted that there is a clause that requires the project proponent to pay compensation to the land rights holder, for the land that will be subsumed into the substation area.

6.3.1.2 Town and Country Planning Act of 1977

The *Town and Country Planning Act of 1977* establishes a framework for the orderly and progressive development of land in urban and rural areas. The Act is applicable in planning areas only and ensures that land is available for expansion purposes as well as other infrastructure service. Application should be made with the relevant authorities to apply for planning permission for all the structures required. The Act will be referred to as Mochudi is a planning area.

6.3.2 Environment and Archaeology

6.3.2.1 Environmental Impact Assessment Act (2005)

The EIA Act provides for Environmental Impact Assessments (EIAs) to be used to assess the potential effects of planned developmental activities; to determine and to provide mitigation measures for effects of such activities as may have a significant adverse impact on the environment; to put in place a monitoring process and evaluation of the environmental impacts of implemented activities; and to provide for matters incidental to the foregoing. Only after the competent authority being Department of Environmental Affairs has approved the Environmental Impact Statement can the project proceed. The EIA process entails:

- the identification of potential environmental impacts
- the identification of measures to mitigate the adverse impacts and enhance the positive effects
- undertaking public consultations to inform and solicit the views and concerns of interested and affected parties about the proposed project
- the development of an Environmental Management Plan that outlines the proposed measures to mitigate both archaeological and environmental effects.

6.3.2.2 Monuments and Relics Act (2001)

As part of the EIA study, an archaeological impact assessment (AIA) has been undertaken to fulfil the requirements of the 2001 Act, which requires the project proponent to obtain a clearance certificate based on the submission of the AIA before development can be initiated. This Act provides for the protection and preservation of ancient monuments, relics and material of archaeological, cultural or historic interest and classifies graves as ancient monuments. Thus, old or new burial sites are not to be disturbed nor moved without the permission of the Director of the Department of National Museums, Monuments and Art Galleries. This is often preceded by a lengthy consultative process with the local communities.

6.3.3 Protection of natural resources

6.3.3.1 Agricultural Resources Conservation Act (1974)

The purpose of the Act is to control and conserve agricultural resources in Botswana such as animals, birds, plants, waters, soils, vegetation and vegetation products, fish and insects.

6.3.3.2 Wildlife and National Parks Act (1992)

The Act gives measures for the management and protection of national parks, game reserves, Wildlife Management Areas (WMAs) and controlled haunting areas (CHAs) where wildlife conservation and use is the primary land use. It also gives guidance on different aspects of conservation such as hunting, game farming and game capture.

6.3.3.3 Forest Act (1976) amended 2004

The objective of the Act is to regulate forest reserves and state protected plant species in the country. The Act also regulates trade (including import or export) of endangered flora and other forest products.

6.3.3.4 Water Act (1968)

The Water Act primarily provides for the prevention of the misuse and pollution of water through enforcement of penalties. The Act also addresses the ownership, protection and the rights to use 'pubic water', and requires that the water resources within the project area and beyond should not be polluted.

The Water Act intends to define ownership of any rights to the use of water and to provide for the granting of water rights and servitude. Water in rivers, streams, lakes, pans, swamps or beneath a watercourse or underground water and in works such as canals, reservoirs and dams is public water. The use of such water can only be with permission granted by the Water Apportionment Board (WAB). Application for the water user rights to the Board is done through the Water Registrar who shall issue a certificate. The holder of a water right is obligated to take precautions to prevent accumulations in any river, stream or watercourse of silt, sand, gravel, stones, sawdust, refuse, sewage, waste or any other substance likely to affect injuriously the use of such water. A holder of water right who contravenes the Act shall be guilty of an offence and liable to a penalty under the Act.

Any increase in water abstraction as a result of the development must be assessed with regard to any existing Water Apportionment Board Abstraction Rights and whether there is need for increased water abstraction rights. The Act is relevant because the current design of the Isang substation has tested one of the existing boreholes, and established suitability for water supply to the site.

Boreholes Act (Chapter 34:02)

The Act commenced on the 19th of October 1956 and it requires the Director of Geological Survey to oversee borehole drilling operations and their records in Botswana. In this regard Section 4 (1) states that "any person who, for the purpose of searching for or abstracting water, proposes to sink a borehole intended to reach a depth of more than 15 meters below the surface or who proposes to deepen any existing borehole of less than 15 meters in depth so as to reach a depth of more than 15 meters from the surface or who proposes to deepen any existing borehole of 15 meters or more in depth or who proposes to sink from headings a borehole intended to reach a depth of more than 15 meters below the surface, shall, before he begins to do so, give to the Director notice in writing of his intention to do so; and shall keep on a form provided by the Director a record of the progress of the work which shall include measurements of the strata passed through and of the levels at which water is struck and subsequently rests". The Act also requires that other data sets related to the drilled borehole such as pump test data be availed to the Director of Geological Surveys.

It will be confirmed that the exisiting boreholes drilled at site have been duly registered with DGS as above.

6.3.3.5 Mines, Quarries, Works and Machinery Act (1978)

This Act is relevant to issues relating to the safety of mining, ancillary and quarrying operations and also the safety, health and welfare of the site employees. The project proponent is required under the

Act to put in place measures that will result in the compliance with the specifics summarized in the legal register. The act is relevant to the project as it specifies that a Mineral Permit must be issued by the Department of Mines for any borrow pit or quarry to be operated during the construction phase. The application for the Mineral Permit has to be accompanied by a completed EIA report for each borrow pit or quarry.

6.3.4 Solid waste management and ground water pollution

6.3.4.1 Waste Management Act (1998)

This Act ensures proper waste management practises from handling to transferring of 'controlled waste' (defined in this act as household, industrial, commercial, clinical or hazardous waste) are put in place. The act stipulates that waste produced by any establishment has to be classified and transported by registered and licensed waste carrier. The act also ensures registration and licensing of waste disposal sites and waste management facilities. Waste disposal, especially during the construction phase should be disposed at appropriate locations.

6.3.4.2 Public Health Act (1981)

This Act addresses diseases and the spread thereof, and provides a range of health measures including regulations on prevention, management and control of diseases as well as cleanliness and sanitation and the control of nuisances. The Act also provides for the welfare of all personnel and addresses working facilities related to sanitation, workshops and offices, stating that these must be cleaned regularly and free of litter, and free of any nuisances that are offensive, injurious to health and possible environmental pollutants.

The Public Health Act aims to protect the public from actions or incidents that can pose health risks. Section 57 forbids pollution of water sources used or likely to be used for domestic purposes. It empowers health officers "to take all lawful, necessary and reasonably practicable measures to ensure the purity of any supply of water which the public has a right to use and does use for drinking or domestic purposes, and to take all necessary measures against any person so polluting any such supply or polluting any streams so as to be a nuisance or danger to health". In this project therefore, it is essential that all activities that can pose risks to public health or are likely to pollute the groundwater resources of the area and its surroundings are to be avoided or mitigated where unavoidable.

Under the Act, proponents are prohibited from conducting operations such that any street, road or part of, any stream, pool, ditch, gutter, watercourse, sink, water tank, cistern, water closet, privy, urinal, cesspool, soak-away pit, septic tank, cesspit, soil pile, waste pipe, drain, sewer, garbage, receptacle, dustbin, dung-pit sewer, garbage, receptacle, dustbin, dung-pit, refuse pit, slop-tank, ash-pit or manure heap so foul or in such a state or so situated or constructed as in the opinion of a health officer to be offensive or to be injurious or dangerous. Additionally, the Act protects the quality of water used by the public, by controlling the disposal of polluted water and control of mosquito larvae.

6.3.4.3 BOBS standards for wastewater disposal into the environment

The standards of wastewater disposal into the environment (as prepared by Botswana Bureau of Standards) should be adhered to.

6.3.5 Safety and fires

6.3.5.1 Factories Act (1979)

The Factories Act is one of the few pieces of legislation primarily concerned with Occupational Health and Safety in Botswana. The Act provides regulations to govern conditions of safety, health and welfare in the employment in factories and other places. It also provides regulations for the safety and inspection of certain plant and machinery and for incidental purposes. The definition of "Factories" according to the Act is essentially all premises where people are employed in manual labour, and is highly relative to the mining industry. Subjects relevant under the act include

- Occupational Hygiene
- First aid
- Personal protection equipment (PPE)
- Notification of accidents, dangerous occurrences and industrial disease
- Cranes and other lifting machines and apparatuses
- Herbage Preservation (Prevention of Fires) Act, 1978

6.3.5.2 Herbage Preservation Act (1978)

The Act requires that permission must be sought from the Herbage Preservation Committee to set fire to any vegetation on land of which one is not the owner or lawful occupier. The objective of the Herbage Preservation (Prevention of Fires) Act is to prevent and control bush and other fires. In accordance with the Act if any activity at the substation requires fire, the proponent must first obtain permission from the Herbage Preservation Committee. In addition, under no circumstance can management or the construction employees start a fire on land that does not legally belong to the substation, as this is considered an offence under the Act.

6.4 SUSTAINABLE DEVELOPMENT PLANS AND SOCIAL POLICIES

Several well-known policies, plans and strategies have been authored in Botswana in recent years, largely due to the fact that the country is progressing towards greater environmental sustainability and increasing efficiency in natural resources and development.

6.4.1 Kgatleng District Development Plan 6: 2003 – 2009

The Kgatleng District Development Plan 6 (KDDP 6) was instituted to run concurrently with the National Development Plan 9: 2003 – 2009. The development of the Isang sub-Station site is not directly linked to the Kgatleng DDP, as it is a project of National significance.

6.4.2 Vision 2016

Vision 2016 was developed in 1996 through a nationwide consultative process and published in 1997 (Presidential Task Group, 1997). While noting the accomplishments of the past, the Vision 2016 document highlights the changing environment and emergent challenges facing Botswana, the need to adapt of a changing environment, and the need to take advantage of opportunities as they arise. Key features of Botswana by 2016, under Vision 2016, are envisaged as follows:

- An educated, informed nation.

- A prosperous, productive and innovative nation.
- A compassionate, just and caring nation.
- A safe and secure nation.
- An open, democratic and accountable nation.
- A moral and tolerant nation.
- A united and proud nation.

Vision 2016 was designed to be consistent with the National Principles of democracy, development, self-reliance and unity that have guided Botswana since independence in 1966, coupled with the concept of 'botho', referring to people reaching their full potential within the context of positive social norms, and refocused to embrace change and tackle development challenges. The aim remained to attain social harmony, sustained development, rapid economic growth, economic independence, and social justice.

Key social environment elements of the Vision 2016 document are as follows:

- Recognition of the importance of sound environmental management and community involvement in conservation and exploitation.
- The need to meet economic growth targets to allow the continued provision of social services.
- Economic diversification for job creation.
- Adequate shelter, following the national housing policy that "will not discriminate against any social group, women or the disabled" (Presidential Task Group, 1997: 8).
- More equitable income distribution.
- The eradication of extreme poverty and the reduction of the percentage of the population in poverty from 46% in 1994 to 23% in 2016.
- Social safety net coverage of all those in poverty, and all of those who are vulnerable.
- Access to adequate health care services.
- A reduction in new infections from HIV, and the provision of treatment to all of those in need.
- Reduced levels of crime.
- Improved road safety.
- Open, transparent governance, including a strengthened role for civil society.

6.4.3 National Development Plan 9 (2003/4-2008/9)

The National Development Plan 9(Ministry of Finance and Development Planning, 2003), covering the current development period, was guided by Vision 2016, and underlined the need to attain domestic development by improving Botswana's competitiveness in global markets. It also noted the difficulty in doing so in the context of an economic downturn.

The "**Revised National Policy for Rural Development**" (Government Paper No. 3 of 2002, Ministry of Finance and Development Planning, 2002) recast rural development in terms of sustainable development, and put forward the following principles (Ministry of Finance and Development Planning, 2002: 14):

- Open and gender sensitive participatory programmes based on people's leadership and ownership of their development.
- Empowerment through increased participation of people in economic opportunities.
- Optimal and environment-friendly utilisation of natural resources.
- Passion for success, human dignity and productivity.
- Achievement of self-reliance and dependable livelihoods.
- Equity, efficiency, effectiveness and sustainability.

In some respects the emphasis on community participation reverted back to the **1997 Community-Based Strategy for Rural Development** (Ministry of Finance and Development Planning, 1997) which had received little practical attention. The 1997 Policy was a sound document that highlighted systems that could improve community involvement in, and control over, the development process in rural areas. However, even with the 2000-2001 review of the **Rural Development Policy** and Government's commitment to a more community-driven approach, the proposed way forward noted in the Revised Policy did not offer much guidance on how this could be effected, aside from through Government institutions (at the district and village levels), nor how social space could be created that would allow a greater role for civil society.

Under Government's classification of remote areas as per the **Remote Area Development Programme (RADP)**, the project area is eligible for benefits under the Programme. The goal of the RADP is "to achieve sustainable social and economic development of the Remote Area Dwellers, through a coordinated and integrated approach of sectoral developments, so that they can equally benefit from the rapid economic development of the country" (BIDPA, 2003).

In brief, government policy on spatial development in response to population distribution is the 1998 **National Settlement Policy** (Government of Botswana, 1998). The Policy identified four planning regions and three ecological zones to guide planning and management of population growth and distribution, as well as urbanisation, regional settlement patterns, land use and land tenure, social and physical infrastructure, and natural resource use and protection. For remote areas, most remote communities were classified as 'tertiary IV', with populations ranging from 250-499 persons (covering 55% of existing RADP settlements). 'Other settlements', broken into two groupings (population ranging from 150-249, and population ranging from < 150 persons), covered an additional 20% of all RADP-served settlements. Under the Policy, communities of 250 persons or more are eligible for social infrastructure in the form of health, water and education services, while larger communities are also eligible for other services.

6.4.4 Other Social Policies

Beyond those noted above, other policies of relevance to the proposed BPC substation development at Isang include:

6.4.4.1 Botswana National Policy on HIV/ AIDS (1998)

The national policy on HIV/ AIDS prevention and care outlines the national response to the epidemic in Botswana. It describes the roles of national leaders, various government ministries, the private sector and community based organizations and the general public in the national response. The policy forms the basis for developing a national strategic plan. It is based on current scientific, epidemiological and medical knowledge about the distribution and transmission of HIV and other sexually transmitted diseases (STDs) and proven effective interventions in prevention and care.

6.4.4.2 Botswana's National HIV/AIDS Strategic Framework (2003-2009)

The main purpose of the *Botswana's National HIV/AIDS Strategic Framework (2003-2009)* is to articulate, disseminate, and educate the public at large on agreed national priorities and strategies within the scope of Vision 2016 and to provide clear guidance for Ministries, districts, NGOs, and the Private Sector to enable them to work in a collaborative manner in achieving the intended goal of the National Response to HIV/AIDS. As with the Policy above (5.2.2.2) the framework implies that the contractor, KDC/PIU should work together to educate the Bokaa and Pilane communities as well as the construction crew on matters relating to HIV/AIDS prior to the construction phase. Information on preventative measures should be available at all times for residents and the incoming labour force.

Several additional policies and strategies have been formulated in respect of resource utilisation and environmental protection several which are listed below, and the most relevant described in the subsection following.

6.5 ENVIRONMENTAL AND CONSERVATION POLICIES

6.5.1 National Policy on Natural Resources, Conservation and Development

One of the primary relevant policies includes the 1990 National Strategy on Natural Resources Conservation and Development (also called "National Conservation Strategy" or NCS). It aims at promoting conservation of natural resources in the country such as fresh air, water, vegetation, wildlife, soils and archaeological features.

This Policy was formulated by Botswana Government and approved by the National Assembly on the 17th December 1990. The conservation goals of the Policy relevant to the water regime are:

- the conservation of all main ecosystems, wildlife and cultural resources;
- the control of the depletion of exhaustible resources;
- the prevention and control of pollution.

This policy's relevance under this EIA involves seeking assurance that the proposal will not use up a finite non-renewable water resource and maintains the quality of the resource for future generations. These issues with relation to Isang substation are discussed in more detail in Chapter 9.

6.5.2 National Master Plan for Wastewater and Sanitation (2003)

The master plan aims puts forward the country's strategy for sanitation and wastewater management until 2030. Its objective is to develop planning and implementation strategies for the generation, collection and disposal of wastewater in an environmentally friendly and acceptable manner. Specifically, it aims to achieve the following management goals:

- To develop sustainable operational and management practices and services for wastewater and sanitation;
- To empower local authorities through the transfer of overall responsibility for service provision;
- To protect and improve public health;
- To prevent pollution of natural resources, water resources in particular; and
- To conserve water resources.

6.5.3 Waste Management Strategy (1998)

The *Waste Management Strategy of 1998* states that waste management will be carried out in a manner that protects human health and the environment, and that ensures prudent use of natural resources. It captures the principles of prevention, the polluter pays and the principle of cooperation. A waste management plan is considered in the EMP, with a strategy adopted according to an internationally acceptable Waste Management Hierarchy (i.e. Waste reduction → Waste Reuse and Recycling → Treatment → Disposal) to minimise wastes.

6.5.4 The Biodiversity Strategy Action Plan (BSAP), 2004

The Biodiversity Strategy and Action Plan of 2004 (Revised in 2007) was compiled in compliance with the Convention on Biological Diversity, to which Botswana is a signatory. The BSAP consists of eleven objectives which are aimed at preserving the biological diversity of our environment. The EMP therefore has to prescribe mitigation measures that will embrace the objectives of the BSAP.

6.5.5 National Implementation Plan for POPs (2008)

Persistent Organic Pollutants (POPs) are synthetic chemical substances that have toxic properties to humans and animals, are bio-accumulative in organisms through the food chains, and get transported over long-range distances from the points of their release through various environmental media such as air, water and migratory species. Their occurrence in the environment lasts for a considerable length of time. They last because they resist photolytic, chemical and biological degradation. POPs are highly toxic as they cause an array of adverse health effects, notably death, birth defects among humans and animals, cancer and tumours at multiple sites, neuro behavioural impairment including learning disorders; immune system changes; reproductive deficits of exposed individuals as well as their offspring; diseases such as endometriosis, increased incidence of diabetes and others.

Many of the POPs have found wide use as pesticides to protect plants against diseases and humans and animals from vector-borne diseases. Some are used as heat resistant dielectrics in electrical equipment such as transformers and capacitors, while dioxins and furans are produced as by-products of incomplete combustion and chemical processes. At present, twelve chemicals have been proved to exhibit POPs characteristics. They are composed of intentionally produced pesticides (i.e. Aldrin, Dieldrin, DDT, Endrin, Chlordane, Hexachlorobenzene, Mirex, Toxaphene and Heptachlor) and industrial chemicals, which are Polychlorinated Biphenyls (PCBs) and Hexachlorobenzene. The second category is the unintentionally produced releases of certain industrial and combustion processes i.e. the polychlorinated para dibenzodioxins and polychlorinated dibenzofurans.

Following the Stockholm Convention, Botswana developed this living document to guide all sectors towards elimination of POPs in the country. The overall goal of National Implementation Plan (NIP) is to provide the road map for the protection of the health of Batswana and environment from harmful effects of POPs and Persistent Toxic Substances. The NIP is very relevant to any electrical infrastructure projects, as nearly half of all the electrical transformers currently installed in Botswana are containing PCBs.

6.5.6 BPC Environmental Policy

BPC has an environmental policy (Environmental Policy and Management Statement. BPC, November 1995), which outlines their commitment to the environment. For brevity the document is not repeated in detail here but the main points are summarised for information.

1. The BPC mission statement is: ‘Botswana Power Corporation strives, at all times, to generate, transmit, distribute and supply electricity in the most safe, reliable, effective, affordable and environmentally friendly manner to enhance the social and economic well-being of the nation.’

2. Their environmental commitment is: ‘Botswana Power Corporation provides electricity to every sector of Botswana’s economy. The Corporation is committed to achieving a balanced approach in satisfying the electrical energy needs of the nation with the protection and sustainable conservation of the environment.’

3. In Appendix A of the BPC policy, which summarises the impacts and actions for BPC’s main work activities, under the activity ‘line design, construction and wayleave location’ the impact

concern is ‘replacement of natural geographical scenery with unnatural visual structures.’ The action required is ‘carry out EIAs for all new major projects and implement their recommendations’.

6.6 INTERNATIONAL CONVENTIONS

The following international conventions have a degree of relevance to the project, and include policy that has been acknowledged worldwide as applicable to similar projects.

6.6.1 Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is the most comprehensive global environmental agreement on hazardous and other wastes. The Convention has 170 Parties and aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes. The Basel Convention came into force in 1992 (Basel Convention Website www.basel.int).

In Botswana, the waste management facilities are not of sufficient standard to treat hazardous waste. Therefore hazardous waste must be transported elsewhere for treatment and disposal. The Convention requires that the mining company requests the Government of Botswana to provide a written notice to transit states and the destination country importing its hazardous waste. These countries would then have to issue prior written consent before any export could take place. Each approved shipment would have to be accompanied by a movement document.

6.6.2 Kyoto Protocol

The United Nations Environment Programme defines the Kyoto Protocol treaty as a legally binding agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990 (but note that, compared to the emissions levels that would be expected by 2010 without the Protocol, this target represents a 29% cut). The goal is to lower overall emissions from six greenhouse gases - carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs - calculated as an average over the five-year period of 2008-12. National targets range from 8% reductions for the European Union and some others to 7% for the US, 6% for Japan, 0% for Russia, and permitted increases of 8% for Australia and 10% for Iceland (Kyoto Protocol website, 2005).

Although the protocol is not binding on developing countries, such countries have to ensure that they act responsibly and avoid greenhouse gas emissions at levels that have been found to be undesirable. The proposed Isang substation forms part of an overall development of power stations, transmission lines, coal mines and related infrastructure. This overall development will increase emissions of greenhouse gases significantly.

6.6.3 Stockholm Convention on Persistent Organic Pollutants

In 1995, the Governing Council of the United Nations Environment Programme (UNEP) called for global action to be taken on POPs, which it defined as "chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment".

Following this, the Intergovernmental Forum on Chemical Safety (IFCS) and the International Programme on Chemical Safety (IPCS) prepared an assessment of the 12 worst offenders, known as the dirty dozen. The negotiations for the Convention were completed on 23 May 2001 in Stockholm. The convention entered into force on 17 May 2004 with ratification by an initial 128 parties and 151 signatories. Co-signatories agree to outlaw nine of the dirty dozen chemicals, limit the use of DDT to malaria control, and curtail inadvertent production of dioxins and furans.

Parties to the convention have agreed to a process by which persistent toxic compounds can be reviewed and added to the convention, if they meet certain criteria for persistence and transboundary threat. The first set of new chemicals to be added to the Convention were agreed at a conference in Geneva on 8 May 2009.

The convention is of significant relevance for the project, as insecticide and termiticides are included in the list of chemicals, with a possibility of being used during construction. It is of even greater significance for electrical infrastructure projects, as some electrical transformers possible contained PCBs in the past, a chemical substance that has been banned under the Stockholm convention.

7 ENVIRONMENTAL SETTING IN GENERAL

This section describes the current receiving environment predicted to be affected by the proposed development. Assessing the environmental setting prior to commencement of the development is critical as it identifies points of sensitivity examined in the scoping exercise, as well as potential mitigation measures and alternatives that will be investigated throughout the EIA process.

The proposed project site is in an area that is sparsely populated, there are however a number of infrastructure developments surrounding the project site:

1. Two 220kV overhead power lines, running parallel to each other, towards the north-western side of the proposed substation site.

2. The Gaborone to Francistown A1 road to the eastern side of the proposed substation site.

3. The Gaborone to Francistown railway line to the eastern side of the proposed substation site and A1 road.

4. An Orange cell phone tower to the eastern side of the proposed substation site, between the A1 road and the substation site. The cell phone tower is located along the proposed access road.

5. A water pipeline parallel to the A1 road, installed at 1 meter depth on the edge of the road reserve.

6. Three boreholes installed by cattle post owners in the area.

A layout of the proposed substation has been provided in the previous chapter, in Figure 6.1. This layout also shows the existing infrastructure described above. The site is currently vegetated with grass and bush type vegetation, a picture is shown in Figure 7.1 below.

Figure 7.1 Current condition of the Isang site.

Along the existing 220 kV powerlines, and within the boundaries of the proposed substation, BPC has already been allocated of the tribal land rights for a smaller 200m x 200m site. This site was used for holding an old transformer. The transformer is not longer in use, and is due to be decommissioned before the start of the proposed Isang substation construction.

7.1.1 Physical Environment

The study area lies on a plateau which is generally characterised by flat to gently sloping terrain. Altitudes range between 960m and slightly more than 961m above see level. The highest point on the site (only referring to the site area surveyed) is located on the south western boundary (at 961.6m) while the lowest point lies near the far north-eastern boundary (at 960.15m). Refer to Figure 7.2 below.

Figure 7.2 Topographical survey of the Isang site.

The area has a slope range of between 0 and 3 percent, with more than 50% of the site lying within 0 and 1 percent slope range. The terrain slopes gently to the east and north.

Due to the general flatness of the terrain this will subject the area to sheet floods in times of very high rainfall. The area and tracks around the substation become difficult to access by vehicle, the current drainage may present a challenge for effective stormwater drainage as well as gravity aided reticulation systems. The provision of stormwater ditches and trenches in the substation designs is further evidence of these conditions.

7.1.1.1 Surface Hydrology

The project area has poor groundwater development prospects. There is a great lack of groundwater largely due to the underlying granite rocks that have very poor secondary aquifer characteristics because of a lack of well interconnected open fracture systems. The hard rock geology has negligible primary porosity and poor secondary porosity, as a result resources are difficult to locate, and generally unpredictable.

Where water is found in fractures or dykes, the static water level ranges from 10m to 100m, depending on the location. Regional groundwater flow, such as it is, is from southwest to northeast. Three existing boreholes were identified in close proximity to the site, but none within the site boundaries. The boreholes are relatively shallow and low yielding boreholes, installed by farmers for provision of water to the cattle posts. The location of the boreholes is shown in figure F.1 in the previous chapter.

Considering the above, water should be measured as a scarce resource and a valuable commodity during all stages of the proposed development at Isang. Water restrictions, water saving devices and water re-use are ways to minimise water usage.

The vulnerability class indicated is “low vulnerability” and described as areas mainly with low potential of ground water resources, the low potential of fractures within the granite formation and the great depth to the water table (>60m) indicates that the study area is associated with low groundwater vulnerability.

7.1.1.2 Geology

Geology in the area is assigned to the Granite Complex of early Proterozoic era Complex (Quarter degree Sheet 2425D Geology Map- Department of Surveys and Mapping). The Gaborone granite intruded the Lobatse Volcanic group in the early Proterozoic era and the cooling of the magma produced concentric lithological zoning in the granite. Granite rocks dominate this major intrusion which covers an area of over 5 000 square km in south eastern Botswana that includes the site area. The geology of the site is primarily composed of different geological units of the Gaborone Granite intrusion. Limited sedimentary deposits found in the area are mainly of sandy alluvium that also overlays granite bedrock. Small isolated areas have dolerite sills and dykes in the areas on the western part of Gaborone dam.

The two geological units typical of the study area are Thamaga Granite (Rapakivi granite with micro granite sheets on the majority of the airport property on the south of the site) and Kgali Granite (medium grained, felsic equgranular granite that covers the northern end).

Concerning to building foundations and construction purposes, Isang presents in general good and stable conditions. Practically there are no serious constraints relating to rock types with intrinsic faults is likely to restrict new developments and improvements of existing physical structures.

7.1.1.3 Soils

The soil type in the area belongs to the group of soils associated with Luvic Arenosols and metamorphic rocks (hardveld).

These soils are developed from sand deposits derived from the weathering of medium grained rocks. The soils are characterised by having low moisture holding capacity and for crop growth, frequent fertilisation is required due to the low fertility status of the soils (Botswana National Atlas, 2000).

Natural vegetation associated with these soils includes medium trees of which some tend develop rooting depths of 6 metres because of the 50 cm thick soils that occur as top layer. The top layers are mostly sandy and or including sandy loam materials. The presence of Acacia tortilis (Name) also usually indicates a good soil layer deeper than 20 cm. The soils are moderately deep to deep, well drained, pale brown to yellowish brown loamy sand. They are also classified as deep to very deep, well to somewhat excessively drained, red to strong brown fine sands to loamy fine sands.

7.1.1.4 Climate

There are no climate details available for the Isang area, the nearest meteorological station is located at SSKA airport in Gaborone. The climate records at SSKA airport compiled by the Department of Meteorological Services (DMS) were made available for this study. A summary of the climate records at this stations is presented in the following sections.

The climate of the greater Gaborone area is sub-tropical semi arid with summer rainfall. The long-term average annual rainfall is 559mm, with almost all rainfall occurring during summer months from October to April. Rainfall tends to be erratic and localised, falling in spells of high intensity. This can result in significant volumes of run-off over very short periods causing soil erosion, and depending on location, downstream flooding.

The maximum temperature ranges from monthly mean of 22 Cº in July to 32 Cº in December and January. However extremes can reach highs of 43 Cº. Minimum temperatures range from a monthly mean of around 5 Cº in July to 19 Cº in January. In extreme cases it can fall to -5 Cº early morning frosts can be experienced between June and August, particularly in low lying areas.

Prevailing winds are east and northeast, although there is a large portion of the year (between 30 – 40% depending on the time of year) when it is still. The wind rose as recorded at SSKA meteorological station, is shown in Figure 7.2 below. South easterly winds dominate in winter early mornings.

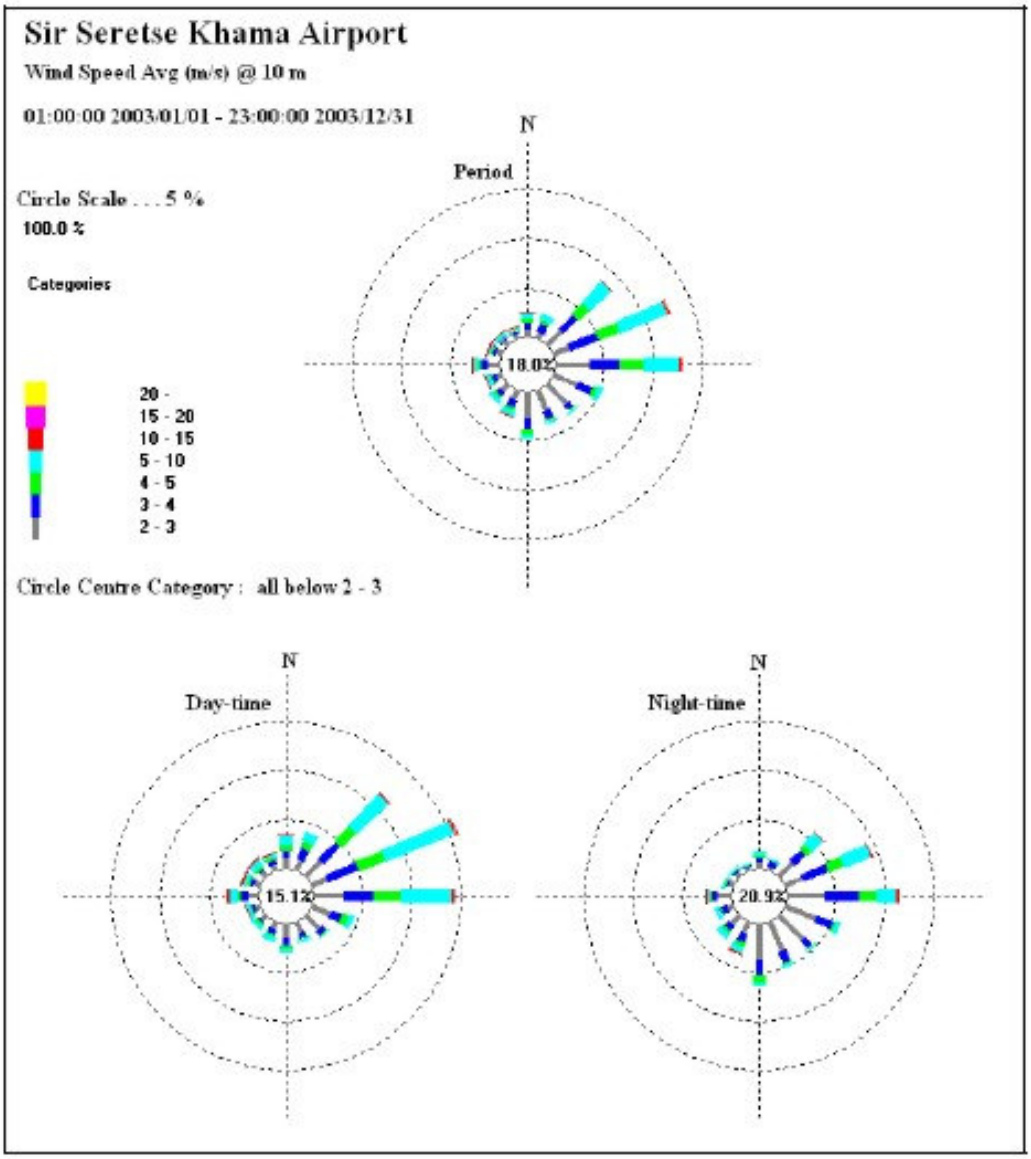


Figure 7.2 Wind Rose, as recorded AT SSKA

Evaporation rates are high with open pan evaporation being in the region of 1732 mm to 1994 mm mm/year, or approximately 3.5 times the annual average rainfall.

Humidity is relatively low, with 55 to 75% recorded for morning and 45 to 25 % for afternoons.

7.1.1.5 Ecology

The area contains vegetation and habitats that are well represented outside of the site. It is expected that no rare and endangered animal species occur exclusively on the site.

A short, close canopy shrubland savannah consisting of Acacia and Combretum species dominates the local vegetation. Tree height is generally 3 to 6 metres, while shrubs are generally ~1 to 4m in height. Trees and shrubs are generally distributed in clumps, with 5-15m spaces between the clumps.

Many of the larger trees, and tree clumps provide nesting habitat for birds and small, tree-dwelling animals.

7.2 EXISTING ENVIRONMENTAL PROBLEMS

As described earlier in this chapter, the proposed site is surrounded by existing infrastructure, including a road, two 220kV overhead power lines, a railway line, an Orange cell phone tower and a number of boreholes. The existing environmental issues in the study area are largely related to these developments:

1. There is fencing installed along the road corridor, which has stopped free movement of wildlife between areas.

2. Clearance has been undertaken in the road corridor as well as the power line corridor.

3. The A1 road is the main haulage route from Gabonone to Francistown and further north, and carries a large volume of heavy duty trucks. The traffic is a safety concern for people in surrounding villages, as well as a cause for 'road kill', noise and air pollution.

4. The overhead power lines as well as the cellular phone tower are causing significant visual impacts.

5. The railway line is used for regular cargo traffic; this train traffic can cause noise and air pollution. It can also be a cause of collision and accidents with people, cattle and wildlife.

The EIA will address the existing environmental issues, particularly in the context of potentially creating cumulative impacts[4], when considering the potential effects of the proposal.

7.2.1 Socio-Economic Issues - Services

The Isang area is undeveloped, and is not populated apart from a few cattle posts. The area hosts a significant amount of infrastructure, such as pipelines, power lines, railway and road, but services such as water and power are not available in the area, due to the fact that connections have not been provided for. The infrastructure consists of main lines providing Gaborone and surrounding areas.

The proposed site is located in between the villages of Malotwana and Artesia, as shown in Figure 1.2 of this report. Water supply is available next to the site from a borehole, but for all other facilities the villages will be the nearest place of supply. A number of social constraints and problems were identified in the Kgatleng District:

- Poor implementation of planned projects in the area.
- Unemployment, especially in the rural villages, the unemployment causes migration from rural areas to main centres.
- Mushrooming of unrecognized settlements.
- Encouragement of agricultural and entrepreneurial initiatives.

[4] Cumulative Impacts are the addition of many individual impacts to create one larger, more significant impact.

- Rising incidence of HIV/AIDS.
- Loss of agricultural land for residential purposes.
- Improvements in management of day care centres.

7.3 EXISTING HUMAN ENVIRONMENT

The Kgatleng district, of which Malotwana and Artesia are part of, is located in the south-eastern part of the country. The entire district covers a land of 7 600 km^2 with a population size of 73 032 people, according to the 2001 Population and Housing Census (PHC). The population consists of an almost similar number of males as compared to females. The PHC of 2001 revealed that the total number of males in the district is 35 734 whilst the total number of females is 37 773.

The village of Malotwana, which is 10 km north of Mochudi has a total number of 354 residents, whereas the village of Artesia is located 55 km north of Mochudi with a population of 1 462 residents, according to the PHC of 2001.

The Kgatleng district is predominantly occupied by a Setswana speaking tribe known as Bakgatla baga Kgafela. This group occupies Malotwana and Artesia where the common language spoken is Sekgatla.

The village of Artesia offers the following services to the local community:

- Health – Local clinics.
- Education – Primary and Junior Secondary Schools as well as adult education services.
- Water – There is water reticulation supply.
- Tribal Administration – Kgotlas with Chiefs, assistants and local police.
- Landboard – A sub-landboard.
- Police – Local police.
- Roads – Main Gaborone to Francistown road and internal roads networks (tarred and unpaved).
- Power – full service.
- Telecommunications – full service, including cellular network coverage.
- Businesses and commercial – A number of small businesses, shops and industry has established.
- Churches – There are a number of small churches established in the village.
- Postal services – The village has a post office.

The village of Malotwana offers the following services to the local community:

- Agricultural services – Veterinaries and drought relief programmes.
- Taxi services – Combis.
- Train station – There is a train station for offloading and uploading goods in Malotwana.
- Education – Primary school
- Health – Local clinics.
- Water – There is water reticulation supply.
- Tribal Administration – Kgotlas with Chiefs, assistants and local police.

- Police – Local police.
- Roads – Main Gaborone to Francistown road and internal roads networks (tarred and unpaved).
- Power – full service.
- Telecommunications – There is only cellular network coverage.
- Businesses and commercial – Two groceries stores and several tuckshops.
- Churches – There are a number of small churches established in the village.
- Postal services – A private bag.

For further services the local community would rely on the capital of the Kwatleng District, which is Mochudi village. Mochudi provides a hospital, a number of clinics, schools, shops, district offices and other relevant facilities. The distance from the site to Mochudi is approximately 40 kilometres.

7.3.1 Environmental Health

Although a majority of the houses in the two villages, Artesia and Malotwana, do not have piped water indoors, there are several households which have yard taps connections. Another form of collecting water is through the use of communal taps.

Paraffin, wood, Gas and electricity are some of the means of fuel used for cooking whilst common fuels used for lighting include paraffin and electricity. As Malotwana and Artesia do not have a reticulated sanitation system, the villages mostly utilise pit latrine systems (ventilated improved pit latrines and other pit latrines) for human waste disposal. Solid waste is collected from house to house by donkey carts and afterwards disposed of at a dumping site. Although the villages do not have a hospital there are small clinics available as stated in the section above.

8 LIMITATIONS ENCOUNTERED

During the Environmental Impact Assessment a number of limitations were encountered, the limitations are briefly described in the following sections.

8.1 GENERAL

Power line routes: The Isang substation makes provision for the connection of eight incoming or outgoing overhead power lines. At the moment the details are only know of the connection of the planned 400 kV line from Morupule, and the connection of the existing 220kV lines. Routes, directions and structures of additional future power lines are not know at this stage, and could not be included in the assessment of cumulative impacts.

Consultation with farming community: During the scoping stage of the project, several attempts were made to set up a meeting with the owners of the cattle posts in the area. The meetings were organized through the secretary of the farmers syndicate, and the meetings were arranged in weekends for convenience for people otherwise employed during the week. Unfortunately there was no attendance at the meeting, and the only consultation took place with the syndicate chairperson, through their permanent secretary.

Undeveloped area: The Isang area is largely uninhabited, and the distance to the nearest kgotla in Malotwana or Artesia is several kilometres. Malotwana was selected as the most suitable venue for the public meeting, as the Isang area is allocated to the Malotwana veterinary services, by the Botswana Government Veterinary services. It was therefore expected that more cattle post owners would be represented. The attendance of the public meeting was very good, but many of the attendees were not familiar with the area around the specific site.

8.2 ECOLOGY

The local ecology at the site, especially the fauna at the site, is already severely disturbed by the developed infrastructure. Particularly the Gaborone to Francistown road and the railway line have disturbed animal behaviour.

8.3 ARCHAEOLOGY

Vegetated areas always present a challenge during the field work for the archaeological survey, due to the fact that artefacts may be covered by vegetation. Certain sections of the proposed site were heavily vegetated, during the time of the archaeological survey.

8.4 LANDSCAPE AND VISUAL

No limitations were encountered during the landscape and visual assessment within this EIA.

9 GENERAL ENVIRONMENTAL ISSUES

During the scoping stage of the project, specific areas such as the archaeology, ecology and landscape and visual were identified as areas that required specific attention. Aside from these specific environmental fields, which are described in Chapter 10 to 13, a number of general environmental impacts have been identified, and are described in the following chapter.

9.1 METHODOLOGY

This section was prepared following an initial study of the project details, technical designs, and processes and methods involved. Based on this a number of general environmental issues have been identified for further analysis, as these issues are expected to cause some impact during the project stages. The environmental issues identified are:

- Noise
- Air quality
- Water impacts
- Waste
- Traffic and safety

A site visit was conducted to establish the existing situation at the project site, other useful information was obtained from interviews, consultations with stakeholders as well as available literature. In addition to the information gathered, Loci also used experience from environmental monitoring at two smaller substation sites which are currently being constructed.

9.2 EXISTING ENVIRONMENT

The proposed site itself is largely undeveloped, the existing environment in terms of noise, air quality, water traffic and safety are largely characterized by the surrounding infrastructure developed in the area:

- The Gaborone to Francistown A1 road.
- A railway line.
- Two 220kV power lines.
- A cellular phone tower.
- Existing boreholes operated by local farmers.

9.2.1 Noise

Within the site area, the noise levels from traffic on the existing road can be clearly noticed. As the road is the main north – south haulage route for Botswana, the road is used by HGVs for haulage of materials. Aside from haulage, the road is the main connection for traffic between the two largest cities in Botswana, namely Gaborone and Francistown. The noise from traffic during daytime is much higher than at night time, due to the increased traffic numbers during the day.

Another noise source is the railway line. The noise from this line is more sporadic, but the level of noise produced by a passing train appears higher than the noise produced by the traffic on the road. The train traffic consists of goods transport; trains are often many wagons connected, which adds to

the overall noise levels. Trains travel at irregular times. There is currently no baseline data available showing the exact noise levels in the area, established on measurements at the location.

Noise levels produced by the cellular phone tower and the existing 220kV power lines were observed as negligible during the site visits. It must however be noted that the site work was undertaken during low wind speed conditions. As shown in the climate section and Figure 7.2, some winds can be expected during the winter season, which may result in some noise from the power line structures and cables.

The noise receptors in the area are limited to the owners or *basida* (herdsmen) at the nearest cattle posts, which are at approximately 1 kilometre distance from the site. Permanent settlements are located at further distances from the site.

9.2.2 Air quality

The existing air quality problems in the project area are mainly caused by road traffic on the Gaborone to Francistown road. Emissions from cars, trucks and trains are experienced to remain in the area near the road, especially in the summer season during days with high temperatures and low wind speeds. Because of the 300 metre distance between the road and the site, the emissions from the traffic could not be physically sensed during the site visits. It may however be possible to detect them with specialized equipment under certain conditions.

Due to the current vegetation cover, there is no existing dust impact at the proposed site area. The site visits were undertaken during the summer season, while the vegetation was growing and water was available, but the vegetation is expected to keep dust under control during the dry season as well. There are no unpaved or gravel roads in the near vicinity of the site, which could cause dust at the site.

There are a number of receptors in the area that may be affected by air quality problems. Dust created on site may compromise visibility on the road, which could create safety concerns. It must be noted though, that prevailing winds are in the opposite direction (see Figure 7.2). Other receptors include employees stationed at the cellular phone tower, farmers at the nearby fields and cattle posts, and construction workers during the construction of the Isang substation.

9.2.3 Water

There are three existing boreholes in the near vicinity of the proposed substation site; all of the boreholes are located within several hundred metres of the proposed plot. The boreholes have been drilled by local farmers and are operated by a farmers syndicate, sharing the operation and maintenance cost between farmers.

Although no exact details of the individual boreholes are available, it is expected that the boreholes are relatively shallow, and water yields are low. Usually, motivated by limited resources and funding, boreholes at cattle posts are only drilled to shallow depths. The water provided to cattle does not need to be high quality, and current baseline data relating to the water quality is not available.

9.2.4 Waste

The proposed site area and surrounding areas have been checked for waste and illegal dumping. It was found that no illegal dumping has taken place at the site or the study area. The construction waste that may have been created during the recent construction of the cellular phone tower has been removed, as there was no waste visible.

The main A1 road is the main source of small littering for the area, it is apparent that road users often dispose of their waste on the side of the road, while travelling through the area. This litter is picked up by winds and spread in the surrounding bush.

9.2.5 Safety and traffic

The safety situation in the area is primarily impacted by the traffic on the main A1 road, as well as the railway line. A fence has been constructed along the road reserve to keep animals, specifically domestic cattle, out of the road reserve. Experience has shown that fencing the road reserve does not eliminate road kill, as fences sometimes need repairs, gates are left open, and farmers use the road reserve for grazing. The risk of road kill and accidents stemming from automobile collisions with animals is the most prominent safety concern in the site area.

As the proposed site area is in an undeveloped area, no provisions have been made for a pedestrian crossing on the main A1 road. The speed limit on the road at the Isang site is 120km per hour, which makes crossing the road by pedestrians unsafe.

Safety concerns related to the cellular phone tower are limited, as the tower plot is fenced and a full time security officer is available at the site. The 220kV power lines do not present a safety risk at the moment.

9.3 PREDICTED IMPACTS

The development of the Isang substation will require vegetation clearance, and will introduce additional traffic and construction plant into the area. The predicted impacts on the general environment related to this development, will be analysed in detail in the following paragraphs. It is expected that the construction impacts are different from the impacts during the operational phase, they are therefore described in separate sections.

9.3.1 Construction impacts

9.3.1.1 Noise

The construction works are expected to significantly increase the noise levels in the area. Noise will be caused by the construction plant operating in the site area. The construction plant will include earth moving equipment, haulage trucks, compaction equipment, generators and possibly a concrete batching plant. The noise will mainly affect the construction workers on the site and the staff at the cellular phone tower.

The construction will require supply of building materials, especially for the sub-base and base layers of the substation foundation and terraces materials will need to be transported to site. The source of the materials is unknown at this stage, and will be identified by the contractor after appointment. It is expected that the contractor will locate an existing borrow pit with suitable materials near the proposed site. Depending on the location, the haulage of materials from this borrow pit to the site may cause increased noise in villages such as Artesia or Malotwana, depending on the haulage route.

It is not expected that blasting works will be required during the construction activities. However, blasting cannot be fully ruled out at this stage, and if limited blasting is required, this will have significant temporary noise impacts and the workers, employees at the cellular phone tower, nearby herdsmen and even road users.

9.3.1.2 Air quality

There are two aspects to the predicted air quality impacts from construction: increased dust production, and emissions from construction plant and machines. The emissions will be caused by the increased number of machines working at the site.

It is expected that dust will be created during the construction period. Vegetation which currently helps contain the dust, will be cleared from the site area. In addition to the clearance, machines will be moving on site, and excavations will take place, which can all cause additional dust creation. The haulage of materials will also form a major source of dust during the construction.

9.3.1.3 Water

The water requirements during construction are expected to be relatively high, particularly in comparison to the water currently used for cattle in the area. During construction, water is required for compaction, for dust suppression, and for mixing of building materials.

It has been proposed to use one of the existing boreholes, located at the south east corner of the proposed site (see Figure 4.1) for the supply of construction water. Due to the increased water demand from this borehole, and the fact that the surrounding two boreholes are expected to be relatively shallow, there is a risk that a slight drop in the water table can compromise the water yield from the other boreholes near the site, as shown in Figure 7.2..

9.3.1.4 Waste

The construction activities are expected to create a considerable amount of waste, which is expected to include the following:

- Building and concrete rubble.
- Vegetation and soil cleared from site.
- Domestic type waste.
- Packaging materials.
- Sewerage.

The some of the waste created will be specific for a certain phase of the construction, e.g. the vegetation and topsoil at the early stages of construction. Other waste such as sewerage will be produced on site for the full duration of the construction.

9.3.1.5 Safety

There are a number of safety related impacts expected during the construction period. The first impact is in relation to the A1 road. There are high traffic volumes on the road at certain times of the day, and traffic entering and exiting the site onto the road will have negative impacts on road safety.

In addition to the road safety, an electrical construction project creates electrical safety hazards. The project scope includes the connection of the existing overhead 220kV lines.

9.3.2 Operational impacts

Compared to the construction phase, there are only a few general environmental impacts expected during the operational phase. Noise levels at the proposed substation will be very low, and there are no emissions expected from the equipment installed at the substation. The impacts predicted for both noise and air quality are therefore negligible. As water consumption at the substation will be very low during the operational phase, no significant impacts are expected on the water table either.

The substation will produce minimal waste during the operational phase, mainly created from the maintenance activities that will take place, and the human activity related to this. Such waste is expected to include:

- Vegetation from maintenance clearance activities
- Packaging from maintenance and replacement parts.
- Domestic waste.
- Sewerage from the toilet.

The waste quantities are expected to be much smaller than during the construction period, but are expected to be consistent the operational phase.

9.4 MITIGATION MEASURES

9.4.1 Noise

The following mitigation measures must be implemented to reduce the predicted noise impacts:

- The construction plant and equipment must be maintained regularly, and fitted with the noise suppression such as exhaust mufflers. Generators and other stationary equipment must be fitted with covers to suppress noise.
- Haulage routes for materials supply to the site must be carefully considered, and avoid densely populated areas in surrounding villages. Haulage activities must be restricted to daytime only, to minimize interruptions, and haulage speed must be restricted, particularly on corrugated roads.
- For blasting activities a full method statement must be prepared and submitted to the resident engineer and environmental manager for approval. Blasting must only be undertaken during the daytime.

9.4.2 Air quality

The following mitigation measures must be implemented to reduce the predicted air quality related impacts:

- The minimisation of dust must be considered for all construction works, with mitigation measures including implementation of a maximum speed limit on haulage roads and keeping the loading drop height to a minimum during excavations.

- The contractor must provide a watering truck for the full duration of the construction works, and the site as well as the haulage roads must be watered daily during the dry season. The dust situation must be monitored, and the watering must be increased if daily watering does not suppress the dust sufficiently. The contractor is responsible for watering all haulage roads used.

- Machines must be maintained and checked regularly to ensure emissions are kept to a minimum.

9.4.3 Water

The following mitigation measures must be implemented to reduce the predicted water related impacts:

- The quality and yields of the water supplied by the three boreholes should be tested and recorded before construction starts. These results can be used as reference if any problems arise during the increased water extraction during construction.

- Any unnecessary use or spillage of water must be avoided.

- Affected borehole owners must be compensated if the construction causes reduced performance from surrounding boreholes.

9.4.4 Waste

The following mitigation measures must be implemented to reduce the predicted waste-related impacts:

- Trees and vegetation cleared from the site should be cut into small lengths, and be made available to surrounding communities for use as firewood.

- Waste produced during the construction must be separated and recycled where possible. The contractor must make dedicated waste facilities available during the construction period, and ensure the facilities encourage separation and recycling. During operation BPC must apply similar principles to encourage separation and recycling of waste.

- Waste must be disposed at licensed facilities.

- Install a septic tank for disposal of the sewerage produced on site. The tank should be checked regularly to ensure it is not overflowing.

9.4.5 Safety

The following mitigation measures must be implemented to reduce the predicted waste related impacts:

- Coordination with the Botswana Roads Department before the start of the project, discuss placement of signage on the A1 road before the site entrance, and reduce the speed limit at the site entrance during the construction period.

- Fencing of the construction site from the beginning of construction to keep unauthorized people out of the construction site.

- Implement safety procedures and checks to ensure power is switched off on electrical components before the start of any works related to these components. This applies for works during the construction and operational phase of the project.

9.5 RESIDUAL IMPACTS

By full implementation of the suggested mitigation measures, the negative impacts regarding noise, air quality, waste and water can be managed and controlled sufficiently. No severe negative residual impacts are expected for these areas of concern. The safety risks, particularly during the construction period, can be reduced by implementing the mitigation measures as outlined. However, a certain level of risk will remain, and the residual negative impacts during the construction period are considered moderate.

Table 9.1: Summary Impact Table

Description of Impacts	Significance (Profound, Significant, Moderate, Slight or Imperceptible)	Scale of Change				Description of Mitigation Measures	Description of Residual Impacts	Residual Impacts (Profound, Significant, Moderate, Slight or Negligible)	Residual Effects			
		(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M /LT)				(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M/ LT)
Noise caused by the development	Moderate	Negative, Temporary, Direct, Short term				Maintenance of machines, work during daytime, speed restriction on haulage	None	Negligible	Neutral, temporary, direct, short term			
Air Quality changes caused by dust or emissions	Moderate	Negative, temporary, direct, short term				Dust suppression through watering, speed limits	None	Negligible	Neutral, temporary, direct, short term			
Water table changes due to additional water use / extraction	Slight	Negative, temporary, indirect, long term				Establish water yield and quality from boreholes before construction. Compensate owners if other boreholes are impacted	None	Negligible	Neutral, permanent, indirect, long term			
Waste	Slight	Negative, temporary, direct, long term				Reduce, reuse and recycle	None	Negligible	Neutral, temporary, direct, long term			
Safety	Moderate	Negative, temporary, direct, short term				Implement speed restrictions, signage and security	Traffic safety risk remains	Moderate	Negative, temporary, direct, short term			

10 ECOLOGY

This specialist section follows a desk-top review and follow-up site visit and site data collection for the Proposed Isang 400kV to 220kV switching station.

The author has worked on the environmental baseline studies for several projects in the area including the North South Carrier Pipeline Project, the addition of the western 220kV power line from Morupule to Thamaga, the Mmamantswe Coal Fired Power Station scoping study and the Mmamabula 66kV power supply line. He also worked on the initial feasibility alignment study for the Morupule to Isang 400kV power supply amended alignment proposal.

10.1 METHODOLOGY

The methodology for the study has included a desktop review and extraction of text excerpts on the fauna and flora of the area from various sources including Timberlake (1980), and Aqua Tech Environmental Consultant's report for the North-South Carrier pipeline project which runs immediately adjacent to the east of the site.

10.2 EXISTING ECOLOGICAL ENVIRONMENT

The general vegetation and soils are eastern Kalahari mixed broad-leaved and microphyllous shrubland savanna (Timberlake, 1980).

10.2.1 Land Use

The current land use of the project site is communal grazing, and the area provides good to moderately good grazing and browse quality for livestock and wildlife and supports populations of donkeys, cattle, goats and horses. Following the past two years of good rainfall, the area could be expected to support approximately 2-3 Livestock Units over a 12-month period.

10.2.2 Landscape and Topography

The landscape is flat to gently undulating with a small mound in the south-east zone and a minor depression in the central section close to the existing access track. The topography is show in Figure 1 below. NB. The contour intervals are very small, and on site, the mound is barely perceptible.

Vegetation indicators are trees that generally grow in deep sands and trees that generally grow on shallow laterite soils in close proximity but in patterns. This is an indication of an ancient erosion surface with ridges and gulleys, which have subsequently been infilled with aeolian sand. The ridging appears to be trending south to south-east which indicates that the erosion surface drained into the Thagale River Basin which is found approximately 5km to the south of the site.

10.2.3 Soils

The soils of the site are sands to loamy sands of aeolian origin. They are orangey-brown (over the greater portion of the site) and moderately deep to deep medium coarse sands with drainage from rainfall percolating vertically into the subsoil.

The small pan is of relatively recent origin, as indicated by the weakly developed loamy sand A horizon and very short-term rainfall holding capability, as indicated by the plants found growing there, which are species associated with semi-arid to moderately high rainfall (as opposed to plant species associated with wetlands and wetland margins, or perched water tables).

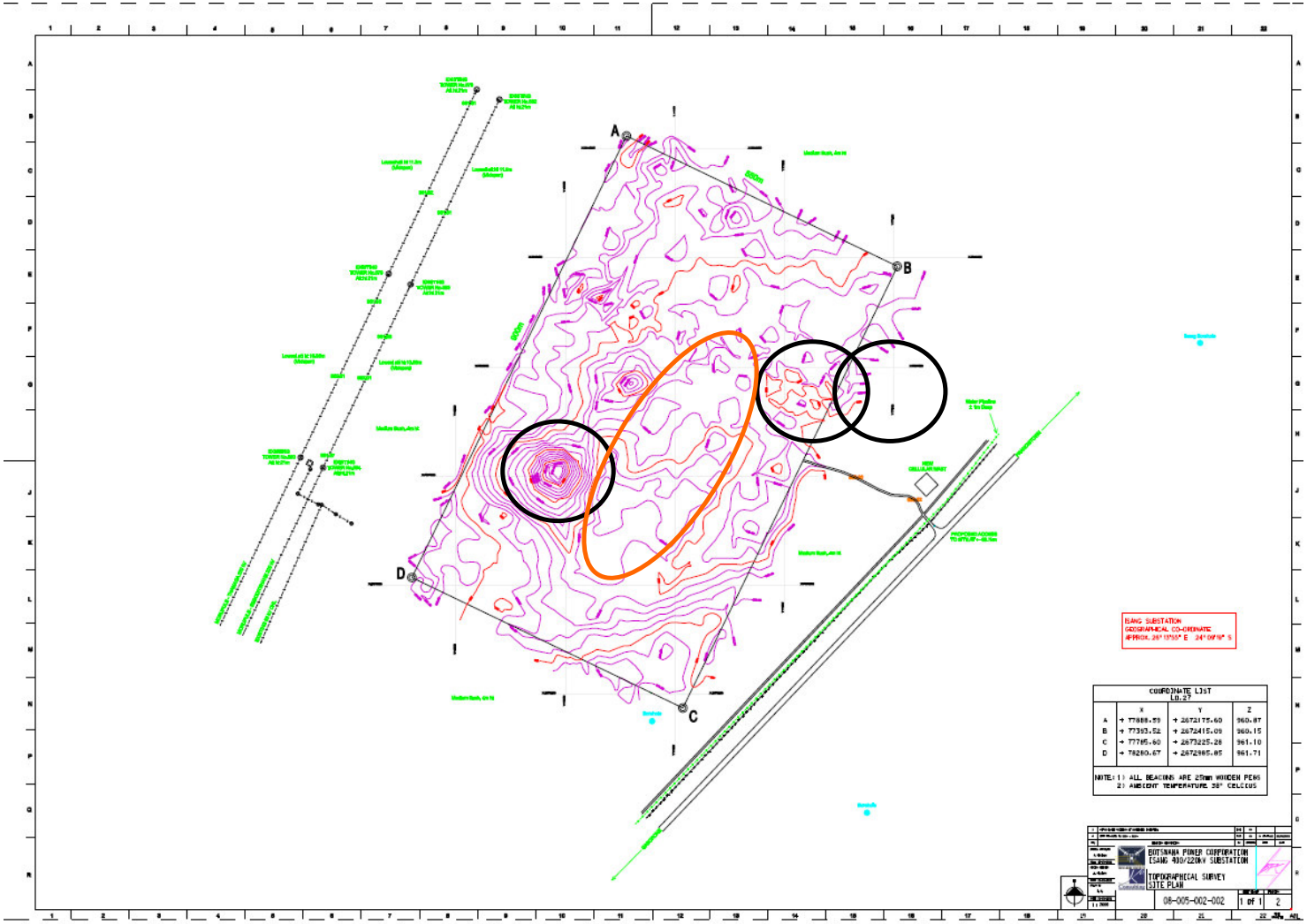


Figure 10.1 Location and topographic contour profile of the proposed Isang switching sub-Station site

10.2.4 Surface hydrology

The local hydrology patterns indicate rainfall percolation directly into the sand soils where they fall. The vegetation patterns on the site imply that there will be some shedding of water as it drops down the soil profile and encounters ridges and slopes in the underlying surficial laterite basement complex. Very heavy surface runoff flows are likely to trend towards the Thagale River basin, situated approximately 5km to the south of the site.

10.2.5 Flora

The vegetation and flora of the area is primarily a mixed broad-leaf and microphyllous type bush savanna. According to Timberlake (1980) the vegetation comprises major vegetation type zones labelled A2, A5 and D3.

A2. Eastern broadleaved savanna: fairly dense tree and shrub savanna on red, non-calcareous sands or loamy sands, generally on higher relief than surrounding areas, where it overlies Sandstone in the Dibete area. This vegetation type is characterised by a dominance of *Burkea africana, Ochna pulchra, Bauhinia petersiana, Terminalia sericea* and *Acacia fleckii. Combretum zeyheri, C. apiculatum, Croton gratissimus* and *Sclerocarya birrea,* which are all commonly present on shallow sands overlying bedrock. *Acacia erioloba* and *Tarchonanthus camphoratus* are found in slightly more calcareous areas in depressions.

A5. Northern microphyllous savanna: this comprises an open tree and shrub savanna in areas of lower relief and in fossil river valleys, found on fine whitish calcareous sands and loamy sands, often mixed with sandy alluvium and/or underlain by calcrete. The vegetation type is characterised by *Acacia erioloba, A. mellifera,* and *Combretum hereroense*, with *Terminalia sericea* and *Acacia fleckii* in the less calcareous areas of deeper sand. *Tarchonanthus camphoratus, Combretum imberbe, Acacia grandicornuta, Grewia flava,* and *Rhigozum* brevispinosum are often present. In raised, more rocky areas, *Acacia nigrescens and A. erubescens can be found.*

D3. Acacia mellifera shrub savanna: This is an open shrub savanna on calcrete and calcium-rich clay pans that have shallow soils and are seasonally flooded. Commonly found in the Serorome Valley (immediately north of the project-affected zone).This vegetation type is characterised by a dominance of *Acacia mellifera* and *Grewia flava*, with *Commiphora pyracanthoides, Rhigozum brevispinosum* and *Tarchonanthus camphoratus. Acacia nebrownii* and *Acacia Senegal* (var. *rostrata*) occur on calcrete ridges, and grades into *Acacia grandicornuta* thicket in the lower Serorome Valley areas.

The vegetation of the site, which is relatively small at 500m by 500m (25ha), is relatively uniform and a plant species list is provided from the site visit (Table 5.1 below). The dispersal of the trees and shrubs is as follows:

- Isolated tall trees of 4-6m height nearest neighbour is 50-100m
- Shorter trees of 3-4m height generally clumped 10-20m apart.
- Shrubs of 1-3m height clumped microphyllous species with the nearest neighbouring shrub 1-15m away, and broadleaved species with nearest neighbour 1-10m away.

The general appearance of the vegetation is shown in the photos in Appendix D.

There are no rare or endangered plant species known to occur or identified during the site data collection exercise.

Table 10.1: List of Plant Species identified on site

	Woody Plants	Herbaceous Plants	
	Tall trees	**Grasses**	**Notes**
1	Acacia erioloba	Aristida congesta	
2	Acacia erubescens	Aristida stipatata	
3	Acacia grandicornuta	Digitaria diagonalis	By the small pan
4	Acacia mellifera	Digitaria eriantha	
5	Acacia tortilis	Digitaria milanjiana	
6	Boscia albitrunca	Eragrostis biflora	By the small pan
7	Burka africana	Eragrostis lehmanniana	
8	Peltophorum africanum	Eragrostis pallens	
9		Eragrostis rigidior	
10		Eragrostis rotifer	
11		Panicum kalahariense	
12		Perotis patens	
13		Pogonarthria squarrosa	
14		Schmidtia kalahariensis	By the small pan
15		Stipagrostis uniplumis	
16		Urochloa mossambicensis	By the small pan
	Woody Plants	**Herbaceous Plants**	
	Shrubs	**Non-grasses**	**Non-grasses (cont..)**
1	Acacia erubescens	Abutilon angulatum	21 Sida chrysantha
2	Acacia hebeclada	Acanthospermum hispidum	22 Sida cordifolia
3	Acacia mellifera	Berkheya sp	23 Solanum nigrum
4	Acacia tortilis	Cassia biensis	24 Talinum crispatulatum
5	Bauhinia petersiana	Ceratotheca triloba	25 Vernonia sp
6	Combretum hereroense	Citrullus lanatus	26 Waltheria indica
7	Commiphora pyracanthoides	Commelina livingstonia	
8	Dichrostachys cinerea	Crotolaria sphaerocarpa	
9	Diospyros lycioides	Crotolaria spartioides	
10	Ehretia rigida	Giseckia pharnecoides	
11	Euclea undulata	Harpagophytum zeyheri	
12	Fluggea virosa	Hibiscus meeusii	
13	Grewia flava	Indigofera daleoides	
14	Grewia flavescens	Indigofera rhytidocarpa	
15	Grewia retinervis	Ipomoea bolusiana	
16	Maytenus tenuispina	Ipomoea obscura	
17	Ochna pulchra	Kalanchoë paniculata	
18	Ozoroa retinervis	Monsonia angustifolia	
19	Rhigozum brevispinosum	Ocimum canum	
20	Tarchonanthus camphoratus	Sida alba	

10.2.6 Fauna

10.2.6.1 Avifauna

The site is situated approximately 35km north of the Bokaa dam. The dam area is rated as an unprotected important bird area (IBA) (BW 009) by Birdlife International, and information on Bokaa from their website indicates that Bokaa Dam occasionally supports small numbers of Pink-backed Pelican (*Pelecanus rufescens*). Waterfowl counts between 1991 and 1995 at the dam reached a maximum of 4,000 birds. The only species present in numbers exceeding the 0.5% threshold are Great Crested Grebe (*Podiceps cristatus*) (max. 46) and Southern Pochard (*Netta erythrophthalma*), numbers of the latter having built up since 1994, usually peaking during the August-October period. Also seen at Bokaa was the Maccoa Duck (*Oxyura maccoa*).

Approximately 250 species of bird may be expected to occur in the project area. One species, the Cape Vulture (*Gyps coprotheres*), is considered threatened by IUCN. All other species either occur broadly within Botswana or are marginal to the eastern hardveld while being widespread elsewhere. Most are common in appropriate habitats. (Source: EIA North South Carrier, 1996).

10.2.6.2 Mammals

The proximity of the main road and the manned microwave transmitter tower site are likely to discourage the presence of large wild animals. Species expected to occur in the area include herbivores such as common duiker (*Sylvicapra grimmia*), steenbok (*Raphicerus campestris*), kudu (*Tragelaphus strepsiceros*), impala (*Aepyceros melampus*), bushbuck (*Tragelaphus scriptus*) and warthog (*Phacochoerus aethiopicus*) may occur sparingly in the project area. Large carnivores that may occur include spotted hyena (*Crocuta crocuta*), leopard (*Panthera pardus*), caracal (*Felis caracal*), black-backed jackal (*Canis mesomelas*) and possibly cape fox (*Vulpes chama*). Other large mammals that may occur include chacma baboon (*Papio ursinus*), vervet monkey (*Cercopithecus pygerythrus*), porcupine (*Hystrix africaeaustralis*), honey badger (*Mellivora capensis*), pangolin (*Manis temminckii*), aardvark (*Orycteropus afer*), and possibly aardwolf (*Proteles cristatus*) (Source: EIA North South Carrier 1996).

Small mammals that may be found in the area include scrub hares (*Lepus saxatilis*), ground squirrels (*Xerus inauris*) and tree squirrels (*Paraxerus cepapi*), as well as several rodent species. One species, the South African hedgehog (*Aterelix frontalis*), is listed as rare by the IUCN.

10.2.6.3 Reptiles

As many as 60 species of reptiles may be found along the pipeline route (Auerbach 1987). Reptiles will be most common in and around the two hills where suitable habitat may be found. Several species of lizards, snakes, and tortoises are found in the area, none listed on the IUCN Red Data List. However, populations of land tortoises (*Testudinidae*) are in a precarious position throughout their range in Southern Africa, including Botswana (Simbotwe 1987); and 3 species may be found in the project area: leopard tortoise (*Geochelone pardalis*), Kalahari tent tortoise (*Psammobates oculifer*) and Bell's hinged tortoise (*Kinixys belliana*) (Source: EIA North South Carrier, 1996).

10.2.6.4 Amphibians

The distribution of most amphibian taxa is particularly poorly documented in Botswana, and many habitats, especially those require for breeding, are ephemeral. Amphibians in the project area might

most predictably be encountered along old drainage systems, flooded areas, pans and depressions during or after prolonged periods of rainfall. About 10 species may occur in the project area, none known to be threatened nationally or globally (Source: EIA North South Carrier, 1996).

Rare and/or Endangered species that are considered to be under threat in the wider area around the project zone are provided on Table 10.2 below

Table 10.2: Animals during the North-South Carrier project field visits

PHYLUM~ARTHROPODA; CLASS~INSECTA			
ORDER	FAMILY	BIOLOGICAL NAME	ENGLISH NAME
Coleoptera	Cicindellidae	*Mantichora* species	Monster Tiger Beetle
Lepidoptera	Nymphalidae	*Precis hierta*	Yellow Pansy
		Danaus chryssipus	African Monarch
	Pieridae	*Eurema brigitta*	Broad-bordered Grass Yellow
		Belenois aurota	Brown-veined White
		Catopsilla florella	African Migrant
Hymenoptera	Formicidae	*Megaponera foetens*	Matebele Ant
PHYLUM~VERTEBRATA; CLASS~OSTEICHTHYES			
ORDER	FAMILY	BIOLOGICAL NAME	ENGLISH NAME
Cypriniformes	Cyprinidae	*Labeobarbus marequensis*	Lowveld Large-scale Yellowfish
Siluriformes	Schilbeidae	*Schilbe intermedius*	Silver Catfish
	Clariidae	*Clarias gariepinus*	Sharptooth Catfish
Cyprinodontiformes	Cichlidae	*Oreochromis andersonii*	Threespot Tilapia
PHYLUM~VERTEBRATA; CLASS~AMPHIBIA			
ORDER	FAMILY	BIOLOGICAL NAME	ENGLISH NAME
Anura	Petropedetidae	*Cacosternum nanum*	Bronze Caco
	Rhacophoridae	*Chiromantis xerampelina*	Southern Foam Nest Frog
PHYLUM~VERTEBRATA; CLASS~REPTILIA			
ORDER	FAMILY	BIOLOGICAL NAME	ENGLISH NAME
Testudines	Testudinidae	*Geochelone pardalis*	Leopard Tortoise
Squamata	Leptotyphlopidae	*Leptotyphlops scutifrons*	Peters' Thread Snake
	Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard
	Varanidae	*Varanus albigularis*	Rock Monitor
	Boidae	*Python natalensis*	Southern African Python
	Colubridae	*Dispholidus typus*	Boomslang
		Thelotornis capensis	Twig Snake
	Elapidae	*Naja mossambica*	M'fezi
	Viperidae	*Bitis arietans*	Puff Adder
	Agamidae	*Acanthocercus atricollis*	Southern Tree Agama
	Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard
	Varanidae	*Varanus albigularis*	Rock Monitor
PHYLUM~VERTEBRATA; CLASS~AVES			
ORDER	FAMILY	BIOLOGICAL NAME	ENGLISH NAME
Ciconiiformes	Ardeidae	*Ardea melanocephala*	Black-headed Heron
Falconiformes	Sagittariidae	*Sagittarius serpentarius*	Secretarybird
	Accipitridae	*Gyps africanus*	White-backed Vulture
		Torgos tracheliotus	Lappet-faced Vulture
		Milvus aegyptius	Yellow-billed Kite

PHYLUM~VERTEBRATA; CLASS~MAMMALIA			
ORDER	FAMILY	BIOLOGICAL NAME	ENGLISH NAME
Insectivora	Soricidae	*Crocidura cyanea*	Reddish-grey Musk Shrew
Rodentia	Bathyergidae	*Cryptomys hottentotus*	Common Molerat
	Muridae	*Tatera leucogaster*	Bushveld Gerbil
		Mastomys coucha	Multimammate Mouse
		Saccostomys campestris	Pouched Mouse
Primates	Cercopithecidae	*Papio ursinus*	Chacma Baboon
		Cercopithecus aethiops	Vervet Monkey
Rodentia	Sciuridae	*Xerus inauris*	Cape Ground Squirrel
		Paraxerus cepapi	Tree Squirrel
Pholidota	Manidae	*Manis temminckii*	Pangolin
Lagomorpha	Leporidae	*Lepus saxatilis*	Scrub Hare
Carnivora	Canidae	*Canis mesomelas*	Black-backed Jackal
	Viverridae	*Galerella sanguinea*	Slender Mongoose
		Mungos mungo	Banded Mongoose
		Civettictis civetta	African Civet
	Hyaenidae	*Hyaena brunnea*	Brown Hyaena
	Protelidae	*Proteles cristatus*	Aardwolf
	Felidae	*Acinonyx jubatus*	Cheetah
		Panthera pardus	Leopard
		Caracal caracal	Caracal
Tubulidentata	Orycteropidae	*Orycteropus afer*	Aardvark
Artiodactyla	Suidae	*Phacochoerus africanus*	Warthog
	Bovidae	*Tragelaphus strepsiceros*	Kudu
		Tragelaphus scriptus	Bushbuck
		Kobus ellipsiprymnus	Waterbuck
		Connachaetus taurinus	Blue Wildebeest
		Aepyceros melampus	Impala
		Raphicerus campestris	Steenbok
		Sylvicapra grimmia	Common Duiker

NB. Species listed in red are considered to be under threat under the IUCN Red Data listings.

10.3 PREDICTED IMPACTS

The predicted impacts will take place with land clearing, i.e. vegetation clearing and grubbing during the construction phase, and risk of fire and or spillage of oils, lubricants and transformer coolant during the operation phase.

10.3.1 Construction Phase Impacts

Construction phase impacts will occur during and immediately post the construction of the sub-station. Many of the impacts will be localised, apart from the impacts of bush fires and pollution of the local groundwater aquifers, The site is close to the main A1 highway, so care should be taken to ensure adequate traffic safety precautions at the entrance to the site off the main road.

10.3.1.1 Positive Impacts

These will be socio-economic, based on the opportunities for manual labour and semi-skilled work during site construction and the availability of relatively large quantities of firewood that can be harvested from the clearing and grubbing phase during site preparation. With adequate pre-construction notification, local entrepreneurs could take advantage of the clearing to salvage firewood from the site and then sell this onwards to local consumers.

10.3.1.2 Negative Impacts

The direct negative impacts will be:

- Permanent loss of 49ha of communal grazing land of moderate to good quality grazing and browse, which will be limited to the fenced site.

- Permanent loss of habitat/refuge for small animals, birds, insects and invertebrates which will be limited to the 49ha site.

During the construction phase various impacts will occur, including:

- Generation of noise and dust from clearing and grubbing works: short-term temporary impact of moderately low to low significance

- Potential to set fire to the communal grazing over a wide area – due to lack of effective firebreaks in the district: short to medium term impacts that will be severe to moderately severe. There is a high probability of bush fires carrying a long distance through the communal grazing area as the prevailing winds from east-north-east will blow the fire through to the Kweneng District Boundary cut line and possibly further, if day-time temperatures are high and strong winds occur at the time of the fire starting.

- Potential to pollute local groundwater supplies due to spillage of fuels, lubricants and transformer coolant liquids: long term to permanent severe to very severe (if transformer fluids are released into the groundwater supply), the extent of the impact here is unknown, but is likely to be widespread if the fluids enter either the Thagale River drainage system, or local borehole recharge aquifers

- Problems arising from spread of livestock diseases associated with tapeworms and other organisms spread in human faeces as a direct result of contract labour defecating in the open bush

- Road traffic safety issues where the construction site entrance abuts the main A1 highway, these could be fatal of long-term and wide-spreading consequence (to the families and/or businesses affected by any accidents that may occur)

- Spread of litter from on-site works, will be low intensity and localised, short to medium duration - depending on the rate at which the litter decomposes in the surrounding environment.

- Fence wire and other off-cuts left around the site will cause problems to livestock and other animals that may get caught in the materials, and to ruminants that may accidentally ingest wire off-cuts, often with fatal results to the animal. These impacts will be medium-term and localised to the livestock owners.

Table 10.3: Impact Direction and Scale: Construction

Impact Arena	Direction	Severity	Scope
	Impacts		
Grazing land	Negative	Slight	Local
Habitat	Negative	Slight	Local
Dust	Negative	Slight	Local
Noise	Negative	Moderate	Local
Fire	Negative	Significant	Regional
Groundwater	Negative	Significant	Regional
Diseases	Negative	Significant	Regional
Road traffic safety	Negative	Significant	Regional
Waste	Negative	Slight	Local
Livestock	Negative	Moderate	Local
Pests	Negative	Significant	Regional

10.3.1.3 Pests

With regard to pests, there are certain animals that can cause problems, mainly as a health and safety issue, the worst of these being poisonous snakes such as Puff Adders, Black Mambas and Cobras. The main problem is disturbance of these reptiles during construction, particularly at the bush clearing stages of the construction operations.

10.3.2 Operation Phase Impacts

Typical operation phase impacts that are likely to occur are:

- Spillages of transformer lubricants and subsequent long-term to permanent contamination of local ground water aquifers of a relatively widespread area associated with the Thagale River basin and/or local ground water supply recharge aquifers

- Sparks from the sub-station setting alight to vegetation off-site and resulting widespread bush fires. The results will be relatively widespread and severe to moderately severe, with short to medium term consequences due to loss of livestock grazing and loss of habitat and forage reserves for wildlife.

- Litter and general pollution from the site officers (foreman?) facilities / housing.

Typical pests that can occur during the project operation phase impacts are:

- Herbaceous weeds growing in and around the transformer station, creating both a potential fire hazard, and habitat for other pests

- Rodents nesting in conduit piping and cable trenches

- The presence of rodents attracting wild/feral cats and/or snakes

- Birds nesting in the transformers and on the power line cable towers, with bird guano facilitating arcing across lines

- Monkeys climbing on and around the infrastructure can cause flash-outs and arcing

Impacts associated with the operation of the substation on the ecology are indicated in the following table:

Table 10.4: Impact Direction and Scale: Operation

Impact Arena	Direction	Severity	Scope	Duration
		Ecology Impacts		
Groundwater	Negative	Significant	Regional	Long
Fire	Negative	Significant	Regional	Medium
Waste	Negative	Slight	Local	Medium
Pests	Negative	Moderate	Local	Medium

10.3.2.1 Pests

Typical pests that can occur during the project operation phase impacts are:

- Herbaceous weeds growing in and around the transformer station, creating both a potential fire hazard, and habitat for other pests
- Rodents nesting in conduit piping and cable trenches
- The presence of rodents attracting wild/feral cats and/or snakes
- Birds nesting in the transformers and on the power line cable towers, with bird guano facilitating arcing across lines
- Monkeys climbing on and around the infrastructure can cause flash-outs and arcing

10.4 MITIGATION MEASURES

A number of mitigation measures can be implemented to reduce or enhance impacts predicted for this project. The mitigation measures are summarized in Table 10.5.

Table 10.5: Mitigation of Construction Phase Impacts

	Impact	Mitigation	Responsibility of
1	Loss of grazing	Use the smallest possible area for the site	Design Engineer
2	Loss of animal habitat	As above	As above
3	Noise generation	Ensure construction machinery has adequate noise suppression	Contractor
4	Dust generation	Work from upwind side to the downwind side during clearing and grubbing to minimize dust being blown offsite onto the main road	Contractor
5	Wild fires started	All cooking/heating fires to be set within a designated, screened areas	Contractor
6	Ground water pollution	All vehicles to be properly serviced and operational before being permitted on site, all servicing to be done off-site at a designated workshop	Contractor
7	Livestock diseases from defecating in the bush	Portable latrine facilities to be provided, no staff to defecate in the bush	Contractor

8	Road traffic safety at site entrance from A1 road	Establish adequate traffic warning signs and man the entrance to the main road during working hours, when trucks are entering and/or leaving the site	Contractor
9	Litter and other solid waste	Provide litter bins with lids and remove all litter and waste material from site at regular intervals to an approved landfill site	Contractor
10	Fencing wire off-cuts harming livestock and wildlife	Collect all wire off-cuts and other waste fencing materials and consign to solid waste bins for removal	Contractor
11	Harmful snakes encountered	All site staff to wear protective clothing and eyewear during bush clearing operations	Contractor

10.4.1 Monitoring of Construction Phase Mitigations

The responsibility for monitoring the construction phase impacts will be the project Engineer.

The main construction phase impacts associated with pests relate to the presence of weeds as a fire hazard and as a habitat for other animal pests. In addition, conduit trenches provide a warm, safe habitat for small rodents, insects, amphibians and snakes. This provides an opportunity for the predators of these creatures to seek out the pests in and around the infrastructure.

Mitigation to reduce the incidences of problems occurring due the presence of pests is by careful design of the facilities to prevent/discourage the entry of small creatures into the trenches and other places where the pests can hide.

Table 10.6: Mitigation of Operation Phase Impacts

	Impact	Mitigation	Responsibility of
1	Pollution from transformer oil spillages	Transformers to be placed on concrete flooring with sealed collection sumps that will prevent seepage of spilled fluids into the groundwater	Design Engineer BPC/Operator
2	Sparks causing bush fires	An adequate firebreak to be established around the perimeter of the substation, on both sides of the perimeter fencing	BPC/Operator
3	Site pollution	Adequate housing, waste management and latrine facilities to be provided for the site foreman	Design Engineer BPC/Operator
4	Site selection – central area is a slight depression i.e. receiving from rainfall runoff	The design Engineer should take note of the location of the low-lying ground which may be subject to temporary flooding under very high rainfall conditions	Design Engineer
5	Weeds growing and creating habitat for small wild animals/pests	Clear all weeds systematically, by hand every month to two months	Design Engineer BPC/Operator
6	Weeds enabling fire	As above	BPC/Operator
7	Rodents nesting	Site design – architect to incorporate rodent proofing e.g. very narrow gaps in slabs overlying conduit trenches Ensure buildings and enclosures are free of clutter and well lit with fluorescent lighting	Design Engineer BPC/Operator
8	Predators encouraged by the presence of pests	As above	Design Engineer BPC/Operator
9	Birds nesting	Use of designs to discourage birds nesting on power line towers and among the transformers Regularly inspect and remove birds nests from critical parts of the station	Design Engineer BPC/Operator
10	Monkeys	Ensure the design of the station incorporates large enough gaps between transformers and overhead lines, so monkeys cannot climb around and cause arcing across the equipment	Design Engineer BPC/Operator

10.4.2 Monitoring Operation Phase Impacts

Monitoring of the operational phase impacts wile b the responsibility of the operator. It is recommended that the sub-station should be permanently manned by a site foreman, and inspections by senior BPC environmental personnel on a weekly basis, or immediately when requested by the site foreman, if a problem does arise.

10.5 SECONDARY OR CUMULATIVE IMPACTS

It must be remembered that the use of pesticides and/or herbicides at the substation could result in moderate to severe ground water pollution in the long term, and over a wide area. This is particularly the case at the Isang site, due to the sandy surface soils, and the subsurface geology and hydrology, as indicated from the surface soils and vegetation, in conjunction with the proximity of the site to the Thagale River.

It is strongly recommended therefore that the use of chemical herbicides and pesticides should be avoided at the sub-station site, and that manual clearing of plants should be the policy. For control of pests, the pests should be discouraged through careful design of the infrastructure, and if necessary baited (enclosed – to prevent chemicals from spreading through the surrounding environment) traps could be used to remove large populations of rodents or problem insects.

10.6 RESIDUAL IMPACTS

The residual impacts will be the permanent loss of grazing, browse and habitat for livestock and wildlife.

Other impacts will be the aesthetic impacts due to the establishment of site infrastructure.

Table 10.7: Summary Impact Table

Description of Impacts	Significance (Profound, Significant, Moderate, Slight or Imperceptible)	Scale of Change				Description of Mitigation Measures	Description of Residual Impacts	Residual Impacts (Profound, Significant, Moderate, Slight or Negligible)	Residual Effects			
		(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M /LT)				(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M/ LT)
Loss of grazing land	Slight	Negative, permanent, direct , long term				Use the smallest possible area for the site	Permanent loss of grazing	Significant	Negative, permanent, direct, long term			
Loss of animal habitat	Slight	Negative, permanent, direct, long term				Use the smallest possible area for the site	Permanent loss of animal habitat	Significant	Negative, permanent, direct, long term			
Noise generation	Moderate	Negative, temporal, indirect medium term				Ensure construction machinery has adequate noise suppression. Work from the upwind side to the downwind side	None	Negligible	n/a			
Dust generation	Slight	Negative, temporal, indirect, medium term				Work from upwind side to the downwind side during clearing and grubbing to minimize dust being blown offsite onto the main road	None	Negligible	n/a			
Wild fires started	Significant	Negative, temporal, indirect, medium				All cooking/heating fires to be set within a designated, screened areas	None	Negligible	n/a			
Groundwater pollution	Significant	Negative, temporal, indirect, medium				All vehicles to be properly serviced and operational before being permitted on site, all servicing to	None	Negligible	n/a			

			be done off-site at a designated workshop			
Livestock diseases from defecating in the bush	Moderate	Negative, permanent, indirect, long term	Portable latrine facilities to be provided, no staff to defecate in the bush	None	Negligible	n/a
Road traffic safety at site entrance from A1 road	Significant	Negative, permanent, direct, long term	Establish adequate traffic warning signs and man the entrance to the main road during working hours, when trucks are entering and/or leaving the site	None	Negligible	n/a
Litter and other solid waste	Slight	Negative, temporal, direct, medium	Provide litter bins with lids and remove all litter and waste material from site at regular intervals to an approved landfill site	None	Negligible	n/a
Fencing wire off-cuts harming livestock and wildlife	Moderate	Negative, permanent, indirect, long term	Collect all wire off-cuts and other waste fencing materials and consign to solid waste bins for removal	None	Negligible	n/a
Harmful snakes encountered	Significant	Negative, permanent, indirect, long term	All site staff to wear protective clothing and eyewear during bush clearing operations	None	Negligible	n/a
Groundwater	Significant	Negative, temporal, indirect, long term	Transformers to be placed on concrete flooring with sealed collection sumps that will prevent seepage of spilled fluids into the groundwater	None	Negligible	n/a
Fire	Significant	Negative, temporal, indirect, medium	An adequate firebreak to be	None	Negligible	n/a

			established around the perimeter of the substation, on both sides of the perimeter fencing			
Waste	Slight	Negative, temporal, indirect, medium	Adequate housing, waste management and latrine facilities to be provided for the site foreman	None	Negligible	Negative, temporal, indirect, medium
Pests	Moderate	Negative, permanent, indirect, medium	Clear all weeds systematically, by hand every month to two months	None	Negligible	Negative, temporal, indirect, medium

11 ARCHAEOLOGY

Archaeological Impact Assessment (AIA) is an integral part of the development process and is undertaken as part of an umbrella Environmental Impact Assessment. The object of an archaeological impact assessment is to identify archaeological sites within the proposed development area so that appropriate mitigation strategies can be implemented to care for the identified archaeological and heritage resources. It is only after the impact assessment has been carried out and the results made available to the Botswana National Museum that the developer may be given permission to proceed basing on the recommendations of the report.

With regard to the above, an archaeological reconnaissance was conducted to determine whether or not there are any significant archaeological remains within or near the proposed Isang substation development area in the Kgatleng District. Since the planned project activities for instance, during construction will involve disturbing the landscape, it was therefore necessary to carry out the survey before any activity to determine how the development activities would impact the archaeology in the area under investigation. The protection of archaeological resources is therefore, significant in safeguarding the national heritage and this is done under the auspices of the Monuments and Relics Act of 2001 as expressed earlier.

This Act is implemented, monitored and enforced by the Botswana National Museum. It strives to protect all archaeological and/or cultural sites (ancient monuments) and artifacts (man-made objects or 'relics') dating before 1902, whether or not they are known and registered with the National Museum. The Act also include any historic structures and objects since 1902 that have been proclaimed a recent historic monument, historic landscape or recent artifact, as well as natural features that have been proclaimed a natural monument. Section 18 of the same states that:

"A person shall not without the written permission of Minister, given after consultation with the commissioner-

a) make any alterations to, or destroy or damage; or

b) remove or allow to be removed from its original site… any national monument, relic or recent artifacts, or any part thereof."

Section 19 of the same Act stipulates that such places and objects may be destroyed only if an Impact Permit is issued. It is only after the impact assessment has been carried out and the results made available to the Botswana National Museum, that the developer may be given permission to impact the land as per the recommendations of the report. The Monument and Relics Act No. 12 of 2001 section 19 (2) articulates that;

"Both an archaeological pre-development impact assessment study and an environmental impact assessment study , shall be caused to be done by any person wishing to undertake major development such as construction or excavation, for the purposes of mineral exploitation and prospecting, mining laying of pipelines, construction of roads or dams or erection of any other structure, which will physically disturb the earth's surface."

Consequently, the post impact assessment results are made available to the Botswana National Museum and the developer may therefore be granted planning consent to proceed as per the recommendations of the report.

11.1 METHODOLOGY

The adopted methodological approach for the collation of data relevant to the proposed project area relied mainly on two main ways of information gathering, primary and secondary data sources. Background information on the project area and set up was obtained through usage of relevant written documents (baseline study), Secondary data was gathered through field surveys and structured oral interviews. The approaches are discussed in more detail below.

11.1.1 Baseline/Desktop Study

Before field survey was carried out, archival material kept at the Botswana National Museum, Botswana National Archives, University of Botswana and the National Libraries were consulted to gather relevant information on the general archaeological, historical and cultural background of the proposed project area.

The Botswana National register of archaeological sites kept at Botswana National Museum was also consulted to find out if there were any reported sites at or near the proposed project area. The following table show reported archaeological sites as recorded by the Botswana National Museum.

Table 11.1: List of reported sites by the Botswana National Museum

Site Number	Name	Type	Location
46-A3-1	Matsieng	Rock Engravings/SA	07 06
46-A3-2	Bokaa Dam	MSA	398 000E 729 00N
46-A3-2b	Rasesa	IA	067 036
46-A3-3	Bokaa slag site	Recent	400 500E 729 6900N
46-A3-3b	Raserura	IA	117 057
46-A3-4	Mathobenyane	IA	105 053
46-A3-5	Raserura East	IA	125 052
46-A3-6	Mochudi	Cultural	131 039
46-A3-7	Mochudi	Cultural	144 040
46-A3-8	Phuthadikobo Museum	IA	142 032
46-A3-9	Tshele Hill	IA Ruins	014 052
46-A3-10	Morwa Hills	LIA	052 990
43-A3-11	Morwa Hills	LIA	048 990
46-A3-12d	Morwa Hill south	IA circa AD1700?	-
46-A3-13a	Morwa Hill	IA Circa AD1700	-

11.1.2 Systematic Field Survey

This comprised comprehensive and systematic field walking of the area earmarked for the establishment of the Isang substation. The survey was mainly based on filed walking. As such, the entire project area was thoroughly walked with detailed surface inspection of the ground. This stage of assessment was done in order to confirm the presence or absence of archaeological signatures; their character, extent and possible impact by the development. A hand held GPS instrument was used to mark the locations or positions of important features encountered in the project areas. As mentioned earlier, the survey relied entirely on field walking as the primary method of locating archaeological resources or remains in the vicinity of the proposed project areas. A digital camera was used to take pictures of important features within the project area.

11.1.3 Oral Interviews

To supplement data obtained from the desktop study and field walking this study intended to conduct some oral interviews among a few households around project area to gather first hand information on the archaeology of the area. However, it was found that there were no households near and around the proposed development area. On that note, only two custodians at the Orange network tower were consulted since they were the only ones near the proposed Isang substation project area.

Figure 11.1 Interviews with Mr. Bonamile and Maphalala at the Orange network tower

Table 11.2: List people consulted during the brief oral interviews session

Name of interviewee	Age	Archaeological/historical knowledge
Bonamile Mathuntsha	27	None
Tlhalefang Maphalala	22	None

11.2 EXISTING ARCHAEOLOGICAL ENVIRONMENT

The archaeology of the Kgatleng District is known from a few researches and a number of archaeological impact assessments that have been done in the area. Very little is known about the Early Stone Age of the area around Artesia. Middle Stone Age tools have been excavated in areas around Artesia such as at Bokaa Dam (van Waarden, 1998). Middle Stone Age tools are associated with Homo sapiens (Neanderthal) as they represent a greater variety of specialized tools suggesting a wider range of activities and resources that were exploited. Robbins (1990) interpreted Middle Stone Age tools as being suggestive of base camp activities.

Later Stone Age tools are said to have been made of small flakes such that the tools are often referred to as microliths. These were made out of stones that formed very sharp blades. The site of Matsieng near Mochudi has been associated with the Later Stone Age period. This site of Matsieng has footprints, which are believed to have belonged to Matsieng the first human to enter the world through a hole (Walker, 1997).

Early Iron Age sites have been reported in the Mochudi area by Segobye (1987) dating to the 10th century A.D. According to Segobye (2000) Southeast settlements have been found to be few and less elaborate in their architecture, size and range of material culture associated with them. A number of Iron Age sites have been reported around Mochudi, which include those of Raserura, Oodi hills and Modipe hill.

The Iron Age period in South Eastern Botswana has often been associated with the coming of farming communities. These sites were identified by new ceramic styles that appeared which are today referred to as Moloko and Eiland. Moloko has been associated with the first Sotho-Tswana groups that entered Botswana. This group is said to have displaced the groups of Bakgalagadi living in the South East and occupied their land. This is when such groups such as Bakwena, Bangwaketse and later Bakgatla came to occupy the Southeastern parts of Botswana (Campbell, 1991: van Waarden, 1992).

11.2.1 Socio-Cultural Background Overview

Towards the end of the 15th Century, according to Tlou and Campbell (1997) a group, whose founder was Mokgatla, broke away and moved northwards. They moved first to live with the Bapedi to whom they were related and later to live on their own. In the 16th Century, merafe (groups) are said to have continued to grow large and split up. The Bakgatla split up and one group moved southwards towards the Vaal River to become the Batlokwa, while the main group remained living in the north near the Bapedi (Tlou and Campbell 1997).

Bakgatla who had been living in Rustenburg split up in the 17th century. Thabane and his large group moved to the North and his elder brother Mogale moved eastwards to Pretoria with the rest of the group. Mogale, had a son, Matshege who died in 1650, leaving two children; a daughter in the first house and a son in the second. It is with these two children that further divisions occurred. Some Bakgatla followed the daughter, Mosetlha, and others followed the son Kgafela. Those that followed Kgafela are the ones known today as Bakgatla ba ga Kgafela who reside in Mochudi and surrounding areas including Artesia and those who followed Mosetlha were already living in the southeast Ramotswa initially, then later moved to Moshupa, Thamaga and Gamafikana in Kanye. This group is known as Bakgatla ba ga Mmanaana (Tlou and Campbell 1997).

In Mochudi, around the 1870s, Kgamanyane had Bakgatla to settle in Mochudi where the current Kgotla is. The kgotla is an institutional center pin of Tswana society- court and point of reference. Traditionally the physical components of the Kgotla were the open area available for the assembly of large numbers of people with a shelter (leobo) for community leaders, a cattle kraal and Chief’s house.

Over the years, the Chief’s Kgotla in Mochudi has undergone extensive change. When the Bakgatla first settled in Mochudi, two houses were built by Chiefs Kgamanyane and Linchwe I. One of these is used today as an office for the Tribal Police and the other is a private home. The Kgotla itself was entirely encircled by compounds (malwapa) occupied by Kgosi Kgamanyane's 52 wives; most of them were demolished in the 1930s and 1940s when the Kgotla was made accessible by road and a new stone walled kraal and office for the Chief and small Tribal Administration staff office was constructed. Today there remains only a single lelapa of all those which were once occupied by Kgosi Kgamanyane's wives-fittingly; it is owned by Phuthadikobo Museum.

On the wall of the kraal can be seen a plaque which records the burial there of the two Chiefs, Linchwe I and Molefi. In other respects too the Kgotla has seen significant change. In 1981, the old timber leobo (shelter) was demolished and replaced, the cattle kraal now is only occasionally used, the tribal office has been much extended and the assembly area, which was normally vacant, has become a much used car park.

Undoubtedly the most important event to occur in the Kgotla was the enquiry in November 1934 into the differences between Kgosi Molefi and the ex Regent, Isang. The six day meeting was attended by the British Resident Commissioner and by many of the Dikgosi, including Tshekedi who arrived in Mochudi accompanied by 200 horsemen. Isang was found guilty of showing disrespect to the chief and of undermining his authority. He was fined 350 pounds and ordered to stay at his cattle post for six months. Molefi was censored for his drunkenness and irresponsible conduct and six 'guardians' were appointed to ensure that he attended properly to his duties (Tlou and Campbell 1997).

11.3 PREDICTED IMPACTS

The focus of the archaeological investigation was within the primary area where the proposed substation extension is to be. As mentioned earlier, the proposed site was systematically walked to assess the probability of archaeological sites. Nonetheless, no archaeological sites or artifacts were encountered within the proposed area. The Botswana National Museum has a site classification system, which is used to assess archaeological sites' relative importance as follows:

1 = Preserve at all costs

2 = Preserve if possible, otherwise extensive salvage work,

3 = Test excavation to determine whether further work is necessary,

4 = Systematic representative sampling sufficient

5 = No further archaeological work required.

This system was to be used to grade site(s) encountered within the proposed project area.

The following figures illustrate features that were encountered within the proposed Isang substation area.

Figure 11.2 Some markings in the project area

Figure 11.3 Some animal burrows within the project area

11.4 MITIGATION MEASURES

The examination of the earth surface in the area designated for the proposed Isang substation project area near Artesia village in the Kgatleng district. As a result, there are currently no possible mitigation measures to be implemented regarding on-site artifacts. However, the absence of archaeological material on the surface of some areas does not mean that they are unlikely to encounter during development when the area is excavated.

The following mitigation can be proposed for potential finds that may be encountered during the construction or operational phases of the project.

- Prior to site preparation or grading activities, construction personnel shall be inducted on the potential for encountering significant archaeological resources and informed on how to identify potential resources.

- This shall include the provision of written materials to familiarize personnel with the range of resources that might be expected, the type of activities that may result in impacts, and the legal framework of cultural resources protection.

- All construction personnel shall be instructed to stop work in the vicinity of a potential discovery until an archaeologist assesses the significance of the chance find.

- Construction personnel shall also be informed that unauthorized collection and/or alteration of archaeological resources is prohibited.

- If the examining archaeologist determines that an archaeological resource uncovered during construction is significant, the resource shall, if feasible, be preserved intact through project design measures.

- Otherwise, the archaeologist will design and implement a treatment plan to document and evaluate the resource and/or preserve appropriate scientific samples.

In conclusion, the following is a summary of the whole archaeological investigation together with the resultant recommendations to be accordingly adhered to by the developer.

- Nothing of archaeological significance was found during this survey. However, the absence of archaeological material on the surface of some areas does not mean that they are unlikely to encounter during development when the area is excavated.

- The contractors should be inducted on the significance of archaeological resources that might be destroyed during the course of the project. The induction is essential to sensitize the contractors on the identification of archaeological materials, their significance and the importance of reporting such material to the relevant experts. The course is essential and should precede the construction stage. Archaeological material in this area is especially precious, as little archaeological research has been done.

- The contractors should keep a watching brief, and should anything of archaeological significance be found they should immediately inform the Botswana National Museum, as is required under the Monuments and Relics Act 2001. They should also be reminded that a development permit must be obtained (either by them or the developer) prior to any clearing or construction-taking place.

- All these mitigation measures must be implemented to meet the requirements of the Monuments and Relics Act (as amended, 2001) of the laws of Botswana. This act protects all archaeological and or historic monuments and sites in the country whether they are recorded in the National Museum site register or not. The act also recommends that upon encountering archaeological material, relevant authorities should be informed. Section 18 prohibits any alteration, damage or removal from original site any national monument, relic or recent artifact. The act also recognizes the fact that the alteration, damage or removal of monuments and relics may be occasioned through authentic developments. Section 19, therefore, provides for predevelopment archaeological impact assessment and mitigation where planned developments are likely to disturb the earth's surface.

11.5 RESIDUAL IMPACTS

No profound impacts to archaeological resources in the study area are expected. No archaeological remains were identified within the proposed impact zone of the Isang substation area. The earth surface within this area is currently considered to have low potential for terrestrial archaeological sites. In this regard, there are no archaeological residual impacts to consider for this particular project. Proposed project activities are unlikely to adversely affect archaeological sites. However, subsurface grading and excavation operations may uncover significant archaeological resources not visible on the earth surface. Upon discovery of chance finds during grading or excavation, the contractors should halt all works within or near the find locality. All chance finds should be examined by a qualified archaeologist on site. The archaeologist would make appropriate recommendations regarding the significance of the finds and appropriate mitigation measures.

Recommendations could include collection, recordation and analysis of any significant cultural materials. In this case, residual impact will be moderate.

As already been stated, the proposed project site does not contain any known archaeological resources. The proposed project would not, as described above, affect any known archaeological resources, and the implementation of the proposed project would include watching briefs which would ensure identification and appropriate treatment of any previously unknown resources if any are uncovered during grading or excavation. The proposed project would not, therefore, have a significant effect or residual impact on archaeological resources in the project area and is not anticipated, in combination with related development projects, to contribute to a cumulative effect upon such resources in the area. As a result, any residual or cumulative impacts of the proposed project upon archaeological resources would be imperceptible or negligible.

Table 11.2: Summary Impact Table

Description of Impacts	Significance (Profound, High, Medium, Low or Negligible)	Scale of Change				Description of Mitigation Measures	Description of Residual Impacts	Residual Impacts (Profound, High, Medium, Low or Negligible)	Residual Effects			
		(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M /LT)				(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M/ LT)
Archaeological remains could be present beneath the surface at the proposed site	Medium	Negative, permanent, direct, long term				The contractors should keep a watching brief, and should anything of archaeological significance be found they should immediately inform the Botswana National Museum, as is required under the Monuments and Relics Act 2001. They should also be reminded that a development permit must be obtained (either by them or the developer) prior to any clearing or construction-taking place.	None	Negligible	n/a			

12 LANDSCAPE AND VISUAL AMENITY

This chapter describes the existing aesthetic environment in the study area, and at the development site in particular. It includes information on landscape and visual amenity, specifically identifying landscape character of the area and visual elements that make up the existing environment and may be potentially impacted.

It is a notable feature of this assessment that the proposed substation will occupy an area measuring 625 x 378m, while the entire site occupies a space of 900 x 550m. The former dimensions are hereafter referred to as the "inner" site, and the latter as the "outer". This is an important aspect of the landscape and visual assessment, due to the fact that it is only the inner site that will be clear-cut, while the outer extents will be left undisturbed for the development of the substation. This assessment is primarily concerned with the inner site, as it is this aspect of the development at Isang which will have any landscape and visual impacts on surrounding receptors.

12.1 METHODOLOGY

The landscape assessment follows the methods described in Guidelines for Landscape and Visual Impact Assessment 2nd Ed. (Landscape Institute - UK, 2002), as well as methodology developed by Loci Environmental through best practice and extensive experience in the field of landscape and visual assessment. The objective is to undertake sufficient assessment to identify the landscape and visual factors and the likely effects upon them, which are taken into consideration in developing and refining the proposed layout and construction of the proposal. The surrounding landscape has been appraised to allow it to be described and classified into landscape character types, which enables the categorisation of landscape quality. The final landscape and visual impact assessment consists of a written statement on the impact of the proposal on the landscape character and values of the area.

The landscape context, classification and quality are described in the following sections this Chapter. The assessment was undertaken through analysis of up to date maps and site photography, in conjunction with detailed plans and sections of the existing and proposed site features. A site visit was carried out in early autumn when, due to leaf cover being at a maximum, any potential visual implications or alterations would be left highly visible and therefore assessed on a "best case scenario" basis.

Site visits were undertaken to assess the existing environment, landscape character, and potential impacts of the proposal on the surrounding landscape. This included taking into consideration key landform and land cover components of the region. The existing landscape character types found in the study area were identified, to which sensitivity rankings were assigned, for aid in subsequent impact analysis. A landscape character assessment determined the capacity of the existing landscape to absorb the proposed substation, and a visual impact assessment was also carried out, isolating sensitive visual receptors likely to be affected by the proposal. Predicted landscape and visual effects of the proposed development are ultimately considered to be relatively low, given the unobtrusive nature of the substation structures (standing at a maximum height of 24m, within rural bushveld setting over a kilometre away from any residential visual receptors).

Landscape has two separate but closely related aspects, visual impact or the extent to which a new development can be seen in the landscape, and landscape character impact or the responses felt toward the landscape based on the shape, form and colour and that interaction to create specific patterns and pictures distinctive to a particular locality. Visual impacts may arise under:

- 'visual intrusion' - the impact on a view without actually blocking the view and
- 'visual obstruction' - where there is an impact on a view involving blocking of it.

An example of each are shown below in Figure 12.1.

Figure 12.1 Visual Intrusion (top) by Windmill, and Obstruction (bottom) by Mine Spoil Piles

The resultant output from the project landscape and visual assessment includes practical mitigation measures proposed to ameliorate the potential impacts.

12.2 EXISTING ENVIRONMENT – LANDSCAPE CHARACTER

Landscape character types are distinct areas of landscape that are relatively homogeneous in character. Each character type represents its own landscape values and sensitivities, as described in subsequent sections of this report. The character type specified for a study area is generally a descriptive term made up of the prominent landform and land cover observed in the area. The landscape character covering the study area can be described as *scrubland/savanna* landscape at

Isang, which is a largely undeveloped area with the closest settlement or village between 8-10km to the south (Malotwana), and 11km to the north (Artesia). *Scrubland/savanna* is a landscape type often comprising (but not limited to) the following key characteristics:

Scrubland/savanna:

- Flat, with very little slope or gradient,
- Wide, long-range views across the landscape only intruded upon by vegetation
- *Acacia* and *Combretum* -dominated trees and dense low-level scrub
- Informal trails made by animals or pedestrians
- Masimo (arable agricultural fields) land use on or nearby the site
- Sandy soils
- Termite mounds

The vegetation of the site is relatively uniform with dispersal of trees and shrubs as follows:

- Isolated tall trees of 4-6m height spaced at an approximate distance of 50-100m from one another

- Shorter trees of 3-4m height generally clumped 10-20m apart.

- Shrubs of 1-3m height clumped *microphyllous* species approximately 1-15m away from one another, and broadleaved species spaced at distances of approximately 1-10m.

12.2.1 Landscape Values

Assessment of the landscape value of the study area considers the landscape in relation to its location, rarity and particular attributes identified on site. The study area may contain areas of common value such as significant aesthetic, ecological, historical, socio-cultural, religious or mythological importance, which are of relevance in identifying the value of individual landscape types. In general, the higher the quality or value of landscape, the more sensitive it will be to change.

A judgement of the landscape value can be based on the value or importance of the affected landscape, to those directly impacted by it. This includes establishment of the level of importance at a local, regional, or national level, by examining planning documentation, or council zoning of lands for particular uses or protection in the future. The proposed substation is located within lands that are not zoned as “sensitive” by any development plan or urban council. Likewise, no protected landscapes or scenic views were found to exist within the site boundaries, or nearby.

The aesthetic value of a landscape is often the most obviously impacted, by new industrial or residential developments and the subsequent shift in character of the developed area. The proposed substation development site is on relatively level terrain, within the currently undisturbed landscapes of the Isang area (Isang is not actually the name of a village, but rather is associated with a now redundant train stop on the Gaborone-Francistown train line). However the area is also characterised by its proximity to the existing A1 Gaborone-Francistown road, which is one of the most busy traffic corridors in Botswana. Therefore the setting of the project area can not be considered entirely undisturbed or devoid of visual receptors.

The current cumulative aesthetic value of the site mainly lies in the naturally occurring scrub and trees, and the diverse species found therein (refer to Chapter 10, Ecology). Overall, the site in its existing state can be described as having a *moderate landscape value*. This takes into consideration the existence of valuable native vegetation and the undisturbed “bushveld” characteristics of the setting,

as well as the disturbed environment nearby that is the A1 highway corridor and adjacent Orange cell phone tower, roughly 200m away from the site.

12.2.2 Landscape Sensitivity

The sensitivity of a landscape to development (and therefore to change) will vary according to its character type, as well as the importance attached to any single value or combination of values which are attributed to that landscape. The sensitivity of a landscape is therefore defined as the measure of its ability to accommodate change or intervention without suffering unacceptable effects to its character and values.

Currently an additional factor that is responsible for preventing the study area from being considered entirely undisturbed, is the presence of a large Orange cell phone tower within 500m of the proposed substation site, the Gaborone-Francistown railway line, and the heavily-trafficked A1 road, which is within 300m of the site. The existence of such infrastructure in close proximity to the proposed development (literally sharing the same landscape) results in the existing landscape having a much lower sensitivity level, than if it was entirely undisturbed by any development whatsoever.

Aside from the above, in the short term, the proposed site is capable of absorbing the proposed substation development successfully, due largely in part to the existing landscape character type being highly visible throughout Botswana (scrubland/savanna), the lack of sensitive or vulnerable landscape characteristics or vegetation, and the potential for the existing vegetation found within the study area to remain intact during the construction and operational phases of the project.

Overall the sensitivity level of the existing landscape is considered to be low.

12.3 EXISTING ENVIRONMENT – VISUAL AMENITY

The vegetation and landform at and around the proposed Isang substation site provides for established visual screening of both construction and operational impacts yielded by the proposed substation, provided the existing savanna and bush vegetation off-site is left intact to as high a degree as possible.

Potential visual receptors geographically situated with the potential to have views to any aspects of the proposed substation include:

- Motorists: partial view, moving view of the substation from the A1 road.
- Residents of masimo lands over 1km from the site.

The area of study for the visual assessment extends to the whole of the area from which the proposed development is visible (the visual envelope), according to Landscape Institute and IEMA Guidelines (2008). Refer to Figure 12.2 for an illustration of the visual zones used when describing the general visual amenity and views to the proposed substation.

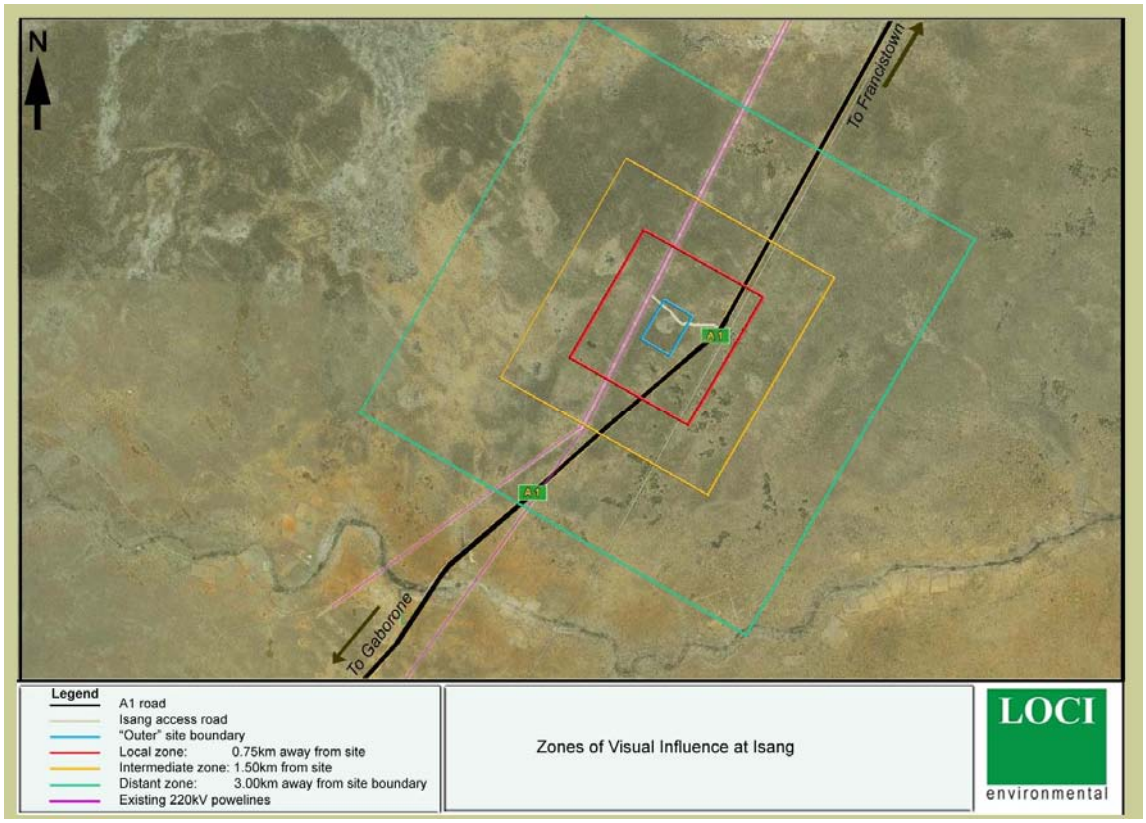


Figure 12.2 Visual Zones at Isang

In terms of existing visual amenity at the proposed substation site, the current landscape (scrubland/savanna) surrounding the study area is such that views afforded are only short-range in nature, and extend from the site as far as the Local Zone only. The Local Zone is ultimately where the majority of potential visual receptors will be located.

Due to the intervening distance between the development and visual receptors identified, as well as the scale of the development, and existing vegetation, the following components of the substation are likely to have a negligible/neutral impact:

- Fencing
- Control building
- Transformers
- Bays

Connections to power lines and lightning rods are likely to be the only components of the substation that will extend higher than the tree canopy, to be viewed by any receptors in the study area.

These receptors are considered to be low in sensitivity.

12.4 ASSESSMENT OF IMPACTS

Assessment of impacts is typically two-fold, including assessment of both the construction phase and operational phase of the project. The nature of construction phase impacts are typically short-term (i.e. for the duration of the construction contract) and are mainly related to the disruption that construction causes to the receptors and existing environment in the area.

Operational impacts in relation to this proposal are related to the proposed future presence of visible elements such as steel structures and control buildings, or fencing.

The physical elements of the proposed development are important to consider when addressing potential impacts on the existing landscape and visual amenity. The substation will included a steel frame with a maximum height of 24 m. All installed transformers and switchgear will be lower than this, and will be constructed from concrete block and brick material, as well as steel. A gravel surface will be laid throughout the inner substation plot.

An access road from the A1 to the substation will be constructed of bitumen, and will extend approximately 300 metres in length, through the Local Zone.

12.4.1 Impacts – Landscape

A variety of landscape impacts are predicted as a result of the proposal, ranging from neutral to adverse. In assessing the proposed substation's impacts on the existing landscape character, the following aspects are considered:

1. Loss of mature or diverse landscape elements or features
2. Effects upon landscape character types that are distinctive and rare
3. Loss of landscape elements, features or characteristics of high value or importance
4. The sensitivity of the receiving landscape's value.

Table 12.1: Predicted Landscape Impacts Related to Isang Substation

Impact criteria	Description of Impact	Nature of change	Severity of change	Duration
1) Loss of mature, diverse landscape elements/features	Clearance (construction phase) will result in the loss of vegetation associated with the greater (non-rare or unique) scrubland and savanna landscape character, 23.6ha in "inner" surface area.	Negative	Slight	Long term
	Topographical change, likely to be permanent – creating structures with a maximum height of 24m within an otherwise flat landscape where currently the tallest features are trees of +/- 6m, in a rural area.	Negative	Moderate	Permanent
2) Effect upon landscape character types – distinctive/rare	The site is set within a landscape character type that is found commonly throughout the Kgatleng District and Botswana in general.	Negative	Negligible	Long term
3) Loss of landscape elements, features, characteristics of high value/importance	The site is currently undisturbed, however the high-traffic environment of the A1 is nearby. Overall the site and study area are devoid of any characteristics of high value or importance.	Neutral	Negligible	Long term
4) The sensitivity of the receiving landscape's value.	The location of the proposed substation is currently within a landscape of low sensitivity, due to its common occurrence throughout the district and country, as well as its rural character and intervening distance between large numbers of sensitive visual receptors.	Negative	Slight	Long term

Other factors to consider when evaluating the proposed substation's impact on the existing landscape, is the difference between the predicted impacts in general, and the likely cumulative impacts of the future. This particular EIA focuses on the predicted impacts related to the development of one substation measuring 23.6ha in size, with a maximum elevation of 24m in height. The landscape impacts of this in the current environmental setting are predicted to be slightly negative overall. However, it is the intention of future developments to have up to 8 large-scale powerlines enter and exit the substation, several years in the future. Such powerlines have not been designed at the time of writing, nor do they form part of this particular proposal. However it is likely that the future infrastructure will include "Guyed-V" style towers and clearance corridors spanning a width of up to 60m. Effectively this results in a future scenario whereby the proposed substation becomes the centre of a large "electricity web", yielding a substantially higher landscape impact than the substation alone.

12.4.2 Impacts - Visual

The first step in identifying predicted visual impacts related to the proposed development is to identify the potential sources of effects with respect to the visual receptors. Categories used in this EIS to achieve this, include:

- The extent of the view that would be occupied by the substation (degree of visual intrusion): full, partial, glimpse, none.
- The proportion of the development or similar features that would be visible: full, most, small amount, none.
- The distance of the viewpoint from the development and whether the viewpoint would focus on the development due to proximity, or the substation would form one element in a panoramic view.
- Whether the view is transient or one of a sequence of views, as from a moving vehicle or footpath.

It is clear from analysis of the technical components of a substation the size of Isang, that the steel structures measuring up to 24m in height will be visible to a "glimpse" degree from the Local Zone only (see Figure 12.2), which at present is considered to be limited only to motorists on the A1.

It should be noted again that there are no permanent residential receptors at the proposed substation site, within any of the Zones of Visual Influence, and the only residents in close proximity to the proposed substation includes rural masimo in the area, the nearest of which is over 1km away from the site. This creates a situation whereby the only existing visual receptors are considered to be those residents along the A1 road, which are likely to be moving at high speeds when passing through the visual envelope. These receptors are predicted to experience little to no visual impact due to the proposed substation development in general.

During the construction period, the presence of machinery, dust, and other construction activities will have an adverse visual impact on receptors identified. A disorderly and poorly maintained site can have serious negative impact upon the visual amenity of the area, as well as draw attention to the largely industrial visual amenity of the construction site, set within a much larger, natural rural scrubland landscape. The excessive clearance of existing vegetation will also exacerbate such visual impacts.

Overall, predicted adverse operational impacts are limited to poles, overhead cables, substation structures and security fencing around the proposed substation, all of which have a tendency to create an untidy visual appearance, and create conspicuous obstructions on the horizon. If used in the

design, any security lighting at the proposed substation locations also have the potential to cause light trespass and spill into naturally dark skies.

12.4.3 Mitigation Measures – Landscape and Visual

- Refrain from clearance of any vegetation within the "outer" site around the substation construction itself.

- Recommend for "tubular busbar" type substation components to be used in the design, in favour of a shorter, more minimalist and low-impact appearance, than the conventional "overhead stringers" design that is commonly found throughout Botswana at present (refer to Figure 12.3, 12.4)

- Allow natural revegetation of all land cleared during construction that does not affect access, safety, or obstruction of electrical operations related to the substation.

- Design, specify, and position any security lighting in consultation with environmental consultant so as to minimise light pollution.

- Design access road to include a slight bend (around existing vegetation), preventing straight-line views into the substation from the A1 road.

- Indigenous landscape planting similar to that which is currently on site should be implemented around the boundaries to alleviate negative impacts on visual amenity.

- To avoid visual clutter, ensure that all construction and operational areas are kept free from litter and rubble (see Figure 12.5). Ensure tidiness of each site throughout construction and operational phases.

Figure 12.3 Example of conventional "overhead stringers" type substation found throughout Botswana

Figure 12.4 Example of shorter, more minimalist "tubular bus bar" substation, yielding less visual impact

Figure 12.5 Existing rubble and visual clutter at an existing substation site

12.4.3.1 Residual Impacts – Landscape and Visual

Residual impacts upon landscape should be evaluated upon the establishment of the mitigation measures proposed. The above mitigation measures address the potential impacts predicted to be yielded by the development; however the ultimate residual impact of the proposal will be mainly attributed to the capability of the existing landscapes to absorb the substation. Overall, the proposal is expected to yield a slight adverse impact on landscape and visual amenity.

12.5 CONCLUSION

The site proposed to be developed for the Isang substation is currently situated within a landscape that includes undisturbed lands (within the proposed site boundaries), and a semi-disturbed landscape within the general study area. This study area is one that includes some scattered masimo lands, as well as a large Orange cell phone tower, the A1 highway, and the Gaborone-Francistown railway line.

The individual landscape and visual impacts of the proposed Isang substation range from negligible to slightly negative, with the overall residual impact of the project expected to be slightly negative. The sensitivity of the visual receptors expected to be impacted is low, as this is largely confined to traffic moving at high speeds along the A1 road, or train passengers.

The most significant impacts predicted to occur over the life of the substation are of a cumulative nature, considering the fact that future development not related to this particular EIA will incur a number of large-scale powerlines entering and exiting the substation site, which in terms of size, scale, and associated bush clearance, will be substantially more visible than the substation itself.

Table 12.2: Summary Impact Table

Description of Impacts	Significance (Profound, Significant, Moderate, Slight or Imperceptible)	Scale of Change				Description of Mitigation Measures	Description of Residual Impacts	Residual Impacts (Profound, Significant, Moderate, Slight or Negligible)	Residual Effects			
		(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M /LT)				(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M/ LT)
(Landscape) Vegetation clearance - within "inner" site.	Slight	Adverse, permanent, direct				None	Permanent vegetation loss (625 x 378m) within "inner" site.	Slight	Adverse, permanent, direct			
(Landscape) Vegetation clearance - within "outer" site.	Slight	Adverse, temporary, direct, medium term				Only allow clearance of vegetation where absolutely necessary, i.e. for access road. Supplement vegetation in "outer" site with indigenous planting after construction	Increase density of vegetation in outer site, adding to the green buffer zone around the permanently disturbed "inner" site, and replacing cleared vegetation to some degree.	Negligible	Neutral and negligible			
(Visual) Visual intrusion of substation	Slight	Adverse, permanent, direct				Allow vegetation to grow unhindered, within the "outer" site	Screened view of electrical cables and poles where surrounding vegetation permits	Negligible	Neutral and negligible			
						Select "tubular busbar" design instead of "overhead stringers"	Less visual clutter due to a more minimalist appearance instead of hanging cables throughout the substation	Slight	Negative, permanent, direct			
						Design access road such that straight-line views from A1 to substation are screened from view	No direct view from A1, down the cleared access road	Negligible	Neutral and negligible			

			by bend in the road and vegetation			
(Visual) Construction elements visible to receptors	Slight	Adverse, temporary, direct, short term	None	None	Slight	Adverse, temporary, direct, short term

13 SOCIO-ECONOMICS

The main objective of this chapter is to address the existing socio-economic status of the study area and identify any predicted impacts that may be yielded by the proposal. The socio-economic assessment includes issues related to population, land use, employment issues, and any relevant results of public consultation and feedback from the affected population.

13.1 METHODOLOGY

This section was prepared following an initial study of relevant literature, maps and aerial photographs followed by a field visit and public consultation. Useful information was obtained from participants in consultation meetings as well as officials and other stakeholders who were interviewed during this process.

Extensive literature was consulted prior to field visits to enable comments from stakeholder interviews and participants in consultation meetings to be put in context. A list of stakeholders to be contacted was prepared prior to the field visit as was a check list of issues to be covered in discussions. Population data was obtained from CSO publications listed in the bibliography but growth rates were calculated independently by the consultants.

The environmental team has conducted interviews at the national and sub-national level with informed persons, with the aim of soliciting insights into social impacts, securing available materials and data, and collecting factual data.

Key issues to be investigated during the socio-economic assessment include, but may not be limited to, the following:

- Impacts on communities proximate to the substation site.
- Opinions of affected communities about the substation.
- Recommendations from affected communities about the substation.
- Development context.

In considering these impacts, the following should be investigated:

- Settlement.
- Migration.
- Employment and incomes.
- Expectations about construction, operations, decommissioning.
- Concerns about construction, operations, decommissioning.
- Possible social and health risks associated with living and working close to the substation.

- Recommendations about construction, operations, decommissioning.

The Loci team considers the social impacts of the nature of construction and operations, and makes recommendations accordingly. Policy documents from the Botswana Power Corporation (e.g., wellness policy, HIV&AIDS policy, corporate social responsibility policy, environmental policy, etc.) are also reviewed.

13.2 EXISTING SOCIO-ECONOMIC ENVIRONMENT

Botswana attained independence from England on 30 September, 1966. It is a landlocked country of 582,000km^2 in size. It is bordered by Zimbabwe on the northeast, Namibia on the north and west, and South Africa to the south and southeast, with a small border with Zambia in the north (see MFDP, 2003).

The 2001 census (Central Statistics Office, 2003) enumerated a population of 1,680,900 people. Over half (54.2%) of the population was classified as urban in 2001, a rise from 46.5% in 1991, and a dramatic increase from only 9% in 1971, and only 17.7% in 1981. In part this reflected the increasingly urban characteristics of what were previously known as the 'major villages', which were classified as urban areas from the 1991 census onward, but generally it reflected a process of rapid urbanisation, affecting the capital Gaborone in particular. Despite the population having more than doubled from 1971 to 2001, the country remains one of the least densely populated countries in the world. Poor Kalahari soils and low rainfall affecting the western and northern two-thirds of the country has limited population growth in these areas, while some 80% of the country's population lives in the eastern and south eastern parts of the country (CSO, 2005).

Despite considerable gains in terms of social development, crude death rates rose from 1991 to 2001 after a downward trend from 1971 to 1991, almost entire due to AIDS-related deaths, affecting economically active males and females in particular. The significant impact of AIDS is also reflected in a decline in life expectancy, from 65.3 years in 1991 to 55.7 years in 2001. This is also reflected in a decline in population growth rates, from over 3% from 1981 to 1991, to 2.1% from 1991 to 2001 (CSO, 2005).

13.2.1 Overview

In the four decades since independence in 1966, Botswana has made considerable progress on a wide variety of development fronts. An extremely poor country with few apparent resources at independence, Botswana today is a middle-income country with economic growth rates among the highest in the world. With the careful use of these funds, Botswana has made huge gains in social development, and has helped many households move out of poverty. From 1993 to 2003, the percentage of households living in poverty dropped from 37% to 30%. This decline in levels of poverty was reflected in a growing middle class with an increasingly urbanised population, and a drop in the Gini co-efficient of income inequality from near 0.70 to 0.63 (the closer the index is to 1, the greater the inequality). Poverty in Botswana today is concentrated in remote areas, particularly in the west and north of the country (see UNDP, 2006).

It is estimated that over 90% of the population lives within ten kilometres of a health facility, gross enrolment rates are over 100% for primary school, and at almost 90% for secondary school. The number of schools countrywide has expanded significantly, with gains made at all levels and locations, including in rural areas.

Botswana's macro-economic performance has been positive, with growth rates averaging almost 13% in the 1970s and 1980s. Much of this growth was due to the rapid expansion of diamond mining, and the reinvestment of revenues in social and economic development initiatives that enhanced local

economic activity. While growth continued well into the 1990s, the economy slowed thereafter. In recent years, Government has focused additional attention on economic diversification, including efforts to establish Botswana as a regional financial centre, the expansion of the service sector, and improving upstream and downstream linkages with the mining sector.

While the economy is growing slower than in the past, and while the difficulties facing economic diversification are greater than anticipated, Botswana retains its status as a country governed by fiscal prudence, an open economy and a functioning democracy. Gross Domestic Product, at almost US$6000 per capita, is one of the highest in Africa.

13.2.2 Rural Botswana

While the economic transformation of Botswana's economy over the past four decades has resulted in over half of the population being classified as urban by 2001, many households retain strong links with rural areas. Transfers from urban areas represent an important source of income for many rural households, and high mobility means strong economic and social links between urban and rural areas. This increasingly holds even for what used to be quite isolated sandveld locations, as large-scale cattle farming has expanded into sandveld locations with the provision of borehole water and the zoning of new land for use as grazing. Strengthened infrastructure throughout the country has further ensured that the rural and urban economics have become increasing integrated.

Accelerated urbanisation in part reflects a lack of investment in the rural economy, and the concentration of economic opportunities in urban areas. The Kgatleng District, where Isang substation is located is located, reflects the trend towards stronger rural-urban integration, and out-migration to seek employment. Mochudi is the main village nearby following this urbanisation, but the due to the fact that the Kgatleng District is located in close proximity to Botswana's capital Gaborone, local economic opportunities are further compromised.

13.2.3 Social Planning and Development Environment

The EIA Act of 2005 does not require the specific commissioning of a social impact assessment. The actions of the applicant in the social arena in Botswana is therefore guided more broadly by the development vision of the country, and the specific challenges facing the project area, rather than issues of compliance. With this in mind, this section focuses on the development context and relevant policies.

Government's response to the development challenges facing the country is guided at the broadest level by Vision 2016 (revert to Chapter 6, Section 6.4), and Development Plans such as National Development Plan 9 and the Central District Development Plan (revert to Section 6.4) are integral pieces of social planning and development in the project area. These were reviewed in-depth and used in the carrying out of the Isang substation socio-economic assessment.

13.2.4 Local Government

Local government authorities are responsible for providing a wide range of social services, including primary education, basic health services, water, sanitation, tertiary roads, social and community services, remote area development, and services targeting most vulnerable groups. The Ministry of Local Government provides planning support; finance and policy guidance as well as strategic direction (see Ministry of Finance and Development Planning, 2003). Over the past two decades, the technical competence of these sub-national authorities to deliver services had improved significantly.

The Kgatleng District Council, based in Mochudi, is charged with the provision of basic infrastructure and social services, as well as to support community development for the district. Infrastructure support includes the following:

- Roads - construction and maintenance of rural roads
- Water and Waste Water - provision and maintenance of systems for potable water supply and sewerage services
- Sanitation and Waste Management - solid waste management
- Primary Education - primary education facilities (provision and maintenance)
- Primary Health - primary health facilities (provision and maintenance)

Social services and community development comprise:

- Administration of social and community development services such as home-based care, orphan care, early childhood care and development, destitutes, home economics through the Department of Social and Community Development
- Implementation of activities under the Remote Area Development Programme
- Promotion of rural housing and expanded home ownership for low-income families through the Self-Help Housing Agency

The Community Development Section of the Department of Social Welfare and Community Services focuses on working with Government institutions, specifically Village Development Committees, but also with voluntary bodies such as Parent Teacher Associations.

The study area is currently undeveloped and dominated by farming activities. The two nearest villages to the proposed site are Malotwana and Artesia. Population statistics and economic information are given within the following sections. The cultural heritage of the area, movement of people and cultural trends throughout history are discussed in-depth within this section.

13.2.5 Population details

The communities within the study area which are likely to be affected by the construction and operation of the sub-stations and associated distribution lines are listed in the table below, along with their populations in 1991 and 2001.

Table 13.1: Populations of Settlements possibly affected by the substation

Settlement	1991 population	2001 population	2006 (estimated)
Malotwana	n/a	2 369	2 564
Artesia	885	1 462	1 582
TOTAL DISTRICT	43 547	73 507	79 550

There is considerable variation in population growth rates between both settlements. Nearly all villages in the District have seen significant population increase, in the period from 1991 to 2001, the increase in the districts primary centre Mochudi was nearly half, and similar increases have been seen in villages like Bokaa, Pilane, Rasesa, Matebele, Malotwana, Olifantsdrift and Artesia. The 2001 census has shown that a migration to Kgatleng districts from other districts was 18 334. This high number of people migrating to the district can be explained by the fact that the villages are located in commutable distance from Gaborone, where sources of employment are available.

According to the 2002 Central Statistics Office multiple indicator survey, the population in the Kgatleng Distict that is economically active was 27 550. The number of people that were employed in an economic activity was 22 032, while 5 518 people were without any form of employment. This translates into an unemployment rate of 20%.

The major urban centre in the Kgatleng District is the village of Mochudi, which is located approximately 42 kilometres from the proposed Isang site. The Kgatleng District offices, main schools, primary hospital and many other institutions are located in Mochudi. The population in Mochudi at the 2001 census was 39 349, which accounts for more than half of the total population in the district.

The 2001 Population and Housing Census has shown that the total amount of males in the District is 35 734, while the amount of females is 37 773. The total amount of households headed by females is 37 745, while the amount of households headed by males is 35 752. This translates into 51.3 % of the households being female-headed, which is slightly higher than the national average of 51.1%.

13.2.6 Land Use

Most rural land in the study area is used for extensive communal grazing under the traditional agro-pastoral production system. The arable component of this system has declined in importance in recent years. This is due to three factors:

- increasing competition with South African farmers as a result of improved road connections,
- continuing high prices (in Pula terms) for beef and,
- a policy environment which sees arable production by smallholders as a sub-economic social support mechanism and is not focussed on enhancing arable production by this sector.

However, due to Isang's close proximity to Mochudi and Gaborone, some of the arable farming has survived the above developments.

The main product of agriculture is live cattle for slaughter. Primary arable crops are maize, sorghum, beans, cowpeas and melons. Production in the livestock sector is primarily commercial for sale to the market with some subsistence consumption, particularly of small stock. In the arable sector, on the other hand, production is mainly subsistence oriented with sales to the market of surplus crops in better years.

13.2.6.1 Land use and allocation at the proposed Isang site

As mentioned in the previous section, the land at the proposed Isang site is currently communal tribal land. The local land boards deal with any issues related to land and land allocations. There is one main land board in the district and three subordinate land board offices in Mmathubudukwane, Artesia and Mochudi. Their responsibilities include the following:

- The granting of rights to use land.
- Authorizing changes of use of tribal land.
- Cancellation of the grant of any rights to use any land.
- Imposition of restriction on the use of tribal land.
- Authorizing transfers of tribal land.

At and around the proposed substation site a number of land use rights have been granted. The rights include the following:

BPC: For the existing two existing 220kV power lines near the proposed substation wayleaves have been agreed upon for the width of two power line corridors. The corridors can still be used for grazing and farming activities, but no vegetation taller than 4 metres can be allowed, and no permanent structures can be allowed within the power line corridor, due to safety standards.

In addition to the power line corridors, a 200x200m plot was allocated to BPC at the Isang substation site. This plot was allocated many years ago for installation of a transmission and communications device for the power lines, and with the expectation that a substation may be required in the future. The footprint of the allocated plot falls within the footprint of the proposed Isang substation.

Orange: The cellular telecommunications company Orange has been allocated the rights of a plot in between the proposed substation plot and the road. On the plot they have installed a cellular phone antenna and associated transformers and switchgear.

Roads Department: The Botswana Roads Department is responsible for maintenance of the A1 Gaborone to Francistown road. The area allocated for the road is called a road reserve, and includes a section of land on each side of the actual road. Specifically with the development of transmission lines to and from the Isang substation the road reserve must be taken into account.

Botswana Railways: A railroad is situated on the eastern side of the Gaborone to Francistown road, on the opposite site compared to the proposed Isang substation. The railroad would have been allocated a railroad reserve of a certain width.

The area at Isang is generally used by farmers for grazing land of their cattle. This includes the power line corridor used by BPC. The farmers formed a farmers association for the purposed of operating the boreholes installed for watering the cattle. Three boreholes have been installed around the Isang site.

13.2.7 Land Tenure

According to the Government White Paper on the Tribal Land Grazing Policy of 1975, Kgatleng District was declared wholly communal, with no other tenure, neither freehold nor state land. The district has a total surface area of 7600km^2 . The table below shows the various land uses in square kilometres and as percentage.

Table 13.2: Land use in the Kgatleng District

Type of land use	Area (km2)	%
Agricultural and Settlement		
Communal Grazing	3281.54	43.18
Arable Farming	524.94	6.91
Mixed Farming	1035.25	13.62
Settlements	2725.00	35.85
Gazetted roads	13.19	0.17
Non-gazetted roads	19.34	0.26
Industrial – Pilane	0.74	0.01
TOTAL	**7600**	**100**

13.2.8 Present Water Supply and Use

As mentioned in previous sections, water supply at the Isang site is available from boreholes drilled by farmers. The boreholes have been drilled for providing water to cattle, and are relatively shallow. The quality of the water from the boreholes may not be suitable for drinking water, and baseline data with results from water tests are not available to date.

The Kgatleng District in general relies on underground and surface water for both human and livestock consumption. The Bokaa dam is located within the District, and the District is also connected to the North South Carrier water pipeline. In some parts of the District there is a problem with the water quality, particularly in villages located close to rivers. To improve the situation an arrangement has been made to draw water from the Molatedi Dam in South Africa to supplement the existing water sources in the District.

Both Malotwana and Artesia have a water reticulation system in place

13.2.9 Waste and waste water

The District has a number of allocated dumpsites for domestic waste, the nearest dumpsite to the proposed Isang site is located in Artesia. A licensed landfill is located in Pilane which is operational, while another landfill is planned at Dikwididi, but is not fully operational yet.

A Mochudi sanitation scheme has been constructed, consisting of primary sewerage lines, pumping stations and sewerage ponds. In other villages across the District no sewerage systems have been installed, and plots rely on septic tanks and pit latrines for disposal of sewerage.

13.2.10 Existing and Planned Development Activities

Apart from the power infrastructure developments already described in this report, there will be substantial planned investment in public facilities by Botswana Central Government and Kgatleng District Council.

District development plans have also been regularly prepared, with the current planning period covering the years 2003-2009. Kgatleng District has a current development plan, linked to Vision 2016. The Kgatleng District Development Plan (Kgatleng District Council, 2003) provides overview information on the District (discussed in this section), as well as more specific information on specific subjects (discussed below in this section).

These developments are described in detail in Kgatleng District Development Plan 6 and include:

- investments in improved facilities in Primary and Junior Secondary schools.
- investments in primary health care programmes and improved facilities at clinics and health posts.
- community development projects.
- construction of a phase 2 sewerage scheme at Mochudi
- upgrading of internal roads.
- improvements in the water supply and quality
- installation of storm water drainage.
- construction of housing for staff in all sectors.
- investment in programmes which aim to enhance agricultural production as well as citizen participation in trade and industry.

All these activities are expected to grow the economy, which will lead to further private sector investment in agriculture, trade, manufacturing and service industry and housing.

13.3 SOCIAL SERVICES: HEALTH

The National Health Policy (Ministry of Health, 1995) aims at providing health services within reach to all persons of Botswana. Improved efficiency and effectiveness and heightened customer satisfaction were noted as central goals, while the specific challenges from HIV&AIDS were noted.

Health services fall under the management of the Ministry of Health, which handles policy issues and strategic direction, oversees hospitals, co-ordinates financing, and handles epidemics and emergencies. Of the 644 fixed health facilities in Botswana, there are three referral hospitals, fourteen general hospitals, and seventeen primary hospitals, all falling under the direct management of the Ministry of Health. The Ministry of Local Government, through District administration, are responsible for clinics (272 nationwide) and health posts (323 nationwide), as well as mobile clinics (with 844 mobile health stops to remote communities nationwide) (2007 data, see Health Statistics Unit, 2007). The average Motswana visited a health facility three times per annum, with figures remaining consistent over time (see http://www.cso.gov.bw/).

The dramatic expansion is health services since independence means that, by 2004, 84% of the population lived within five kilometres of a health facility, 11% lived within 5-8 kilometres, and the remaining 5% lived within 9-15 kilometres, with a number of these in the final category reached as well by mobile services (see Health Statistics Unit, 2007). While the averages were lower for rural areas, nevertheless, 72% lived within five kilometres, and most of the remainder lived within eight kilometres. Key diagnosis for outpatients comprised respiratory infections (30.8%), skin conditions (16.3%), and hypertension (9.9%). In 2004, there were 3,889 in-patient hospital beds nationwide, with 413,694 in-patient admissions. This yielded a national occupancy rate for facilities with beds of 58%. Twelve percent of children were born with low birth weight in 2004 (Health Statistics Unit, 2007).

Because of the rural location of most of the villages, the Kgatleng District has used the following planning guidelines for the District Development Plan 6:

- Providing clinics with maternity within 30 km radius
- Providing clinics without maternity within 15 km radius
- Providing health posts within 8 km radius

The above guidelines for the health care planning are in line with social and public health acts, which also provide frameworks for their interpretation and implementation.

Table 13.2 below shows the current health facilities available in the District.

Table 13.2: Health facilities in the Kgatleng District

Health Facilities	Number
Referral hospitals	none
General hospitals	none
Primary Hospital	1
Clinics with maternity	5
Clinics without maternity	6
Health Posts	16
Mobile stops	27

The Kgatleng Distict is served by a single Primary Hospital, the Deborah Retief Memorial Hospital in Mochudi, which is run by the Botswana Government. Aside from the primary hospital there are a number of clinics, health posts and mobile stops throughout the District. The nearest clinic to the Isang substation site is located in Artesia

13.3.1 HIV&AIDS

Of all the challenges to Botswana's socio-economic gains, none is more severe than HIV&AIDS (Human Immunodeficiency Virus; Acquired Immune Deficiency Syndrome). According to UNAIDS (2007), Botswana has the second highest HIV seroprevalence rate in the world (after Swaziland), at 32% among women attending antenatal clinics. The first case of AIDS in Botswana was diagnosed in 1985. For the next two decades, the infection rates rose dramatically, until they finally began to stabilise over recent years.

Of Botswana's population of 1.62 million in 2001 (CSO, 2003), an estimated 300,000 - 350,000 were living with HIV/AIDS. Population growth rates have slowed considerably, in part due to improved education levels and improved well-being, but mostly due to the impacts of HIV/AIDS. A country that had managed to make enormous gains in life expectancy saw rates fall as the pandemic began to take its toll from the mid-1990s. Life expectancy at birth, which had risen steadily from the 1960s to the mid-1990s, declined from 65 years in 1991 to 51 years in 2005. Similarly, infant and underfive mortality rates increased during the same period, rising from 48 to 56 deaths per 1,000 live births from 1991 to 2001 for infants, and rising again to 82 by 2005, and 63 to 74 deaths per 1,000 live births for underfives, rising sharply to 112 by 2005 (UNDP/Botswana website). Further, poverty rates are projected to have risen due to HIV&AIDS, with an estimated 8% fall in household per capita income, and an increase of 5% in the number of people living in poor households, meaning that gains in reducing poverty could have been substantially better.

It is only in recent years that Botswana has begun to see a levelling of prevalence rates among younger age groups, reflecting changes in behaviour that reduce risk. This has coincided with a strong roll-out of anti-retroviral drugs, and today Botswana reaches a higher percentage of those in need of such drugs that any other African country (estimated at almost two-thirds, personal communication). This also holds true for drugs to prevent the infection of infants during childbirth and breastfeeding. Nevertheless, while HIV&AIDS is increasingly being viewed as a chronic illness in Botswana, poorer and more remote households in particular have difficulty accessing the necessary services and securing sufficient, nutritious food to maintain a healthy lifestyle. Continued high rates of infection, still averaging over 30% among adults aged 15-49, reach even the most remote parts of the country, and are especially high in areas of considerable population movement (Botswana AIDS Impact Survey II, NACA, 2005).

The Botswana National AIDS Control Programme was established in 1986, co-ordinated by the Epidemiology Unit in the Ministry of Health. A short-term plan was prepared for the period 1987-89, focused on protection of the blood supply and the supply and use of disposable needles. Thereafter, Botswana's first five-year Medium Term Plan was prepared covering the period 1989-1993. The second Medium Term Plan (MTP II) for 1997-2002 was published in 1997 (Ministry of Health, 1997). The National AIDS Policy was adopted in 1998. Like many countries in the region, the focus of the MTP II was on an expanded multi-sectoral response that dealt with prevention, impact mitigation, co-ordination, monitoring and evaluation. Since the ending of the timeframe for MTP II, no MTP III has been developed. Instead, Botswana continues to operate within the context of the National Strategic Framework for HIV/AIDS (2003-2009) (NACA, 2003a), published in 2003, and within the context of the National Policy on HIV/AIDS, issued in 1998. The Framework was a comprehensive document noting the roles and responsibilities of various actors, and setting forth priority strategies and activities. In recent years Botswana's response has expanded significantly, with particular gains made in the roll-out of testing services and the provision of anti-retroviral (ARV) drugs. Botswana adopted a routine testing approach in 2005, meaning that out-patients or in-patients were given the option of taking an HIV test, and counselled on their decision. As of 2007, it is estimated that Botswana has the higher proportion of those in need of ARVs accessing the necessary drugs, reaching over half of those in need (personal communication, 2007).

As with much of the rest of Botswana, Kgatleng District is directly affected by HIV&AIDS. The most affected age group in the District is between 15 and 44 years, with the worse effected between 24 and 39 years of age. It has however been shown that all age groups are affected, and that the prevalence rate among females is higher than among males in the District. Based on data from people who have visited health facilities, which may not provide a true reflection of the overall situation, it is estimated that over 10 000 people are infected.

The orphan crisis is Botswana is largely associated with the rapid increase in HIV infection that occurred in the late 1980s and throughout the 1990s. The 2001 census found 111,828 orphans (CSO, 2003), or 15.2% of all under eighteens. Consistent with international definitions, the figure includes paternal orphans who had been deserted by their fathers and whose status is not known (they could be alive or dead) or were known to be dead, but whose unmarried mothers were alive. Paternal orphans were most common (those who had lost their fathers but not their mothers; 63.2%), followed by maternal orphans (those who had lost their mothers but not their fathers; 23.7%), and double orphans (those who had lost both parents; 13%). The total number of orphans under this definition is projected to rise to 20% of all children by 2010 (NACA, 2003a). Data on the number of orphans in Kgatleng District are not available, but are expected to be in line with national trends.

13.4 POTENTIAL IMPACTS

The potential impacts yielded by the proposed substation on the socio-economic environment are not likely to exceed slight or moderate in severity. There will be some positive impacts on the socio-economic environment due to construction. The following sections are intended to break down those predicted impacts into Construction/Operational/Residual categories. Definitions for scale of change (e.g. positive, neutral, negative) and degrees of severity (e.g. slight, moderate, profound) are described in Tables 3.3, 3.4 and 3.5 (revert to Chapter 3).

13.4.1 Construction Impacts: Socio-Economic Environment

The construction phase will have moderate to significant positive impacts in socio-economic terms due to the creation of employment on construction work. This positive impact will be substantially enhanced if vegetation clearance is undertaken by labour based methods as this will generate "piece job" type work, which is well suited to rural dwellers with limited formal job skills.

Regarding the social issues such as the importing of labour into the Isang area and related health and safety implications of such, much is dependant on whether the contractor will be setting up a residential camp at the construction site, or using the nearest villages for accommodation of people. By securing accommodation within the nearest villages, a number of environmental and social impacts can be avoided, and some of the positive impacts expected can be enhanced.

13.4.1.1 Employment, present and projected populations

The construction phase of the project will have a negligible to slight impact on population growth in the area. Although the hiring of local labour must be implemented by the contractor for all general labouring requirements, the construction of electrical infrastructure will require the skills of qualified and experienced personnel, which are not expected to be available in local villages surrounding the site. It can therefore be expected the contractor will bring approximately 25 qualified people in, for the duration of the contract period.

By utilising local labourers for the construction phase of the project, this will also allow for stability in the community by ensuring labourers on the project will be able to continue living in their family homes and not be required to move into constructors' camps nor temporary accommodation elsewhere as transportation and relocation not be an issue. This can also be a potential mitigation in relation to the spread of HIV/AIDS.

The overall improved reliability of power supplies can be expected to support the current trend of population growth which is slightly more significant than the national average. It can be expected that the benefits from the improved reliability will have more significant impacts on the population growth in Gaborone, than in the area directly surrounding the Isang substation.

13.4.1.2 Land Use and Land Tenure

The construction phase of project is expected to have a negligible impact on land use patterns, and it does not impact land tenure in the area. The loss of the site footprint for cattle and grazing area is relatively small compared to the available lands for farming activities.

13.4.1.3 Households

There are no permanent settlements at the proposed substation site, or in the near vicinity of the site. The nearest permanent villages are Malotwana to the south of the site, and Artesia to the north of the proposed site. Both villages are at a distance of over 10 kilometres from the proposed substation site. Closer to the substation site are a number of cattle post, which can be qualified as seasonal residences. The nearest cattle post is located several kilometres from the proposed substation site. Impacts on both permanent and seasonal residences are expected to be insignificant.

13.4.1.4 Water Supply

The construction of the project is expected to have an moderate impact on water resources or water supplies. One of the boreholes that is currently located around the site will be used for the supply of construction water. There is a possibility of the contractor and BPC taking over the borehole, or sharing it with the cattle syndicate. Details on this issue have not been agreed upon at time of writing this document.

The construction of the project may require significant quantities of water. Boreholes for providing water to cattle are usually very shallow, and extracting large quantities of water from one of the boreholes on the site may slightly reduce the water table. A slight change in the water table can incur reduced water yields from the nearby boreholes.

13.4.1.5 Development

The construction of the project is expected to have slight to moderate positive impact in reinforcing the present trend of buoyant economic growth in the urban sector in the study area and to have negligible impact on rural development. The accommodation of skilled labour within the villages is expected to further encourage this impact. Additionally, by recruiting non-skilled labour from the Malotwana and Artesia areas for the construction of the project, this will in turn yield a positive impact upon the development of the area, albeit temporary.

13.4.1.6 HIV/AIDS

The use of local labourers will certainly decrease the risk of spreading HIV/AIDS and other diseases. However, the construction of electrical infrastructure however requires specialized and qualified workers which may not be available locally. The introduction of this workforce into the area does increase the risks of spreading diseases such as HIV/AIDS.

13.4.2 Operational Impacts

The operational phase will have negligible to slight positive impacts in socio-economic terms for the areas surrounding the substation, due to the limited creation of additional employment by the substation. Some small job opportunities may arise seasonally for vegetation maintenance and safety clearance activities. Maintenance of the electrical components is expected to be done by qualified BPC engineers from Gaborone.

13.4.2.1 Employment, present and projected populations

The project will have a negligible to slight impact on population growth in the area but overall, improved reliability of power supplies can be expected to support the current trend of population growth which is slightly more significant than the national average. It is however expected that this will impact the Gaborone area much more than the area immediately surrounding the substation. Improved power availability and reliability can encourage business and investment in Gaborone, which leads to job creation and population growth. The Kgatleng District is expected to see some spin-off from this impact, as certain people choose to settle in villages in the District and commute to the Gaborore area.

13.4.2.2 Land use and land tenure

The project is expected to have a negligible impact on land use patterns, and is not expected to impact land tenure in the area.

13.4.2.3 Households

As outlined in Section 13.4.1, there are no permanent or seasonal residences on or adjacent to the site. Impacts are therefore expected to be insignificant.

13.4.2.4 Water supply

The project is expected to have no impact on water resources or water supplies. The water use of the operational substation is expected to be very low, and will only provide the sanitary facilities with running water.

13.4.2.5 Development

The project is expected to have a slight to moderate positive impact on reinforcing the present trend of buoyant economic growth in the urban sector, specifically in Gaborone and surrounding areas which are benefiting from the improved power supply. It is expected to have negligible impact on rural development.

Impact direction and scale for potential substation-specific impacts and cumulative impacts are summarised below. The first table covers the construction phase (which only holds for the duration of construction), the second operational phase, and the third closure:

Table 13.3: Impact Direction and Scale: Construction

Impact Arena	Direction	Severity	Scope
	Substation Impacts		
Employment / population	Positive	Moderate	Local
Water resources	Negative	Moderate	Local
Households	Neutral	Insignificant	Local
Land use	Negative	Slight	Local
Development	Positive	Slight	Local
	Cumulative Impacts		
HIV&AIDS	Negative	Slight	Local
Housing Market	Neutral	Insignificant	Local
Urban Development	Positive	Slight	Local
Economic Activity	Positive	Slight	Local
Social Cohesion and Community Stability	Negative	Slight	Local

Impacts associated with the operation of the substation are indicated in the following table:

Table 13.4: Impact Direction and Scale: Construction

Impact Arena	Direction	Severity	Scope
	Substation Impacts		
Employment / population	Positive	Slight	National
Water resources	Negative	Insignificant	Local
Households	Neutral	Insignificant	Local
Land use	Negative	Slight	Local
Development	Positive	Slight	National
	Cumulative Impacts		
HIV&AIDS	Negative	Insignificant	Local
Housing Market	Neutral	Insignificant	Local

Impact Arena	Direction	Severity	Scope
Urban Development	Positive	Slight	Local
Economic Activity	Positive	Slight	Local
Social Cohesion and Community Stability	Neutral	Insignificant	Local

13.5 MITIGATION MEASURES

The main impact of the construction phase on the socio-economic environment will be positive, through employment creation, and will be enhanced by use of labour based methods for all bush clearing work required.

Continued use of labour-based methods for vegetation maintenance will enhance the socio-economic benefits of the project and thus its positive impacts.

Negative impacts caused by increased HIV/AIDS risks must be mitigated throughout the construction period of the contract. The risks are caused by the temporary influx of workers. The most effective mitigation measure for this problem is to hire local labour where possible. As part of the contractors corporate responsibility, and in accordance with Botswana HIV/AIDS policies the contractor must organise regular HIV/AIDS courses, provide HIV/AIDS educational materials, provide free condoms and offer opportunities for voluntary testing.

The yield of the boreholes around the site should be established before the start of construction. During the construction yields must be monitored closely, and if negative impacts become apparent due to the additional water extraction for the construction, the borehole owners much be compensated as per the Land Board guidelines.

13.6 RESIDUAL IMPACTS

The long term residual impacts on the socio economic environment will be positive and moderate. There will be long term benefits due to enhanced employment opportunities in the operation and maintenance of the sub-stations. The most significant impact is the improved power supply to Gaborone, which is expected to have general economic and development spin-offs.

Table 13.5: Summary Impact Table

Description of Impacts	Significance (Profound, Significant, Moderate, Slight or Imperceptible)	Scale of Change				Description of Mitigation Measures	Description of Residual Impacts	Residual Impacts (Profound, Significant, Moderate, Slight or Negligible)	Residual Effects			
		(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M /LT)				(Pos. Neu. Neg.)	(P/ T)	(D/I)	ST/M/ LT)
Employment Generation on site clearing and construction	Moderate	Positive, temporary, direct, short term				Use labour based methods to enhance impact	None	Negligible	Neutral and negligible			
Employment Generation resulting from improved power supply to Gaborone	Slight	Positive, permanent, indirect, long term				Inform possible foreign investors about the power in frastructure improvements	Permanent increase in employment and economic activity	Slight	Positive, permanent, indirect, long term			
Disturbance of Households	Negligible	n/a				n/a	n/a	n/a	negligible			
Working condition	Slight	Positive. Temporary, direct, short-term				Local hiring where possible, provide training, use transparent systems of local hiring	None	n/a	n/a			
HIV/AIDS	Slight	Negative, permanent, direct, short-term				The contract with the construction company must include requirement for comprehensive HIV/AIDS mitigation plan.	Continued HIV/AIDS infection rate	Slight	Negative, permanent, indirect, Long term			
Water resources	Moderate	Negative, permanent, direct, long term.				Assessment of current water yields from boreholes before construction start, financial compensation	None	n/a	n/a			
Land use	Slight	Negative, permanent, direct, long term				During construction, continue discussions with surrounding	Loss of land will remain	Slight	Negative, permanent, direct, long term			

			farmers, land users			
Housing Market	Negligible	n/a	n/a	n/a	n/a	n/a
Urban development and economic activity in Kgatleng Distict	Slight	Positive, temporary, direct, short term	Accommodate staff in surrounding villages instead of at camp on site	None	n/a	negligible
Urban development and economic activity Gaborone area	Slight	Positive, permanent, indirect, long term	None	Increased development	Slight	Positive, permanent, indirect, long term
Social cohesion and community stability	Negligible	n/a	n/a	n/a	n/a	n/a

14 ENVIRONMENTAL MANAGEMENT PLAN

The following sections present the Environmental Management Plan (EMP) for the proposed Isang substation. Although the EMP includes the design phase, which is currently ongoing, the majority of the impacts are related to the construction phase as well as the operational phase. Monitoring and reporting procedures will be described in Chapter 15.

14.1 EMP TEMPLATE

The template in which the EMP is presented in the following paragraphs is as per the DEA guidelines. The EMP must be included in any contract documentation for contractors undertaking work on the project, to ensure they are aware of the environmental requirements.

The headings in the EMP table are according to the DEA template, clarification on the exact meaning and content will be described in the following.

14.1.1 Project Stage

The project stage describes the stage of the overall project in which the impacts are expected. A project typically follows four clear stages throughout its lifetime:

- Design phase
- Construction phase
- Operational phase
- Closure and decommissioning phase

Every stage of the project is expected to have a unique set of expected impacts and related mitigation measures. The stages are clearly separated in the project EMP.

14.1.2 Subject

The subject describes the field or category in which the impacts are expected. The subjects are generally organised as per the specialist studies undertaken for this project, although a number of more general subjects are also included to ensure all areas are covered, and a full comprehensive EMP is presented.

14.1.3 Management Objective

The management objective describes the goal to be achieved. Some goals are crucial for the success of the project, and have very clear thresholds. Non compliance with the objective will result in technical difficulties for the operations or non compliance with Botswana laws and guidelines.

Other objectives have thresholds that are less clearly defined. In practice these objectives are sometimes perceived are less important. It is crucial to the success of the implantation of the EMP that all parties involved in the project fully understand that these objectives are equally as important as objectives with clear thresholds, for successful implementation of the project.

The thresholds for management objectives will be further set out in the monitoring plan in Chapter 15.

14.1.4 Mitigation Measures Recommended

The mitigation measures recommended aim to minimize the expected negative impacts, and maximize the expected positive impacts. For a single management objective there is usually a set of recommended mitigation measures. The maximum result from the mitigation measures will be achieved when the full set or combination will be implemented.

It is therefore important that mitigation measures will be implemented in totality and with similar levels of propriety, to ensure minimum affect of the negative impacts and maximum affect of the positive impacts.

14.1.5 Estimated Cost

The DEA has requested inclusion of this section in the EMP to ensure that developers allow sufficient funding in the project budgets for environmental items. Many of the items require careful planning and management, and when both planning and management are implemented will come at no additional cost to the project. Other items such as regular monitoring and sampling will come at a certain cost.

The cost in the table has been included in a descriptive format, rather than an exact cost. The reason for this is that the document is prepared by an environmental consultant, not a quantity surveyor. Precise costs in terms of Pula and Thebe would require extensive input from engineers and quantity surveyors professionally trained to analyze materials, quantities, and market prices required to estimate expected frees. By including the items in a descriptive manner the client will know what items are to be included in the budget, and can make their own calculations to establish an accurate estimated cost.

14.1.6 Implementing Agency

The implementing agency is responsible for full implementation of the mitigation measures. As some of the positions and contracts for the project have not been finalized and awarded yet, the general role description of the person or organisation has been used for the EMP.

14.1.7 Monitoring Agency

It is crucial for the success of the EMP that regular monitoring is implemented to ensure that mitigation measures are being adhered to. The monitoring is also important to evaluate measures and processes, and implementation of improvements as the project develops.

The next Chapter will present a full scale monitoring plan for the implementation of the project, and will further establish roles and responsibilities. In the EMP table the agency ultimately responsible for monitoring compliance has been stated. For some management objectives it is possible that more that one monitoring agencies is applicable, in these cases careful and regular communication between the agencies is recommended.

Table 14.1 Design, Construction and Operational impacts and recommendations

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
Design phase	Review of alternative locations	*Assess all possible locations for the substation*	The design phase has already been completed and hence alternative locations were reviewed and design phase requirements were undertaken.	Already completed	Design Engineer	BPC
	Land issues and rights	*To ensure that land issues and rights do not cause contractual problems and that peoples land rights are respected*	Land size procurement for the extension of allocated BPC plot size, to be authorized by land board authorities as per the national laws.	No extra costs	Design Engineer	Land board
	Infrastructural services	*To inform surrounding service providers of proposed works and planned services*	Consultations with relevant service providers in the area such must be undertaken.	Part of design / EIA scope	EIA consultant / Design consultant	BPC
	Erosion	*To ensure that erosion risk is minimised*	Avoid areas of existing erosion with the positioning of the substation infrastructure	No extra costs	EIA consultant / Design consultant	BPC
	Pests	*To ensure the designs have considered pests*	Ensure that the design includes rodent proofing such as narrow gaps inn slabs overlying conduits and lighting	No extra cost	Design consultant	BPC
			Ensure the layout has considered prevention of birds nesting and maintenance, and avoidance of monkeys climbing on structures	No extra cost	Design consultant	BPC
	Road safety	*To ensure that the access road to the site does not create any road safety issues.*	Coordination with the Botswana Roads Department, construction and signage in compliance with the Botswana roads manual	Legal requirement, part of design scope	Design consultant	BPC
	Materials	*Ensure the use of environmentally acceptable materials*	The specifications must state clearly that the electrical components do not contain any PCBs	No extra cost	Design Engineer	BPC
	Emergency fire access	*To minimise possible fire risks*	Ensure accessibility inside and around the substation. Fire extinguishers must be installed within the substation.	No extra costs	Design Engineer	BPC
Construction phase	Work planning	*Ensure contractors method statements have been submitted and approved*	Contractor must submit method statements for each section of the works, including sections on health and safety, working spaces and environmental issues.	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
		Labour planning	The acquisition of unskilled labour must be from the local area to avoid need for on-site labour camp.	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
			Acquisition of local skilled labour is highly encouraged. However imported skilled labourers are encouraged to be accommodated in surrounding villages instead of living on-site.	Unknown at this stage	Contractor, Foreman	CECO, Resident Engineer

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
Construction phase (continued)	Erosion	*Ensure erosion risk is minimised*	Vegetation must not be removed unless necessary as it assists in minimizing the risks of soil erosion.	May result in a cost saving	Contractor, Foreman	CECO, Resident Engineer
			Areas around the site with scarred soil surface must be restored or rehabilitated	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
			Re-seeding of restored areas with a grass seed mix. The grass seed must be kept available on site.	Purchase of grass seed mix	Contractor	CECO, Resident Engineer.
	Ground and surface water	*Minimise risk of ground and surface water pollution during construction*	Chemicals and fuel as well as used empty containers of oils and lubricants, must be stored in an area with a concrete base. Fuel storage on site must be fitted with a containment kerb and a concrete parking base for refuelling machines.	Part of the site set-up	Contractor, Foreman	CECO, Resident Engineer
			Ablutions must be provided for all workers to utilise, at a rate of 1:12 toilets per workers and under no circumstances should workers relieve themselves outside of toilets.	Legal requirement – no extra cost	Contractor, Foreman	CECO, Resident Engineer
			The contractor must implement all measures necessary (in addition to the above) to prevent contamination of ground water.	Unknown at this stage	Contractor, Foreman	CECO, Resident Engineer
		To efficiently deal with any occurred oils spills, to minimize environmental damage	The contractor must make oils spill kits and drip trays available on site, and instruct operators how to use them in the event of a leak.	Purchase of spill kits and drip trays	Contractor, Foreman	CECO, Resident Engineer
			In areas where oil spills have occurred, the contaminated soil must be isolated, and the area must be rehabilitated within 2 days after the spill occurred	Depending on the size and scale of spillage	Contractor, Foreman	CECO, Resident Engineer
			Contaminated soil must be taken to a central point on site for bio-remediation by a specialist company.	Depending on the size and scale of spillage	Contractor, Foreman	CECO, Resident Engineer
	Refuse	*To manage refuse collection and disposal during construction*	The construction area must be cleaned and kept neat at all times. Waste is not to be dumped or burned or buried on-site. The contractor will suffer financial penalties for any waste present on-site.	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
			The contractor must make waste facilities available for collection of waste created during construction activities. Recycling must be implemented.	Monthly refuse removal fee	Contractor, Foreman	CECO, Resident Engineer

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
Construction phase (continued)			The waste must be disposed at legal and licensed facilities	Refuse charges	Contractor, Foreman	CECO, Resident Engineer
		Materials from existing power lines	Materials to be demolished from the tie-in power lines must be disposed of in legal and licensed facilities. (e.g. concrete rubble, stone)	Refuse charges	Contractor, Foreman	CECO, Resident Engineer
			Technical utilities must be returned to the Botswana Power Corporation (BPC) for recycling and re-use.	May result in future cost saving	Contractor, Foreman	CECO, Resident Engineer
	Natural resources	*To minimise over-exploitation of energy resources*	Construction machinery must be switched off when not in immediate use, as a means to save fuel.	May result in a cost saving	Contractor, Foreman	CECO, Resident Engineer
			The contractor must adhere to the National Policy on Natural Resources Conservation and Development (1990).	Legal requirement – no extra cost	Contractor, Foreman	CECO, Resident Engineer
			The use of natural resources must be limited and restricted only to legal and licensed sources. In the event of using new borrow pits or quarries, EIA studies and approval by Department of Mines and DEA must be undertaken.	Part of the contract	Contractor	CECO, Resident Engineer
	Air quality	*Minimise risk to public health caused by dust and emissions of other air pollutants*	Operations that are likely to create excessive dust must be avoided, if not minimised during windy weather.	No extra cost, programming needed	Contractor, Foreman	CECO, Resident Engineer
			Dust creation must be reduced by dampening the ground to be excavated.	Part of the contract	Engineering consultant, Contractor	CECO, Resident Engineer
			Construction machinery must be serviced to prevent excessive gaseous emissions into the atmosphere.	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
			Temporary stockpiled soil must be covered to prevent it from being blown by the wind.	Purchase of cover material	Contractor, Foreman	CECO, Resident Engineer
	Traffic disruption	*Minimise traffic disruptions during construction*	In case of road use interference to the public, due to construction activities, clearly marked detours must be provided.	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
			Clear signage must be erected to warn road users of construction activities in the vicinity. During transport of oversize equipment as well as haulage of construction materials flag people must be provided on the main A1 road.	Purchase of appropriate signage	Contractor, Foreman	CECO, Resident Engineer

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
Construction phase (continued)			Clear access into the cellular phone tower facilities and to surrounding boreholes and cattle gates must be ensured at all times.	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
			Haulage of construction materials must be discouraged during peak hours and loads sizes must be careful managed to reduce the risk of materials spilling onto the road.	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
	Flora	*To control and minimise vegetation clearing*	Vegetation clearing must be limited only to the construction site.	No extra cost	Contractor	CECO, Resident Engineer
			Under no circumstances shall vegetation clearing be undertaken by the use of fire.	No extra cost	Contractor	CECO, Resident Engineer
			Vegetation such as mature trees must be retained as much as possible. Penalties must be implemented for unnecessary removal of trees	No extra cost	Contractor	CECO, Resident Engineer
			Cleared spaces from construction works, must be rehabilitated by reintroducing trees.	Purchase of trees and landscaping materials	Contractor	CECO, Resident Engineer
		To control use of herbicide	The use of herbicide is prohibited for this contract.	No extra cost	Contractor	CECO, Resident Engineer
	Fauna	*To minimise risk to animals*	The construction area must be secured so as to not endanger livestock. Fencing must be maintained at all times	Purchase of sufficient fencing material	Contractor, Foreman	CECO, Resident Engineer
			The contractor must ensure not to disturb the calving / lambing at the surrounding cattle posts,	No extra cost	Contractor	CECO, Resident Engineer
			The contractor must ensure gates and fences belonging to farmers, remain undamaged.	No extra cost	Contractor	CECO, Resident Engineer
			Construction personnel are not allowed to kill any cattle or wildlife for consumption purposed	No extra cost	Contractor	CECO, Resident Engineer
			Working personnel must be vigilant in preventing animals from invading the construction site.	No extra cost	Contractor, Foreman	CECO, Resident Engineer
			Full time security must be provided during the construction period.	Salary of security officer	Contractor, Foreman	CECO, Resident Engineer

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
Construction phase (continued)		*To control the use of pesticides*	The use of pesticides must be avoided during constructions. Pesticides may only be used after approval by the resident engineer and the environmental consultant.	No extra cost	Contractor	CECO, Resident Engineer
	Site facilities	*To ensure the site layout minimizes disturbances to surrounding people and road users*	The contractor must submit the site set-up plan for approval to the engineer. Visibility from the main road must be taken into account during the layout approval	No extra cost, careful planning required	Contractor	Design Engineer, BPC
		To ensure appropriate sanitary facilities are available for construction workers	The contractor must supply mobile chemical toilets at the construction site, for all the workers. These toilets must be shared at a ratio of 1:12.	Legal requirement – no extra cost	Contractor, Foreman	CECO, Resident Engineer
			Under no circumstances are the workers to relieve themselves on the surrounding environment apart from the provided toilets. Therefore the contractor must enforce usage of these toilets by training of the staff, or penalties will be incurred for non-compliance.	No extra cost – training required by contractor	Contractor, Foreman	CECO, Resident Engineer
		To provide a designated area for maintenance and repairs	The contractor must provide a designated area for maintaining and repairing machines. The area must be fitted with a concrete base, containment kerbs and oil separator traps to avoid oil spillages	Construction of a maintenance yard	Contractor, Foreman	CECO, Resident Engineer
			Repairs and maintenance of machines must only be undertaken in the designated area	No extra cost	Contractor, Foreman	CECO, Resident Engineer
		To avoid soil contamination from fuel storage	A designated fuel storage area must be constructed, fitted with impermeable concrete floor, spillage containment walls, fire extinguishers and safety signage. The area where machines are re-fuelled must also be fitted with a concrete floor	Part of site set-up	Contractor	Design Engineer, BPC
		To avoid soil and water contamination caused by chemical spillage	The contractor must construct a designated chemical storage area, with impermeable concrete floors and containment kerbs. Access to the chemical storage must be restricted due to safety concerns	Part of site set-up	Contractor	Design Engineer, BPC
		To avoid environmental damage from concrete batching plant	In the event of a batching plant being installed on site, it must be placed on a concrete floor, and spilled water must be channelled through cement / water traps	Part of site set-up	Contractor	Design Engineer, BPC

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
Construction phase (continued)		*To avoid environmental damage from structures left behind*	After completion of the construction project the site camp must be decommissioned without delay,	Part of the contract	Contractor	Design Engineer, BPC
	Fire risks	*To ensure fire risks are minimized*	No open fires are allowed on the site at any time. Fires are not allowed for cooking purposed either.	No extra cost	Contractor, Foreman	CECO, Resident Engineer
			Fire extinguishers must be provided at accessible places on site.	Legal requirement	Contractor, Foreman	CECO, Resident Engineer
			All site vehicles and plant must be provided with fire extinguishers	Part of plant cost	Contractor, Foreman	CECO, Resident Engineer
	Noise	*To minimise impacts from excessive noise*	Noisy construction activities must be carried out during the daytime.	No extra cost	Contractor, Foreman	CECO, Resident Engineer
			Mobile construction equipment must be utilised in substitution for stationery equipment so that in case of a noise issue, it may be easily moved.	Part of the contract	Contractor, Foreman	CECO, Resident Engineer
			Construction vehicles must be properly serviced to avoid excessive noise.	Unknown at this stage and inspection	Contractor, Maintenance team	CECO, Resident Engineer
	Archaeology	*To minimise the risk of loss of archaeological sites and artefacts*	The contractor must hire an approved archaeologist to carry out an inspection during construction.	Induction cost and inspection approx P10000	Contractor, Archaeologist	CECO, Resident Engineer
			Construction personnel must be inducted on the discovery of archaeological remains, by a approved archaeological consultant hired by the contractor.	Induction cost and inspection approx P10000	Contractor, Archaeologist	CECO, Resident Engineer
			Construction should commence with caution for archaeological artefacts.	No extra cost	Contractor, Archaeologist	CECO, Resident Engineer
			If any archaeological artefacts are discovered, construction personnel must follow procedure to report this to the National Museum, Monuments and Art Gallery.	Unknown – depending on discovery	Contractor, Archaeologist	CECO, Resident Engineer
	Landscape and visual	*Minimise landscape and visual impacts during construction*	During the construction activities efforts must be made to ensure that negative visual impact on the area are minimised, especially since the construction will be taking place in a residential area and will be very visible. This includes maintaining a neat and tidy site at all times.	No extra cost	Contractor, Foreman	CECO, Resident Engineer

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
Construction phase (continued)	Occupational health and safety	*To ensure a safe workspace for all construction workers*	The contractor must issue Personal Protection Equipment (PPE) to all workers.	Legal requirement	Contractor, Foreman	CECO, Resident Engineer
			The contractor must comply fully with the rules and policies of the Factories Act to ensure maximum safety in the work area.	Legal requirement – part of contract	Contractor, Foreman	CECO, Resident Engineer
			The contractor must ensure that the working area is demarcated to prevent accidents.	No extra cost	Contractor, Foreman	CECO, Resident Engineer
			A safety induction course must be provided for the workers by the contractor, including induction for proper use of PPE. No workers are to be allowed on-site without attendance of this induction.	Purchase of training material and lost work time	Contractor, Foreman	CECO, Resident Engineer
			Appropriate signage must be in place at all construction areas.	Purchase of signage	Contractor, Foreman	CECO, Resident Engineer
			The contractor must ensure safe and responsible driving on public roads and all drivers must hold valid appropriate licenses.	No extra cost – legal requirement	Contractor, Foreman	CECO, Resident Engineer
			The contractor must provide a full time qualified SHE officer for the duration of the project	Salary of SHE officer	Contractor, Foreman	CECO, Resident Engineer
			Induction courses must be provided for new staff, and on a regular basis thereafter (at least bi-monthly)	Cost of induction courses	Contractor, Foreman	CECO, Resident Engineer
	Public safety	*To ensure risks for public safety are minimised during the contract period*	The contractor must alert the public of any potential danger, by putting up construction works signage around the working area.	Purchase of signage	Contractor, Foreman	CECO, Resident Engineer
			There must be sufficient lighting of areas used by the public after dark, to illuminate construction works on-site.	Hire of equipment	Contractor, Foreman	CECO, Resident Engineer
			Public walkways and roads must be kept clean of rubble at all times.	No extra cost	Contractor, Foreman	CECO, Resident Engineer
	Site security	*To ensure site security at all times*	All entrances must be fitted with gates, the gate locations must be approved by the design engineer and environmental consultant before construction	No extra cost	Contractor	Design Engineer, BPC
			All gates must be locked when not in use, a full time security officer must be supplied by the contractor	Salary of security staff	Contractor	Design Engineer, BPC

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
Construction phase (continued)			After completion of the contract locks must be changed to specific locks for BPC only	Cost of new locks	Contractor	Design Engineer, BPC
	HIV/AIDS	*To prevent the spread of HIV/AIDS*	The contractor must organize a regular course for construction personnel, to educate them on the dangers of HIV/AIDS. Attendance must be compulsory for all workers and records of attendance must be kept.	No extra cost – provided by local authorities	Contractor, Foreman	CECO, Resident Engineer
			Employ local workers to reduce the risk of HIV/AIDS infections among the workers.	No extra cost	Contractor, Foreman	CECO, Resident Engineer
			The contractor must supply condoms free of charge to all the workers.	No extra cost – provided by local authorities	Contractor, Foreman	CECO, Resident Engineer
	Social benefits	*To enhance social benefits expected for the surrounding communities*	Apply labour intensive clearance methods, and make cleared trees available for firewood to surrounding communities	Unknown at this stage	Contractor	Design Engineer, BPC
			Use local businesses or supply of materials, fuels and food to site where possible, consider engaging local subcontractors where possible	May result in cost saving	Contractor	Design Engineer, BPC
	Damage to infrastructure	*To avoid any damage to existing infrastructure*	Any damage to existing functional and non-functional infrastructure must be repaired immediately, by the contractor.	Unknown at this stage	Contractor, Foreman	CECO, Resident Engineer
	Disputes / claims	*To maintain a good relationship with affected and surrounding property and land owners*	Good relations with surrounding property and landowners must be exercised so as to warn them of any interruptions they might experience due to the construction. Any construction activities that might affect a particular property must be reported beforehand to the landowners	Salary of CECO for duration on the contract	Contractor, Foreman	CECO, Resident Engineer
			A record of all queries and complaints by surrounding land and property owners must be kept by the contractor and monitored by the client. Photographic evidence should be made where possible	No extra cost	Contractor, Foreman	CECO, Resident Engineer
			All claims and disputes must be dealt with immediately	No extra cost	Contractor, Foreman	CECO, Resident Engineer
			The CECO must arrange a meeting with the local farmers syndicate before the start of the project, and regularly thereafter	No extra cost	Contractor, Foreman	CECO, Resident Engineer

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
	General	*To ensure effective environmental protection*	A satisfactory introductory course on the protection of the environment must be arranged for all on site personnel by the contractor. It is suggested to make this part of the new employees induction	No extra cost, part of new employee induction	Contractor, Foreman	CECO, Resident Engineer
			A frequent environmental monitoring process must be conducted during construction to ensure the mitigation measures are followed to minimise impacts.	Salary for SHE officer	Design Engineer, CDC	BPC, DEA
Operational phase	Operation and maintenance	*To avoid public safety risks*	Regular maintenance is to be undertaken to ensure good working condition of the substation.	Unknown at this stage	BPC Maintenance	BPC management
			Ensure that only vegetation affecting the substation is cleared during maintenance.	No extra cost	BPC Maintenance	Kgatleng District Council
	Soil and groundwater protection	*To avoid soil and groundwater contamination*	Any fuels or chemicals on site must be stores in designated areas, on concrete bases.	No extra cost	BPC Maintenance	Kgatleng District Council
			All equipment containing oil, must be checked monthly by BPC maintenance for signs of wear or leakage.	No extra cost	BPC Maintenance	Kgatleng District Council
			Any areas of possible leakage on equipment must be repaired without delay. A register must be kept to record the monthly checks and repairs	No extra cost	BPC Maintenance	Kgatleng District Council
			The level of the septic tank on site must be checked monthly, it must be emptied before overflowing	No extra cost	BPC Maintenance	Kgatleng District Council
	Security	*To ensure public safety*	Ensure that the site is properly fenced and that emergency contact numbers are displayed visibly.	No extra cost – part of contract	BPC Maintenance	Kgatleng District Council
	Flora	*To ensure clearance during maintenance is controlled*	Clearance activities during maintenance must only remove the minimum vegetation as required by the safety standards	No extra cost	BPC Maintenance	Kgatleng District Council
			Under no circumstances fire can be used for clearance or for disposal of cleared vegetation	No extra cost	BPC Maintenance	Kgatleng District Council
		To control herbicide usage	Under no circumstances shall herbicide be used during clearance activities	No extra cost	BPC Maintenance	Kgatleng District Council

Project stage	Subject	Management Objective	Mitigation measure or recommendation to be implemented	Estimated cost	Implementing agency	Monitoring agency
	Fauna	*To ensure pest control at the site is implemented*	Develop a pest control plan for the substation site	No extra cost	BPC Maintenance	Kgatleng District Council / DEA
			Avoid using pesticides on site	No extra cost	BPC Maintenance	Kgatleng District Council / DEA
	Resources	*To ensure that natural resources are used wisely*	Check water connections regularly for spills and leakage. Necessary repairs to be done immediately	No extra cost	BPC Maintenance	Kgatleng District Council
	Emergencies	*To develop set procedures for emergencies*	Ensure that visible emergency numbers are placed near the substation in case of emergencies.	No extra cost	BPC	Kgatleng District Council / DEA
	Health and safety	*To minimise health and safety risks during operation*	A health and safety plan and policy must be developed and implemented for the facilities	No extra cost	BPC	Kgatleng District Council / DEA
			A risk assessment must be carried out by a health and safety professional	Approx P10000	BPC	Kgatleng District Council / DEA
			Regular environmental monitoring to be in place	Annual fee approx P7500	BPC	Kgatleng District Council / DEA
	Community involvement	*To ensure continued community involvement throughout the project life*	Involvement of the local residents in the project should continue throughout the operational phase	Unknown at this stage	BPC	Kgatleng District Council
	Future extensions	*To ensure recommendations in this EIS are included in future extensions*	This EIS document must be included for consideration / evaluation in future substation extensions as well as future power line connections	No extra cost	BPC Maintenance	DEA
Decommissioning		*To ensure site area rehabilitation*	Closure currently not foreseen, however, in future a detailed decommissioning and rehabilitation plan must be prepared before closure.	Unknown at this stage	BPC	Land board/ DEA
			Recyclable materials during decommissioning to be stored properly for recycling.	No extra cost	BPC	Kgatleng District Council / DEA
			Disposal of non-usable materials must be done in a legal and responsible manner.	No extra cost	BPC	Kgatleng District Council / DEA

15 MONITORING AND AUDITING

Environmental monitoring is a process that assists in assessing compliance with the mitigation measures drawn up in the EMP. There are several parties that are involved in carrying out this environmental monitoring, as stated in the responsibility matrix and reporting structure.

15.1 RESPONSIBILITY MATRIX

The responsibilities of the involved parties are summarised in Table 15.1, the responsibility matrix. This matrix should be updated with contact details of all parties involved, once appointments and contracts have been completed, and should be distributed amongst the project team.

Table 15.1: Responsibility Matrix

Function	Name / Contact details	Responsibility
Project Manager (PM)	BPC project manager	Overall management of project and EMP implementation
Site supervisor / Contracts Manager (CM)	TAP contracts manager	Oversees site works, liaison with Contractor, PM and ECO
Environmental Control Officer (ECO)	TAP resident staff with assistance from Loci	Implementation of EMP and liaison between management, contractors and labourers
Contractor (C)	To be appointed	Implementation and compliance with recommendations and conditions of the EMP, appoints dedicated person (CECO) to work with ECO
Contractor Environmental Control Officer (CECO)	Subcontractor SHE officer	Implementation of EMP, environmental control of site actions, remediation and rehabilitation work, daily health and safety control
Environmental Advisor / Auditor	Loci Environmental	Environmental advice and auditing

15.2 REPORTING STRUCTURE

The success of an EMP and suggested mitigation measures depends on the level of cooperation and collaboration between the parties in the project. It is of great importance that every party knows their roles and requirements within the EMP. An environmental reporting structure should be put in place, following the general guideline as illustrated in Figure 15.1.

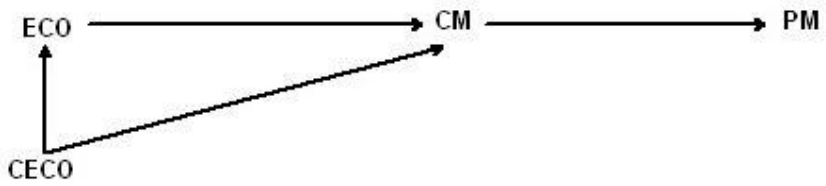


Figure 15.1 Environmental management reporting structure

ECO: Environmental Control Officer

CM: Contracts Manager

CECO: Contractor Environmental Control Officer (appointed by contractors on site)

PM: Project Manager or Project Director

It is of great importance that communication between the project developer and members of the community will be maintained during the construction period. This provides a platform for members of the community to raise their concerns, fears and comments. The contractor should appoint a dedicated person for this communication. The contractor, through this appointed person, should respond to all questions and queries and records of all comments and queries must be kept. These records should include names, dates and contact details, as well as the issue raised, and how the issue has been resolved. The records must be made available at any time to environmental monitoring agencies.

The EMP should become an item raised during construction team meetings, operation meetings and management review meetings. The project manager must ensure that continuous reporting through monitoring takes place.

15.3 MONITORING PLAN

All aspects of environmental monitoring during the design, construction, operation and closure period are summarized in Table 15.2, 15.3, 15.4 and 15.5.

In the event of non-compliance or exceeding set thresholds, corrective action by the responsible personnel is required immediately. The corrective action can include:

- Immediate implementation of the suggested mitigation measure.
- Review of the set mitigation measures and thresholds.

All expected impacts and mitigation measures have been established based on designs, models and site data before Isang substation was developed. It can therefore be expected that certain circumstances change during the implementation and development of the project. A constant review of the set guidelines and measures is required to ensure that the EMP is developing along side with any new developments on the project.

Table 15.2: Design Phase Monitoring Plan

Environmental Impact	Subject	Monitoring Frequency	Location	Monitoring Objectives	Parameter Monitored	Monitoring Resources/ Method	Threshold	Exceeded Threshold Action	Responsibility (for monitoring progress)
Planning and design									
	Vegetation clearing	Once at completion of designs or revisions	Site area / complete design	To avoid unnecessary vegetation clearing	Vegetation	Review of designs	Clearing further than 2 m outside the site boundary	Review of clearing limitations	BPC / Loci
	Indigenous trees	Once at completion of designs or revisions	Site area / complete design	To ensure the replanting of indigenous species	Indigenous trees	Review of designs	Removal of a single tree	Inclusion of indigenous plants in design	BPC / Loci
	Environmental Impact Assessment	Once at completion of designs or revisions	Site area / complete design	To assess all potential environmental results of the proposed project	Compliance with EIA Act	Review of documents	Non compliance with any of the approved EMP requirements	Halt on commenceme nt of project	BPC / Loci
	Erosion	Once at completion of designs or revisions	Site area / complete design	To avoid erosion	Evidence of erosion	Review of designs	Any predicted erosion risk	Advice to avoid damaging areas	BPC / Loci
	Traffic / access	Once at completion of designs or revisions	Site area / complete design	To ensure easy access, to minimise traffic disruption	No. of vehicles and public road accessibility	Review of designs	Any limited access to public	Advice to provide easily accessible roads	Roads Department / Loci
	Landscape and visual amenity	Once at completion of designs or revisions	Site area / complete design	To minimise degradation of aesthetic environment	Topography	Review designs	Any disturbance/da mage of landscape	Advice to modify designs	Kgatleng District Council / Loci
	Land issues	Once at completion of designs or revisions	Site area / complete design	To avoid complaints on land invasion	Complaints log	Review designs	Any registration of complaints	Advice to modify designs	Land board
	Security and access	Once at completion of designs or revisions	Site area / complete design	To avoid health and safety risks	Security measures	Review designs	Lack of security fence in design	Advice to intensify security measures	Kgatleng District Council / Loci

Table 15.3: Construction Phase Monitoring Plan

Environmental Impact	Subject	Monitoring Frequency	Location	Monitoring Objectives	Parameter Monitored	Monitoring Resources/ Method	Threshold	Exceeded Threshold Action	Responsibility (for monitoring progress)
Occupational health and safety									
	Personal protection equipment	Daily	Construction site	To ensure workers' safety	Personal protection equipment	Visual inspection	Any workers on-site without sufficient PPE	Issue of instruction to contractor and environmental monitor to issue non-compliance records to client	SHE officer, Resident Engineer
	Work areas	Daily	Construction site and contractors' site office	To ensure workplace safety	Workplace safety	Visual inspection	Occurrences of any accidents	Stop construction until issue is resolved	SHE officer, Resident Engineer
	HIV/AIDS awareness	weekly	Construction site and contractors' site office.	To raise HIV/AIDS awareness	HIV/AIDS induction courses and posters	Visual inspection	Less than 4 (four) induction courses over duration of construction period	Contact National AIDS Coordinating Agency (NACA) Authorities	Environmental monitor, Resident Engineer
Air quality									
	Dust	weekly	Construction site	To avoid health problems of residents and workers caused by dust	Dust	Visual inspection	Botswana air quality thresholds for total suspended particulates (TSP)	Issue of instruction to contractor to increase watering	Environmental monitor
	Vehicle emissions	weekly	Construction site	To avoid health and environmental problems	Fumes	Visual inspection	Botswana air quality thresholds for total suspended particulates (TSP)	Issue of instruction to contractor	Environmental monitor
Waste management									

Environmental Impact	Subject	Monitoring Frequency	Location	Monitoring Objectives	Parameter Monitored	Monitoring Resources/ Method	Threshold	Exceeded Threshold Action	Responsibility (for monitoring progress)
	Refuse disposal	weekly	Construction site	To ensure a neat and tidy construction environment	Litter, rubbish piles	Visual inspection	Any presence of litter on-site	Issue of instruction to contractor and the environmental monitor to issue non-compliance records to client	Environmental monitor
Noise									
	Excessive noise	weekly	Construction site	To avoid community disruption due to noise (see also Occupational Health and Safety)	Noise	General noise level inspection	SABS 0103:1994 for rural areas	Issue of instruction to contractor and the environmental monitor to issue non-compliance records to client	Environmental monitor, contractor
Traffic									
	Signage and detours	weekly	Construction site	To ensure traffic safety and road accessibility	Signage and access roads/detour s	Visual inspection	Signage on all access roads, in compliance with Botswana Roads Manual	Issue of instruction to contractor	Environmental monitor
	Material haulage	weekly	Contractor's camp site and construction area	To ensure traffic safety and road accessibility	Transportati on of materials	Visual inspection	Hauling materials between 7and 8 am and 4 and 5 pm	Issue of instruction to change haulage times	Environmental monitor
Public safety									
	Construction signage	weekly	Construction area and contractor's site office	To caution the public of possible danger from the construction area	Signage	Visual inspection	Signage on all access roads, in compliance with Botswana Roads Manual	Issue of instruction to stop work	Environmental monitor, Resident Engineer

Environmental Impact	Subject	Monitoring Frequency	Location	Monitoring Objectives	Parameter Monitored	Monitoring Resources/ Method	Threshold	Exceeded Threshold Action	Responsibility (for monitoring progress)
	Road maintenance	weekly	Construction area and contractor's site office	To assess damage to existing roads	Existing access road	Visual inspection	Any visible damage to the road	Issue of instruction to repair damage	Environmental monitor
	Security	weekly	Construction area and contractor's site office	To ensure authorised access into construction area and contractor's site office	Security measures e.g. fencing	Visual inspection	No fence or security guard	Issue of instruction to appoint security	Environmental monitor
	Site hazards	weekly	Construction area and contractor's site office	To caution the public of possible danger from the construction area	Construction hazards	Visual inspection	Any unsecured site hazards	Issue of instruction to fence or hoard site hazards	Environmental monitor
Flora									
	Excessive vegetation clearing	weekly	Construction area and contractor's site office	To retain as much indigenous vegetation as possible	Vegetation	Visual inspection	Clearing further than 2 m outside the site boundary	Financial penalties to the contractor	Environmental monitor
Natural resources									
	Water conservation	weekly	Construction area and contractor's site office	To ensure that water is not wasted and recycle where necessary	Water pipes and faucets	Visual inspection	Any water spills / leaks	Instruction to repair	Environmental monitor, Resident Engineer
	Supply of materials	Weekly	Construction area and contractor's site office	To ensure that materials are sourced from legal and licence borrow pits	Licences	Visual inspection	No licence	Instruction to source from a different borrow pit, or apply for license before use	Environmental monitor, Resident Engineer
Human environment									
	Log book	monthly	Contractor's site office	To keep a record of issues/complaints/ comments	Complaints, comments and issues	Visual inspection	Any record of complaints / claims and issues	Instruction to update logs	Environmental monitor, Resident Engineer

Environmental Impact	Subject	Monitoring Frequency	Location	Monitoring Objectives	Parameter Monitored	Monitoring Resources/ Method	Threshold	Exceeded Threshold Action	Responsibility (for monitoring progress)
Damage to infrastructure									
	Existing structures	monthly	Structures around construction site	To ensure that there is no damage to existing infrastructure	Damage to infrastructur e	Visual inspection	Any damage to existing infrastructure	Instruction to repair	Environmental monitor, Resident Engineer

Table 15.4: Operational Phase Monitoring Plan

Environmental Impact	Subject	Monitoring Frequency	Location	Monitoring Objectives	Parameter Monitored	Monitoring Resources/ Method	Threshold	Exceeded Threshold Action	Responsibility (for monitoring progress)
Erosion	Land rehabilitation	Monthly until rehabilitated	Site area	The restoration of land and vegetation	Erosion	Visual inspection	Any visible erosion	Soil treatment and planting	Land board
Security									
	Public safety	Quarterly	Site area	To avoid property vandalization by the public	Public safety	Visual inspection	Any reported accidents	Immediate repair	Kgatleng Distric Council
Health and safety									
	Health and safety audits	Annually	Site area	To ensure health and safety in the workplace	Health and safety	Visual inspection	Any reports of accidents	Training, update / change health and safety policy	BPC
Waste management									
	Refuse disposal	monthly	Site area	To ensure a neat and tidy environment	Litter / rubbish	Visual inspection	Presence of any litter	Training, waste policy update	BPC
Emergencies									
	Emergency procedures	monthly	Site area	To ensure proper emergency procedures	Emergency procedures at substation site	Visual inspection	Failures of emergency procedures	Review of emergency procedures	BPC

Table 15.5: Decommissioning Phase Monitoring Plan

Environmental Impact	Subject	Monitoring Frequency	Location	Monitoring Objectives	Parameter Monitored	Monitoring Resources/ Method	Threshold	Exceeded Threshold Action	Responsibility (for monitoring progress)
Decommissioning									
	Recycling of materials	monthly	Site area	To ensure site area rehabilitation	Substation materials	Visual inspection	Closure of site without any decommissioning plans in place	Stop decommission until plan has been developed and approved	BPC / DSWM
	Rehabilitation	monthly	Site area	To ensure site area rehabilitation	Natural regeneration of vegetation	Visual inspection	Closure of site without a rehabilitation plan in place	Stop decommission until rehabilitation plan has been developed and approved	Land board / DEA

At the end of the substation lifespan, a full comprehensive and site specific closure plan will be developed and submitted to relevant authorities. It is of crucial importance that this closure plan also includes an updated monitoring plan for environmental monitoring during site closure.

15.4 ENVIRONMENTAL AUDIT

It can also be anticipated that the Department of Environmental Affairs (DEA) will carry out an audit of the project at any time(s) during construction and operation, to check implementation of the EMP and ensure that all mitigation measures are adhered to. The DEA also reserve the right to check participation of all monitoring authorities listed in the management plan.

The monitoring plan presented in this chapter is designed for monitoring and regulations of environmental impacts of the project by contractor and BPC responsible personnel. Qualified and capable people are expected to be appointed, dedicated for the Isang substation project. The management structure at BPC must ensure that the people appointed have the means and authority to fully implement the mitigation measures, and rectify any issues that arise.

In addition to the appointed qualified personnel and audits by DEA, the Client is required to have an annual audit carried out by an independent environmental auditor/consultant. During the environmental audit, the following general items must be included in the investigation:

- Review of the implementation of EMP and monitoring plans on site.
- Review of responsible personnel on site.
- Review of any developments and changes required to the EMP.
- Discussion of any problems encountered during the implementation of the EMP.
- A comparison of the impacts expected during the EIA phase vs. the impacts experienced during the project implementation.
- Review of environmental record keeping on site.

A full environmental audit checklist needs to be developed and agreed upon between the independent auditing company and BPC. Both the Client and the auditing company must keep records of the audit reports for a period of at least 5 years. Copies of the audit reports must also be forwarded to DEA for information.

15.5 POLICY, ORGANISATION AND TRAINING

It should be a requirement that all BPC management staff as well as management staff of contractors on site, are familiar with the content of the EMP and monitoring plan. The project manager should ensure that the contractor(s) commissioned to carry out the construction of the project has an Environmental Policy, which their suppliers, subcontractors and agents and are covered by and follow vigilantly.

Appointed contractor site staff personnel must have authority and management support to rectify any problems occurring on site. It is important that responsibilities concerning environmental management and monitoring are clear to everyone involved.

During regular on site training of all personnel employed on the site, environmental awareness should be a re-occurring topic. By ensuring awareness and responsibility of environmental issues at all levels of the organisation, successful implementation will be accomplished.

16 ENVIRONMENTAL GUIDELINES AND CODE OF CONDUCT FOR THE CONTRACTOR

16.1 INTRODUCTION

The points raised below are compiled from general environmental guidelines and practice that should be followed for all projects, and specific points that have been raised in the EIA. Many of the points may seem obvious or unnecessary. Construction work should be conducted in an environmentally and socially sensitive and responsible manner. These guidelines are intended to ensure that all parties are aware of the potential impacts of their activities and carry out their work in an appropriate way.

They are designed to be a written statement of intent for contractors to adhere to, and to which recourse can be made in the event of a perceived undesirable impact. They should therefore be included in the contract documents for all contractors working on the project. Contractors should be required to familiarise all employees with the contents and spirit of the guidelines.

It should be noted that many of the negative environmental impacts identified for this project are associated with the construction stage. Therefore implementation of the mitigation measures through these guidelines is essential to reduce environmental impacts.

16.2 GENERAL ITEMS

- All disposals of construction wastes to be conducted in a legal and environmentally acceptable way.
- Ensure that dust production from the work area and access roads is minimised by watering.
- Where possible, schedule main dust producing activities in the rainy season when the potential for dust production is reduced.
- Cover stockpiled material, which could be blown by the wind.
- Avoid or minimise operations likely to create dust during windy weather.
- Minimise stripping of vegetation so that earth is less susceptible to erosion.
- Ensure that all plant and equipment is regularly serviced to reduce emissions.
- No maintenance of vehicles and equipment to take place on-site.
- Plant and machinery to be properly maintained to reduce noise.
- Construction works to only take place during reasonable working hours in accordance with local bye-laws or as otherwise agreed.
- Keep working area orderly.

- Ensure that site compounds are kept orderly.

- Open fires to be strictly controlled and avoided if possible

- Ensure environmental awareness amongst staff, and ensure subcontractors do the same

16.3 SITE SET-UP AND SITE OFFICES/CONSTRUCTION CAMP

- Permission for camp areas to be agreed with the relevant land authority prior to set-up.

- Camp, offices and access roads to be sited to cause minimum impact to surrounding residents, and preferably away from residential area. Road accesses to be suitably positioned to minimise impact to existing road users.

- On completion of the project the camp shall be suitably decommissioned, and all construction debris, wastes, scrap etc removed. The area is to be rehabilitated after decommissioning.

- Contractor to submit a plan for solid waste management at camps and offices (which should be approved by the Engineer/Council).

- Contractor to submit plan for handling and storage of fuels, oils, lubricants and other hazardous materials used in construction (which should be approved by the Engineer/Council).

- Contractor to ensure that sanitation facilities at camps/offices are supplied and maintained to prevent environmental pollution.

- Contractor to supply plan on how noise at the camp, from both the workforce and equipment will be minimised.

- Measures to prevent soil erosion at the camp to be implemented.

- Plan for stormwater runoff management from the camp, considering this may contain fuels and oils.

- Avoid spillages and leaks of fuels, oils and other hazardous materials and clean up spillages without delay.

- Storage and disposal of surplus tars, bitumen and associated products to be managed in an environmentally acceptable way.

- Educational support with regards HIV/AIDS and other social diseases to be freely available at the construction camp.

- Condom dispensers to be placed at the construction camps and site offices

- The construction camp to be suitably positioned to minimise conflicts with surrounding land uses. All statutory procedures for the temporary allocation of the land to be complied with.

The terms of the allocation, including clearance of the site at the end of the contract should be adhered to.

16.4 EMPLOYMENT POLICY

- Contractor to ensure, where possible that local people are employed for both skilled and unskilled labour grades.
- Where possible and if required, local construction companies and labour to be employed, so that financial benefits remain in the locality, and the number of migrant workers is minimised.
- Where possible use local companies to supply the construction project.

16.5 HEALTH AND SAFETY

- Contractor to undertake to abide by the national occupational health and safety guidelines.
- Contractor to have company health and safety policy and to ensure that employees know their rights in this regard.
- Contractor to supply adequate health and safety clothing and equipment.
- Contractor to provide health and safety training to all grades of employees.
- Contractor to provide method statements for each work item including how health and safety will be managed for that particular activity. Engineer to have power to halt a work activity if it is progressing in an unsafe manner or in contravention of the approved method statement.
- There must be regular liaison meetings between the contractor and representatives of the local community to discuss safety issues.
- Contractor to provide adequate toilet / sanitation facilities (rate of 1 toilet per 12 people on site) for employees.
- Contractor the erect and maintain fencing around sites to keep unauthorized people and animals out.
- Contractor is to provide a full time SHE officer for the site for the full construction period. The SHE officer must be qualified to undertake this responsibility.

16.6 HUMAN RELATIONS

- Contractor to respect peoples land and property.
- Contractor not to enter peoples land /plot without prior permission.

- All conflicts /disagreements any agreements, no matter how trivial, to be logged and dated, with details of persons involved and subject matter, in a book for this purpose at the site office.

- Contractor to have adequate personnel to manage human relations on site (see Section on nominated persons)

- Contractor to set up regular liaison meetings with local representatives.

- Plant operators should have due respect for the area in which they are working. Haul routes should be carefully designed to ensure minimum disruption.

- Contractor to repair any damage on existing infrastructure, caused by the construction, immediately and to the original standard / specification.

16.7 WORK ITEMS

The following subsections describe issues to be taken note of by the contractor, and they include but are not limited to method statements, clearing, stormwater management and soil erosion, excavation and backfilling as well as material sourcing.

16.7.1 Method Statements

- For each site operation, the contractor is to supply a method statement detailing how the activity will be undertaken and how environmental issues have been addressed.

16.7.2 Clearing

- Remove as little vegetation as possible. This will avoid unnecessary exposure of bare soil and will maintain vegetative screen.

- Rehabilitate or landscape cleared areas where appropriate as soon as possible to minimise soil erosion and improve visual impact.

- Comply with the project specific bush clearing specification (attached).

16.7.3 Stormwater Management and Soil Erosion

- Areas of potential soils erosion due to construction works to be identified and stabilisation measures to be implemented where appropriate.

- Access roads clearly to be marked, and construction vehicles to stay on these access roads at all times

- Avoidance of soil scarring in areas surrounding the sites. Rehabilitation of scares soils to take place without delay.

- Rehabilitation of temporary access roads and sites to take place without delay.

16.7.4 Excavation and Backfilling

- Excavation of trenches, laying of cables and backfilling to be co-ordinated and managed in such a way that open trenches do not become conduits for stormwater. It will reduce the potential for erosion and trench collapse.

- Trenching, cabling and backfilling to take place in a sequenced manner so that long lengths of trench are not left open.

- No open trenches /holes to be left overnight.

16.7.5 Land Issues and Community Liaison

- The contractor to have a suitably qualified member of staff whose sole duty is liaison with the relevant land authorities along the alignment and individual plot holders, who would be the contractor's point of contact for any issue regarding human relations. Each land authority should also have a representative to deal with relations with the contractor.

- There must be regular meetings between the contractor and land authorities so that issues and disputes are speedily resolved. All conflicts and disagreements, however trivial, and any agreements to be logged and dated.

- Well in advance of the contractor starting on a section of work, he is to set out the extent of the works to satisfy himself that there are no land related problems, and that all necessary access or working space he requires is available and agreed. Affected residents and landowners are to be informed of the type of work that will be carried out and what the duration will be.

- All land compensation should be agreed and paid before Contractor enters site.

- The contractor should respect people's property and land. e.g. leave gates closed to prevent livestock getting to crops or onto roads etc).

16.7.6 Material sourcing

- Borrow pits: Permission to open the pits should be obtained from the relevant authorities, and they should not be opened until permission is granted. All borrow pits and excavations now require a licence from Department of Mines.

- Commercial sources: Material only to be supplied by licensed and registered commercial sources.

16.7.7 Education and Training

- All operatives to be provided adequate training with respect to the job they are performing.

- Local residents to be educated about the dangers of construction sites and plant.

16.7.8 Archaeology

- The contractor to be made aware of the location and importance of identified archaeological sites on the drawings and verbally, prior to construction commencing. Plant and machinery must be kept well away from the area.

16.7.9 Nominated Personnel

- The contractor to have a senior member of the site staff responsible for implementation of the environmental code of conduct.

- The contractor to have a senior member of the site staff responsible for the issue of public safety.

- The contractor to have a senior member of the site staff responsible for the issue of land and public liaison.

17 CONCLUSIONS AND RECOMMENDATIONS

During this EIA process Loci Environmental and its specialist teams have conducted a thorough investigation of the proposed Isang substation project. No fatal flaws have been encountered for the substation development and associated infrastructure on any of the bio-physical or socio-economic environmental aspects investigated.

The project will result in both positive and negative impacts for the local environment. Positive impacts can be expected in the socio-economic field, and by implementing the mitigation measures the impacts can be maximised. Negative impacts are expected in some of the bio-physical environment fields, with most severe impacts expected in the ecology and landscape and visual fields. By full implementation of the mitigation measures outlined in the report, it is predicted the impacts can be suitably managed.

As the Isang substation project is expected to have an operational life of at least 25 years, it can be assumed that aspects, equipment and processes of the project will change during the operational lifetime, compared to the plans and designs at the time this EIA study was undertaken. In addition to this, technical provisions have already been made for future extensions of the substation. It is therefore recommended that the EMP will be updated as the project develops during the operational phase. Updated documents and plans must be submitted to the relevant authorities.

The EMP and monitoring plan must be reviewed on a regular basis during the construction and operational phase of the project. Review of these plans ensures that they are updated, and they are effective and efficient in managing the environmental concerns during the project.

It is Loci's recommendation that environmental approval of the Isang substation project (including the access road infrastructure) will be granted to Botswana Power Corporation, permitting that the EMP and monitoring plans will be fully implemented.

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APPENDIX A

PEIA and DEA Correspondence

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Department of Environmental Affairs

Ministry of Environment, Wildlife and Tourism

Private Bag 0068
Gaborone
Botswana

All Correspondence to be addressed to the Director

Managing Director
Loci Environmental (PTY) Ltd
P. O. Box 2749
Gaborone

Attention: Mr. Johannes Westra

RE: DEA/BOD 7/9 XLII (43) **15th DECEMBER, 2008**

RE: REVIEWED PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT REPORTS FOR THE PROPOSED CONSTRUCTION OF THE NEW ISANG 400/220kV.

1. Reference is made to the above Environmental Impact Assessment Report that you submitted to us for review.

2. We have reviewed the report and have resolved that the implementation of the proposed projects would require a detailed Environmental Impact Assessment (EIA).

3. Please note that in accordance with Section 7(1) of the EIA Act, Public Consultation as part of the Scoping exercise should be undertaken to identify the salient issues to be addressed by the EIA study.

4. The Scoping report and draft Terms of Reference (ToR) should be submitted to the Department of Environmental Affairs (DEA) for review and approval before proceeding with the detailed assessment.

Thank you.

Yours faithfully

Kuda Mpolokang
/ For Director

Proposed Construction of the New Isang 400 / 220kV Substation

Our Reference: 08EIA039TAP

Date: 13th November 2008

Prepared By: J. Westra

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INTRODUCTION

In accordance with Section 6 (1a) of the EIA Act, an application to obtain an authorisation for a proposed activity shall contain or will be accompanied by a Preliminary Environmental Impact Assessment (PEIA).

A PEIA is a short report informing the Department of Environmental Affairs (DEA) that a prescribed activity or development is being considered. The main purpose of a PEIA is to provide sufficient information to allow DEA to determine whether a detailed Environmental Impact Assessment (EIA) is required before the implementation of the proposed development activity. The PEIA should be submitted at the concept or pre-feasibility study stage of the project cycle.

PROJECT HISTORY

This document refers to the proposed construction of a new BPC 400 / 220kV Isang, between Molotwane and Mpepu villages (see Appendix A). Trans-Africa Projects in association with KE Consulting have been appointed to undertake the engineering designs. Loci Environmental has been subsequently appointed to undertake the Environmental Impact Assessment (EIA) for the project.

The purpose of the proposed project is to construct a new substation near the existing overhead powerlines, running from Morupule to Gaborone where existing lines will be tied into the new substation. The substation is required due to the increased power demands by BPC clients. Once in operation, the substation will enhance the power supply to Gaborone and neighbouring areas.

A small electrical transformer already exists on the proposed Isang site and will remain in operation. The footprint of the proposed new substation will overlap part of the existing transformer footprint. The overall footprint of the new substation will be 49.5ha compared to 4.0ha currently used. A sketch of the new footprint is included in Appendix B.

The following PEIA is the first stage in the environmental assessment process for this particular proposal. Subsequent stages of the consultancy will continue, following guidance from the DEA.

PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

1. Background information

Project Title: Proposed Construction of the New ISANG 400 / 220kV Substation

Project Applicant: Trans-Africa Projects (on behalf of Botswana Power Corporation)

Contact Person: Mr. Norman Ford

Postal Address: PO Box 6583, Halfway House, Midrand 1685, South Africa

Telephone No: +27 11 205 9429

Fax No: +27 11 205 9441

E-mail Address: Norman@taprojects.co.za

Project Location: Between Molotwane and Mpepu villages, approx 77km north of Gaborone.

For correspondence, please use the contact details for Loci Environmental, to avoid delays caused by post.

2. Project description

a) **The purpose of the project:** The construction of the new BPC Isang substation. The substation is required due to increased power demand by BPC customers. The substation will enhance the power supply to Gaborone and surrounding areas.

b) **Anticipated phases:** The planned phases for the project are shown in Table 2.1 below.

Table 2.1: Planned stages within the development of the project

Phase	Expected completion date
Engineering Design Phase	June 2009
Tender Phase	October 2009
Contract Award	December 2009
Construction Phase	December 2010
Operational Phase	unknown

It is notable that for electrical engineering projects, items such as new transformers are on long delivery times. After appointment of a contractor it usually takes a number of months before a contractor can start the actual work, due to these delivery times for equipment

c) **The current stage of the development:** The project is currently at Engineering Design Phase and the EIA process is to be undertaken as part of this phase.

d) **Physical size and scale:** The footprint of the existing BPC site is approximately 200 x 200m. The footprint for the new substation will be 550 x 900m, and will partly overlap the old site. The height will be approximately 24m. The project also includes construction of an access road of approximately 290m length. A drawing of the proposed site layout has been provided in Appendix B.

For reference / size purposes the substation can be compared with the existing BPC substation opposite Old Naledi adjacent to the Gaborone Dam, in Gaborone.

e) **Project implementation strategy:** Construction of the new substation will take place while the existing electrical infrastructure remains in operation.

The project area will be cleared and fenced first. After this drainage and foundations will be installed. On this electrical equipment will be placed. The existing 220kV powerlines will be connected to the new substation.

f) **Project location:** The location of the project is at the existing BPC Isang site, located along the A1 Gaborone to Francistown road. The site is approximately 75km north of Gaborone, in close proximity to Molotwane and Mpepu villages.

The coordinate list for the corners are:

A: 77888.59 (X) and 2672175.60 (Y)
B: 77393.52 (X) and 2672415.09 (Y)
C: 77785.60 (X) and 2673225.28 (Y)
D: 78280.67 (X) and 2672985.85 (Y)

g) **Alternatives under consideration**: Due to already existing services at the location, the proposed location is the only location currently under consideration. During the engineering design alternative layouts and equipment specifications have been considered.

h) **Preliminary project design:** The project has recently been awarded to the engineering design consultants. Designs for the substation are currently being developed.

i) **Project processes including inputs:** Inputs in the project include (but are not limited to) building materials, electrical equipment, steel structures, power cables and labour.

Outputs: There are very few outputs from the proposed substation, aside from the power supplied to the area. One single toilet will be installed as part of this project, generating a small amount of sewerage.

Major equipment/technology: Electrical equipment such as busbars, feeder bays, transformers, protection and control panels for the new transformers, switchgear and all associated control, protection and metering equipment, line bay with auto-recloser and cabling. Building materials such as bricks, cement, gravel, sand, fencing, doors and windows and fittings are expected to be used.

Other useful information: none

3. Planning Issues

a) **Funding for project secured:** Yes

b) **Stakeholder/Public consultation:** No stakeholder and public consultation has been undertaken yet. However, liaison with other service providers about existing services will be undertaken before the construction begins. Consultation with the Land Board has taken place, and the proposed location has been approved. Further consultation can be undertaken as part of the EIA process.

c) **Current land use:** The current land use for part of the proposed footprint is already in use by BPC infrastructure. The main part of the footprint is however tribal land, covered with low bush vegetation. Dimensions are shown in Appendix A.

d) **Potential change in land use:** Yes, the tribal lease to BPC will be extended to include the new larger boundaries.

e) **Information on land tenure:** There is a current tribal lease in place for the existing BPC substation, the tribal lease is to be extended to the new boundaries. A sketch has been included in Appendix A.

f) **Services available in the area:**

- Water: There are currently no WUC water connections in close proximity to the site. There are however 3 boreholes in close proximity to the site. Two of the boreholes are being used by farmers, but the third borehole has been identified as a suitable water source for the project.

- Power: There are two 220kV overhead transmission lines running along the proposed site. These lines will be connected to the proposed substation and will provide power supply. A smaller 33kV line is also in close vicinity to the site.

- Telephone: There are no BTC services available close to the site.

- Sewer system: There is now sewerage service of septic tank currently on site. It is not known at this stage if the proposed toilet under the scheme will be able to be connected to the scheme, if not a septic tank will be installed.

- Waste Management System: There is no waste collection system at the Isang site at the moment.

g) **Can the capacity of services absorb the outputs resulting from the implementation of the project:** Yes.

h) **Displacement of people or property:** No displacement of people or property is expected.

i) **Sustainability of the material source:** Most materials used during construction are electrical equipment, building materials will be sourced from licensed suppliers.

j) **Change of life for local people:** Implementation of the project will improve the reliability of the power supply in Gaborone and surrounding areas.

k) **Land/space expansion:** The proposed site for the new substation will be approximately 495000 square meters (49.5ha), in comparison to 40000 square meters (4.0ha) currently used for BPC infrastructure.

l) **Approximate distance from settlement:** The substation site is located approximately 8km south west of Mpepu village, and approximately 8km north east of Molotwane village. The site is along the A1 Gaborone to Francistown road. Please refer to the map in Appendix A.

- **Distance from sensitive environments:** There are no sensitive environments in near vicinity. The main Gaborone to Francistown road as well as the railway line are in close proximity to the site.

m) **Employment of people throughout contract:** During the construction it can be expected that approximately 25 people will be employed for this project. Many of the skills required are qualified electrical skilled labour. During operation no fulltime staff will be employed for this substation.

n) **Clearance of site:** The footprint for the proposed substation site will need to be cleared completely

4. Environmental Issues

a) **Questionnaire/checklist filled out:** Please refer to the table on the following page.

b) **Management strategies that will be put in place to mitigate or enhance the impacts of the development:**

- Retention of health and safety officer on site during construction.

- Environmental and Occupational health and safety measures such as Personal Protection Equipment (PPE) will be utilised within the construction site, by staff, and enforced by management as required by ISO 9000 and 1400 regulations.

Table 4.1: Environmental Issues

Issue	Yes	No	Unknown
Is the type of ecosystem one of the following: Forest? Savanna? Grassland? Desert? Wetlands? Other? describe:	 X 	 X X X X 	
Are these ecosystems: Pristine? Moderately degraded? Severely degraded?	 X 	 X X	
Are there present trends towards alteration of the ecosystem through cutting, burning etc to produce agricultural, industrial or urban land?		X	
Does the local population use the ecosystem to obtain or access: Food plants? Medicinal plants? Wood products? Fibre? Grazing land for livestock? Traditional pathways, religious sites? Other (specify)?	 X 	 X X X X X X	
Will the project decrease use of products from the ecosystem by producing or providing substitute materials?		X	
Will the project cause increased population growth in the area, bringing about increased stress on the ecosystem/services/etc?		X	
Are any of the following located on the site earmarked for the development? A river, stream, dam or wetland A unique habitat A conservation or open space area An area that is of cultural importance, e.g. historical site, graveyard, place of worship, etc	 	 X X X X	
Are there significant numbers of wildlife in the area?		X	
Will the project interfere with wildlife movements?		X	
Will development impact on the safety and health of workers and surrounding communities (e.g. communicable diseases, hazards, risks, accidents)?		X	
Will the development result in pollution of: Water resources? Soils? Air? Noise?	 	 X X X X	
Will the development result in soil erosion?		X	
Are there threatened/protected species within the project site?		X	
Will the development result in an increase in traffic?	X		
Will there be any potential for transfrontier impact?		X	
Will the effect of the development be unusual in the area or particular complex?		X	
Will it be difficult to avoid, or reduce or repair or compensate for the effect?		X	

5. Legal Issues

Will the following Acts impact on or have a bearing on the proposed development?

Table 5.1: Legal Issues

Issue	Yes	No
Land Use Related Laws:		
▪ Land Control Act		X
▪ Town and Country Planning Act	X	
▪ Monuments and Relics Act	X	
▪ State Land Act		X
▪ Tribal Land Act	X	
▪ Agricultural Resources (Conservation) Act		X
▪ Other (specify)		X
Resource Specific Laws:		
• Forest Act		X
• Water Act	X	
• Agricultural Resources (Conservation) Act		X
• Waterworks Act	X	
• Fish Protection Act		X
• Wildlife Conservation and National Parks Act		X
• Herbage Preservation (Prevention of Fires) Act	X	
• Disease of Animals Act		X
• Aquatic Weeds Act		X
• Tourism Act		X
• Other (specify)		X
Pollution Control Laws:		
• Public Health Act	X	
• Sleeping Sickness Act		X
• Factory Act	X	
• Industrial Development Act	X	
• Mines, Quarries, Works and Machinery Act		X
• Atmospheric (Prevention) Pollution Act	X	
• EIA Act	X	
• Waste Management Act	X	
• Public Health Act	X	
• Other (specify)		X

6. OTHER INFORMATION

Please refer to “Project History” and “Introduction” on page 1 of this PEIA.

7. SIGNATURE

I…….certify that the information provided is to the best of my knowledge true and correct

Signed:_____Date:_____

For further information or clarification, please contact the Department of Environmental Affairs at the following address:

Private Bag 0068
Gaborone
Tel: 3902050
Fax: 3902051
e-mail: envirobotswana@gov.bw

APPENDIX B

ToR / Scoping and DEA Correspondence

Republic of Botswana

Telephone: (267) 3902050
Fax: (267) 3902051/ 3914687
Email: envirobotswana@gov.bw

Department of Environmental Affairs

Ministry of Environment, Wildlife and Tourism

Private Bag 0068
Gaborone
Botswana

All Correspondence to be addressed to the Director

Ref: DEA/ BOD 7/9 XLV I (110)

29th March 2009

Managing Director
Loci Environmental
P. O. Box 2749
Gaborone

Dear Sir,

RE: SCOPING REPORT AND TERMS OF REFERENCE FOR ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED CONSTRUCTION OF THE NEW 400/220KV ISANG SUBSTATION:

1. Reference is made to the scoping report and terms of reference for the above project which you submitted to the Department of Environmental Affairs (DEA) for review.

2. We have reviewed the terms of reference and consider it to be adequate as it addresses the relevant issues.

3. You can proceed with undertaking the detailed environmental assessment study.

Thank you

Yours faithfully

David Aniku
/for Director

Environmental Impact Assessment Study for the Proposed Construction of the New 400/220KV Isang Substation

ENVIRONMENTAL TERMS OF REFERENCE

PO Box 2749
GABORONE
Botswana

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DOCUMENT DETAILS

Client	Botswana Power Corporation				
Project Title	Environmental Impact Assessment Study for the Proposed Construction of the New Isang Substation				
Document Title	Draft Environmental Terms of Reference				
Document No.	08EIA039TAP				
This Document Comprises	Text (pgs)	Tables (no.)	Figures (no.)	Appendices (no.)	Other
	43	8	8	2	none

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
D01	Draft for review	JW	JRW	RC	Loci	10-03-2009
D02	Draft for DEA	JW	JRW		Loci	16-03-2009
F02	Final Draft					

APPLICANT DETAILS

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Contact:	Mr. N. Ford

EXECUTIVE SUMMARY

INTRODUCTION

This document refers to the proposed development of a new substation at Isang, in the Kgatleng District. The proposed substation will be located in an undeveloped area of the country known as Isang, which is located between the Malotwane and Artesia villages.

The substation is envisaged to be the largest in Botswana in terms of dimensions. It will require a land size of 49.5ha for current and future developments. Currently, the proposed position of the substation is characterized by scrub vegetation and an existing electrical transformer, which occupies a land size of 4.0ha.

The objective for the construction of the substation is to supply the main city of Botswana, Gaborone, with supplementary power and also create the opportunity for future supply the neighbouring areas of Isang with much needed electricity, due to frequent power cuts and lack of electricity.

Once completed, the substation will ensure improved reliability of power supply to Gaborone. It will also create opportunities for low voltage lines to be connected, for additional power supply to villages close to the Isang area.

BACKGROUND

Prior to embarking upon this Terms of Reference, as per the EIA Act of 2005, Loci completed and submitted a Preliminary Environmental Impact Assessment (PEIA) to the Department of Environmental Affairs (DEA) for review. The EIA Act specifies that the next step in the environmental assessment process is the Terms of Reference (ToR) stage. This environmental ToR will be the basis for the EIA. The EIA will examine the potential environmental effects (both positive and negative) of the development of the substation or the hypothetical “No Development” alternative, and will identify appropriate mitigation or optimization measures.

Environmental scoping is significant in the preparation of the environmental ToR, and is used to point to important issues which must be addressed in the project EIA. The environmental scoping exercise carried out for this project is summarised and written up as part of this document. Often non-critical issues are also identified during scoping, and these are then omitted from the environmental scope of works.

PURPOSE AND OBJECTIVES OF THE EIA

The purpose and objectives of the EIA include the following, as set forth by the DEA:

- To identify and evaluate the environmental effects, which will be caused by the proposed development.
- To examine the environmental effects of site specific or alternative development proposals for the site to be developed, including the ‘no-development alternative.
- To identify and describe procedures and measures that will mitigate the predicted adverse impacts of the development proposals and measures that enhance the beneficial effects of the proposed activities.

- To liaise with key interested and affected parties and relevant government departments on issues relating to the proposed development to ensure compliance to existing policies, guidelines, regulations (bye-laws)and accommodate public views.
- Undertake an archaeological impact assessment.
- Develop an environmental management and monitoring plan.

POLICY AND REGULATORY FRAMEWORK

Key policies, legislation, regulations plans, guidelines, which have a direct bearing on the proposed planning, development and operation of the proposed project, are included within this document.

- Monuments and Relics Act (2001)
- Mines, Quarries, Works and Machinery Act (1978)
- Tribal Land Act (2001)
- Waste Management Act (1998)
- Atmospheric Pollution (Prevention) Act (1971)
- Environmental Impact Assessment Act (2005)
- Factories Act (1979)
- Herbage Preservation Act (1978)
- Public Health Act (1981)
- Town and Country Planning Act (2002)
- Water Act (1968)
- Waterworks Act (1962)
- National Settlement Policy (2004)
- Electricity Supply Act (1973)
- Wildlife Conservation and National Parks Act (Act No.28 of 1992)

International conventions

- Basel Convention
- Kyoto Protocol

SCOPE OF THE PROPOSED DEVELOPMENT

The planned footprint for the substation is 550 x 900m. The current project scope will not need the full footprint; part of the area is for allowance of future expansions.

The design and construction of the project include are as per the following technical details:

- Construction of a substation in a confined area suitably sized for the power demand. The dimensions will be approximately 900 x 550 x 24m.
- Terrace work and drainage requirements.
- Installation of fencing.
- Installation of equipment foundations.
- Construction of buildings to accommodate secondary plant equipment.
- Installation of transformer and shunt reactor plinths.
- Construction of concrete road within substation boundaries.
- Erection of steel structures with maximum height of 24m.
- Installation of transformers and shunt reactors within oil containment areas.
- Construction of concrete access road from main Gaborone to Francistown road, approximately 400m length.

SCOPE OF THE EIA

Prior to composing this project's environmental ToR, a variety of scoping exercises were undertaken by the individual environmental consultants involved in the project EIA, using a variety of methodologies described herein, depending on the environmental parameter being investigated. This included (but is not limited to) the undertaking of liaison with stakeholders and the general public, as well as examining baseline data from the project area, and other EIA studies done for similar projects, particularly in Botswana.

The scoping phase also identified the geographical study area on which the EIA would focus. It was established that the geographical zone studied in each specialist environmental parameter within the EIA would be unique to that parameter due to the individuality of the varied environmental impacts that are predicted to arise.

EXISTING ENVIRONMENT

The proposed project site is in an area that is sparsely populated, there are however a number of infrastructure developments surrounding the project site:

1. Two 220kV overhead power lines, running parallel to each other, towards the north-western side of the proposed substation site.
2. The Gaborone to Francistown A1 road to the eastern side of the substation site.
3. The Gaborone to Francistown railway line to the eastern side of the substation site and A1 road.
4. An Orange cell phone tower to the eastern side of the proposed substation site, between the A1 road and the substation site. The cell phone tower is located along the proposed access road.
5. Three boreholes installed by cattle post owners in the area.

PHYSICAL ENVIRONMENT

The study area lies on a plateau which is generally characterised by flat to gently sloping terrain/ altitudes ranging between 960m and slightly more than 961m above sea level.

The project area has poor groundwater development prospects. There is a great lack of groundwater largely due to the underlying granite rocks that have very poor secondary aquifer characteristics because of a lack of well interconnected open fracture systems.

Granite rocks dominate this major intrusion which covers an area of over 5 000 square km in south eastern Botswana that includes the site area. The geology of the site is primarily composed of different geological units of the Gaborone Granite intrusion.

The soil type in the area belongs to the group of soils associated with Luvic Arenosols and metamorphic rocks (hardveld).

The climate of the area is sub-tropical semi arid with summer rainfall. The maximum temperature ranges from monthly mean of 22C° in July to 32 C° in December and January. Prevailing winds are east and northeast, although there is a large portion of the year (between 30 – 40% depending on the time of year) without any wind.

The project area contains vegetation and habitats that are well represented outside of the site. It is expected that no rare and endangered animal species occur exclusively on the site.

A number of existing environmental problems occur in the project area, which are largely related to existing infrastructure including a road, two 220kV overhead powerlines, a railway line, an Orange cell phone tower and a number of boreholes.

TERMINOLOGY

In the project EIS, individual methodologies will be outlined within each section pertaining to distinctive areas of study, when specific models and tests are utilised. This document will explore individual methodologies for the EIA in detail.

To this end, Loci's "best practice"-based methodology ensures that all environmental impacts which are likely to be significant are assessed. There is no specific definition in Botswana environmental guidelines of what constitutes significance of impact in this context, but the following factors should be considered:

- The relative importance of the environment i.e. is it of national, regional, district, local, or site-specific importance.
- The scale of the change e.g. positive, neutral, or adverse.
- A degree to which the environment is affected e.g. enhancement or impairment.
- Whether the effect is temporary or permanent and if temporary its duration.
- The degree of mitigation that can be achieved, and how.

KEY LINE OF ENQUIRIES AND SCOPING RESULTS

Key lines of enquiry (KLOE) are detailed questions stemming from various scoping exercises that provide a framework for the EIA consultants to investigate during the comprehensive environmental assessment.

The EIA will address the existing environment of the project site, and provide answers to the following general environmental KLOEs:

- What is the terrestrial physical environment, including topography, geology, hydrology, soils and groundwater resources?
- In what state or quality is the terrestrial biological environment, including species at risk and their habitats (flora and fauna), species migratory patterns, ecologically sensitive or significant areas, and protected areas or important habitat features?
- What is the current use of land and resources?
- What is the existing public sentiment about the project?

One of the major Key Lines of Enquiry to be addressed in the EIA is evaluation of alternatives to the proposed substation development. When discussing alternatives the study will also provide an overview of how environmental conditions have influenced the project design, and will not limit alternative means for carrying out the development to alternatives the developer currently considers feasible.

Ecology
The following KLOEs will be addressed through an in-depth study of the biological environment:

- What is the state of forest/vegetation cover, existing wildlife (flora and fauna), rare or endangered species, sensitive habitats, species of commercial importance, migratory paths of birds, nuisance species and pests, in the area?

The ecology impact assessment study will conduct the following activities:

- Describe the current state of flora and fauna in the study area.
- Identify Red Data species.
- Identify any rare or endangered species or sensitive habitats.
- Identify potential impacts (positive or negative, including cumulative impacts if relevant) of the proposed development on ecology during construction and operation..
- Identify mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and.
- Formulate a simple system to monitor the above impacts.

Archaeology

The study to uncover the prehistory, historical attributes of the region and potential damage to the archaeology of the area will be done through:

- Conducting a record of historical and archaeological resources in and around the project area.
- A collation and documentation of existing written reports and oral information provided.
- Areas of maximum sensitivity identified.

The archaeological section will address the following:

- What is likely to be found on site during field work?
- What mitigation strategies or any alternative actions can be put into place to preserve any monuments and relics that have been identified and those that may be encountered when field work is conducted?

Landscape and visual amenity

- The assessment of the landscape to allow it to be described and classified into landscape character types which enable the categorisation of landscape quality.
- The assessment of the capacity of a landscape to accept change of the landscape type proposed.
- A general viewshed analysis to identify from how far away the development will be visible, who the visual receptors will be, and how severe this impact will be on them.

Socio-economic environment

The socio-economic section provides the results of primary data collection in the area around the substation location, and in the neighbouring community such as Malotwana and Artesia. The team has also conducted consultation interviews at the national and sub-national level with informed persons, with the aim of soliciting insights into social impacts, securing available materials and data, and collecting factual data.

Key issues to be investigated during the for the socio economic environment section include, but may not be limited to the following:

- Impacts on communities proximate to the anticipated substation location.
- Opinions of affected communities about the proposed substation.
- Recommendations from affected communities about the substation.
- Development context.

CONSULTATION

A public participation meeting was conducted at the *kgotla* in the village of Malotwana. The meeting was held on the 16th of February 2009 and the attendance was satisfactory as many of the local residents turned up to attend the *kgotla* meeting.

The people welcome the proposed development and expressed their gratitude towards BPC, as they will now have improved livelihoods due to sufficient power from the substation. They desire that the project proceed as soon as possible so that they may start enjoying the benefits now.

Issues about HIV/AIDS were raised as concerns that might impact the society during construction. Concerns by other individuals, regarding the welfare of the livestock in the area, were brought up and it was noted that a separate meeting will be conducted with the farmers' syndicate for the Isang cattle posts.

It was further elaborated that an Environmental Management Plan will be drawn up so that strict measures are followed in ensuring that positive impacts are enhanced and negative impacts minimised. One of the ways of ensuring this will be successful is to carry out inspections for compliance during construction.

Stakeholder consultation with both local and national level stakeholders was undertaken. Subsequent to the consultations, the following comments and queries were raised:

- Vegetation clearance: The consultation revealed fears from the stakeholders, about the amount of vegetation that might be lost in the process of creating space for the substation.
- Loss of farmland: The stakeholders raised concerns that, with vegetation being cleared, there will be a loss of farmland and livestock might suffer in feeding.
- Visual amenity: The presence of the substation and its transmission lines will bring about aesthetic intrusion on the natural environment. Concerns were raised by the stakeholders that the substation might interfere with the landscape around the Orange transmission tower.
- Effects of substation: The stakeholders were curious to know how: vibrations, sound, heat and radiation, which might occur from the substation, are going to be mitigated. There were no fears from the Orange stakeholders, about interference of the substation with the existing Orange transmission tower which is located near the proposed substation.
- Livestock concerns: Concerns about the well being of the livestock and wildlife found in the in the vicinity of the substation were also raised, as the stakeholders feared that the substation might be secured with an electric fence/line.

Overall the stakeholders welcomed the project and warned that the above mentioned issues must be taken seriously to avoid disastrous situations on the natural environment and human environment. As mentioned previously, consultations with the farmers in the Isang area are still ongoing and the results will be incorporated in the EIA phase of the project.

ENVIRONMENTAL MANAGEMENT

An Environmental Monitoring Plan and Mitigation Plan format/structure to be used in the project EMP have been included in this document to show the responsibilities and environmental parameters that are to be taken note of in the proposed project. The EMP and monitoring plan must be part of the contract documents to ensure compliance.

EIA TEAM

The team involved in the commission of the EIA study is as follows:

• Project Manager / Environmental Engineer	Mr. J. Westra, Loci
• Archaeology	Ms. P. Sekgarametso, Loci
• Environmental Consultant / Landscape and Visual Specialist	Ms. J. R. Westra, Loci
• Environmental Consultant	Mr. E. Mohale, Loci
• Public Consultation Assistant	Mr. L. Gaolekwe, Loci
• Ecology (Flora and Fauna) Specialist	Mr. J. Burgess, Loci
• Engineering substation specialist	Mr. R. Coney, KEC

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APPENDICES

ABBREVIATION LIST

AIA	Archaeological Impact Assessment
BPC	Botswana Power Corporation
CCC	Contractor's Code of Conduct
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
GPS	Global Positioning System
IAPs	Interested and Affected Parties
IEMA	Institute of Environmental Management and Assessment
KEC	Kutlwano Engineering Consultants
KLOE	Key Line of Enquiry
MP	Member of Parliament
MRA	Monuments and Relics Act
PEIA	Preliminary Environmental Impact Assessment
Pty Ltd	Proprietary Limited

SIA	Social Impact Assessment
SHE	Safety, Health and Environment
TAP	Trans-Africa Projects
ToR	Terms of Reference
VDC	Village Development Commitee

LIST OF SYMBOLS

℃	Degrees Celsius
km	kilometer
kV	kilovolt
m	meter
mm	millimetres
MW	Megawatt

1 INTRODUCTION

This document refers to the proposed development of a new substation in Isang, in the Kgatleng District. The proponent of this project, Botswana Power Corporation (hereafter referred to as "BPC" or "The Client" has appointed the engineering consultants Trans-Africa Projects in association with KE Consulting (KEC) to undertake the engineering designs for the project whilst the services of Loci Environmental (Pty) Ltd were procured to carry out an Environmental Impact Assessment (EIA) study for the project.

The proposed substation will be located in an undeveloped area of the country known as Isang, which is located in between the Malotwane and Artesia villages, on the Gaborone – Francistown A1 route. The substation is envisaged to be largest in Botswana in terms of dimensions. It will require a land size of 49.5ha for current and future developments. Currently, the proposed position of the substation is characterized by vegetation and an existing electrical transformer, which occupies a land size of 4.0ha.

The objective for the construction of the substation is to supply the main city of Botswana, Gaborone, with supplementary power and to create the opportunity for future supply to the neighbouring areas of Isang with much needed electricity, due to frequent power cuts and lack of electricity.

This document has been prepared in accordance with Section 8 (1) of the Environmental Impact Assessment (EIA) Act, which outlines that a Terms of Reference (ToR) must be prepared and submitted for approval by DEA. In effect, the ToR is used to guide the EIA team to prepare an informative and systematic report based on EIA findings, referred to as an Environmental Impact Statement (EIS).

An integral step in preparing ToR for a project of this nature is the undertaking of a scoping exercise, the results of which will be addressed within this document. Scoping is the process of determining which issues must be addressed in an EIA study, and which may be omitted. Scoping also involves the undertaking of consultation with the relevant stakeholders (including the general public and local communities) in order to seek their views or concerns about the proposed development.

The exact location of the proposed substation site is shown in Figure 1.1 below:

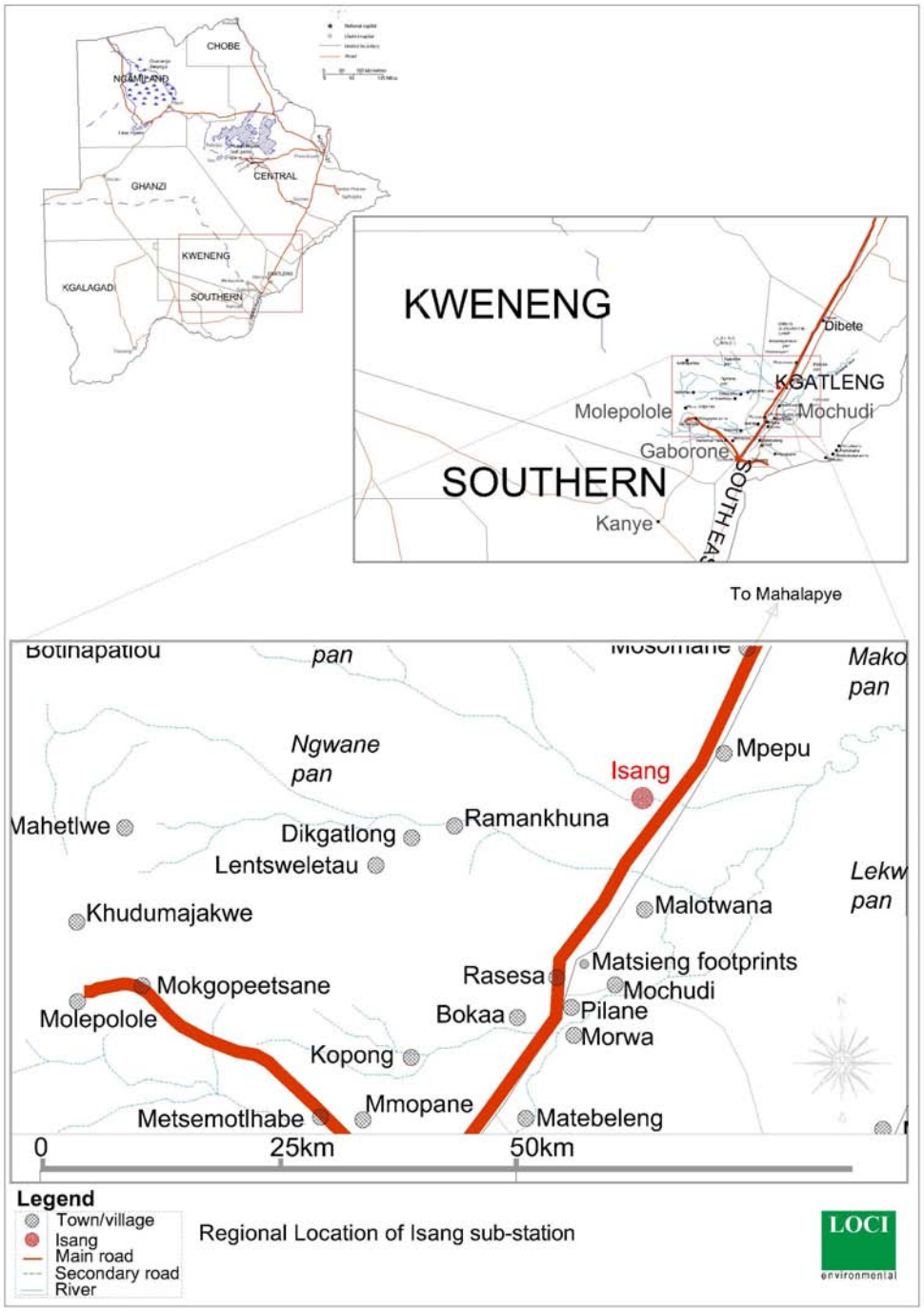

Figure 1.1 Locality Map of Study Area

The exact location of the proposes substation, in comparison to the surrounding infrastructure, has been shown on Figure 1.2 below.

Figure 1.2 Exact Isang substation location

2 BACKGROUND

For the proposed construction of the Isang substation, the BPC seek to attain land in an area known as Isang, in the Kgatleng district. Isang is located in between two established villages. Malotwana is the south of Isang, and Artesia is situated to the north. From a lands and veterinary planning point of view, the project site falls under the Malotwana area.

Isang is an undeveloped area which was once recognized by the title 'Isang's ranch'. The area has a historic significance. Historic story is that the area was to be provided with a railway station on the Lobatse to Rhodesia line, during the construction of this line. The station was intended for the local chief to be able to stop and inspect his cattle on the fields in the Isang area.

2.1 TECHNICAL BACKGROUND

Due to increased power demand by its customers, and reduced power supply from neighbouring countries, specifically South Africa, BPC is working on a large number of power infrastructure projects to ensure sufficient power supply for Botswana in the near future. The projects include the Morupule B power station project, as well as planned power infrastructure from the planned Mmamabula power station, developed by CIC Energy.

The planned Isang substation is one of the power infrastructure upgrade projects. Currently there are two 220kV powerlines running from Morupule to the Gaborone area. These powerlines are expected to reach maximum capacity, and further transmission capacity is required. Aside from the construction of the Isang substation, it is expected that additional powerlines to and from the substation will be developed in the near future. The substation design allows for feeder bays for these powerlines, but no powerlines are part of the current scope of works. The current scope is allowing for connection to the two existing 220kV powerlines.

Once completed, the substation will ensure improved reliability of power supply to Gaborone. It will also create opportunities for low voltage lines to be connected, for additional power supply to villages close to the Isang area.

2.2 ENVIRONMENTAL BACKGROUND

Prior to embarking upon this Terms of Reference (ToR), as per the EIA Act of 2005, Loci completed and submitted a Preliminary Environmental Impact Assessment (PEIA) to the Department of Environmental Affairs (DEA) for review. The PEIA also serves as an introduction to the project. The PEIA was submitted in November 2008, and correspondence in response to the document was received from the DEA in December 2008 (DEA reference no. DEA/BOD 7/9 XLII (43), see Appendix A).

The EIA Act specifies that the next step in the environmental assessment process is the ToR stage, where the ToR for the EIA study must be approved by the DEA, in order to provide certainty for the DEA and other stakeholders that the important issues will be addressed to the depth needed. The ToR also ensures the proponent that no issues will be raised later and delay the EIA approval process. It is for this reason that the ToR is finalized before the proponent solicits proposals to carry out the work involved.

This environmental ToR will be the basis for the EIA. The EIA will examine the potential environmental effects (both positive and negative) of the development of the substation or the hypothetical "No Development" alternative, and will identify appropriate mitigation or optimization measures. Mitigation or optimization measures are those procedures or protocols that will be employed to ensure that

negative effects are minimized and positive effects are maximized during the development of the project. Additional options identified during the environmental assessment process may be considered as applicable. Following the assessment study, a written Environmental Impact Statement (EIS) will be produced.

Environmental scoping is significant in the preparation of the environmental ToR, and is used to point to important issues which must be addressed in the project EIA. The environmental scoping exercise carried out for this project is summarised and written up as part of this document (reference to specific sections where each element is contained within this document is given in the table below). As required in draft guidelines procured from the DEA, this document includes all information obtained through the scoping phase of this project, by the numerous consultants involved in the project, primarily within Chapter 8. The items discussed related to scoping, as well as their locations, are as follows:

Table 2.1 Scoping Results' Locations

Scoping Exercise Items (taken from DEA draft guidelines obtained 2008)	Included in this Report
Advertisement of at least 21 days, for Public Consultation (refer to Appendix B)	√
Description of environmental issues identified by ALL CONSULTANTS (refer to Chapter 8)	√
Descriptions of alternatives identified (refer to Section 8.1.1)	√
Scope of the Development (refer to Chapter 6) Scope of the EIA (refer to Chapter 7)	√
Description of Public Consultation process (refer to Chapter 9)	√

Often non-critical issues are also identified during scoping, and these are then omitted from the environmental scope of works, in an effort to make the study as efficient and relevant as possible. Scoping also involves the undertaking of consultation with relevant stakeholders, including the general public. This is done to register any views, queries, concerns or criticisms about the proposed development. Results of the public and stakeholder consultations are included in this ToR.

3 PURPOSE AND OBJECTIVES OF THE EIA STUDY

The purpose and objectives of the EIA include the following, as set forth by the DEA:

- To identify and evaluate the environmental effects, which will be caused by the proposed development.
- To examine the environmental effects of site specific or alternative development proposals for the site to be developed.
- To identify and describe procedures and measure that will mitigate the predicted adverse impacts of the development proposals and measures that enhance the beneficial effects of the proposed activities.
- To liaise with key interested and affected parties and relevant government departments on issues relating to the proposed development to ensure compliance to existing policies, guidelines, regulations (bye-laws)and accommodate public views.
- Undertake an archaeological impact assessment.
- Develop an environmental management and monitoring plan.

4 POLICY AND REGULATORY FRAMEWORK

This section is intended to identify all policies, legislation, regulations plans, guidelines, etc. which impact on the proposed planning, development and operation of the proposed mine project. The key pieces of legislation that have a direct bearing on the successful implementation of the proposed substation development are highlighted below.

4.1 NATIONAL LEGISLATION, POLICY

4.1.1 Monuments and Relics Act (2001)

As part of the EIA study, an archaeological impact assessment (AIA) will be undertaken to fulfil the requirements of the 2001 Act, which requires the project proponent to obtain a clearance certificate based on the submission of the AIA before development can be initiated. This Act provides for the protection and preservation of ancient monuments, relics and material of archaeological, cultural or historic interest and classifies graves as ancient monuments. Thus, old or new burial sites are not to be disturbed nor moved without the permission of the Director of the Department of National Museums, Monuments and Art Galleries. This is often preceded by a lengthy consultative process with the local communities.

4.1.2 Mines, Quarries, Works and Machinery Act (1978)

This Act is relevant to issues relating to the opening of potential borrow pits for construction. It deals with ancillary and quarrying operations and also the safety, health and welfare of the site employees. The project proponent is required under the Act to put in place measures that will result in the compliance with the specifics summarized in the legal register. The Act specifies that a Mineral Permit must be issued by the Department of Mines for any borrow pit or quarry to be operated during the construction phase. The application for the Mineral Permit has to be accompanied by a completed EIA report for each borrow pit or quarry.

4.1.3 Tribal Land Act (2002)

Land administration in rural Botswana is governed by the Tribal Land Act of 1968. The Act governs access, use and disposal of over 70% of land in Botswana. It provided for the establishment of Land Boards whose functions involve the grant of customary land rights. Part III of the Act states that the powers vested in a Chief under customary law in relation to land include:

- The granting of rights of use of any land
- The cancellation of any grant of any rights to use any land
- Hearing of appeals from, confirming or setting aside any decision of any subordinate land authority
- The imposition of restriction on the use of tribal land

The above shall be vested in and performed by a Land Board. In essence the Tribal Land Act transferred powers previously vested in the chiefs to the Land Boards. In accordance with the

conditions of this Act, the project proponent must be granted legal surface rights for the land on which the developments are to take place. Following the completion of the application process by the project proponent, the Land Board will issue surface rights for a fixed period. The process will require the project proponent to:

- consult the land overseer
- consult the affected local community
- consult and obtain consent from the existing land rights holders and at least three neighbours
- submit the application form to the Land Board.

It must be noted that there is a clause that requires the project proponent to pay compensation to the land rights holder, for the land that will be subsumed into the substation area.

4.1.4 Waste Management Act (1998)

"Waste", as defined by the Waste Management Act includes the following substances and any combination thereof which are discarded by any person or accumulated or stored by any person for the purpose of recycling: undesirable or superfluous by-products; residue or remainder of any process or activity; any gaseous, liquid or solid matter. Waste is also defined by place of origin or generation (household, industrial, mining waste etc). The Waste Management Act 1998 was promulgated to manage controlled waste and Section 45 of the Act incorporates the provisions of the Basel Convention. It addresses management of controlled and hazardous waste. This includes provision of waste management plans; identification of waste management sites and control of groundwater pollution.

The Act provides for the management of controlled waste which by definition includes general waste and clinical waste but excludes mining waste. The provisions of this Act require the project proponent to apply to the Department of Waste Management and Pollution Control (DWMPC) for a waste management license for the facility to be run by the project proponent, if applicable.

4.1.5 Atmospheric Pollution (Prevention) Act (1971)

Atmospheric Pollution (prevention) Act of 1971 is currently the only piece of legislation which is specifically directed at pollution prevention and control. The Act also provides for the prevention of the pollution of the atmosphere caused by industrial processes, and further provides for the appointment of pollution control officers as well as inspectors. Given the amount of clearing that is expected for the installation of the proposed substation, the act is of particular importance during the construction period of the project.

The proponent will have to ensure adherence to air quality standards as prescribed by the Botswana BOB standards and other international standards such as the World Bank air quality guidelines. This is especially important in that the operations are to be periodically monitored by legally mandated air pollution control officers who will check for compliance. The Air pollution control officers also retain the power to request the registration certificate holder to take steps to improve the performance of the equipment in use or to request that the existing equipment be replace with newer, more efficient equipment. Non-compliance is an offense that can result in the registration certificate holder in court and with fines to pay.

4.1.6 Environmental Impact Assessment Act (2005)

The EIA Act provides for Environmental Impact Assessments (EIAs) to be used to assess the potential effects of planned developmental activities; to determine and to provide mitigation measures for effects of such activities as may have a significant adverse impact on the environment; to put in place a monitoring process and evaluation of the environmental impacts of implemented activities; and to provide for matters incidental to the foregoing. Only after the competent authority being Department of Environmental Affairs has approved the Environmental Impact Statement can the project proceed. The EIA process entails:

- the identification of potential environmental impacts
- the identification of measures to mitigate the adverse impacts and enhance the positive effects
- undertaking public consultations to inform and solicit the views and concerns of interested and affected parties about the proposed project
- the development of an Environmental Management Plan that outlines the proposed measures to mitigate both archaeological and environmental effects.

4.1.7 Factories Act (1979)

The Factories Act is one of the few pieces of legislation primarily concerned with Occupational Health and Safety in Botswana. The Act provides regulations to govern conditions of safety, health and welfare in the employment in factories and other places. It also provides regulations for the safety and inspection of certain plant and machinery and for incidental purposes. The definition of “Factories” according to the Act is essentially all premises where people are employed in manual labour, and is highly relative to the mining industry. Subjects relevant under the act include

- Occupational Hygiene
- First aid
- Personal protection equipment (PPE)
- Notification of accidents, dangerous occurrences and industrial disease
- Cranes and other lifting machines and apparatuses

4.1.8 Herbage Preservation Act (1978)

The Act requires that permission must be sought from the Herbage Preservation Committee to set fire to any vegetation on land of which one is not the owner or lawful occupier. The objective of the Herbage Preservation (Prevention of Fires) Act is to prevent and control bush and other fires. In accordance with the Act if any activity at the mine requires fire, the proponent must first obtain permission from the Herbage Preservation Committee. In addition, under no circumstance can management or the construction employees start a fire on land that does not legally belong to the project, as this is considered an offense under the Act.

4.1.9 Public Health Act (1981)

This Act addresses diseases and the spread thereof, and provides a range of health measures including regulations on prevention, management and control of diseases as well as cleanliness and sanitation and the control of nuisances. The Act also provides for the welfare of all personnel and

addresses working facilities related to sanitation, workshops and offices, stating that these must be cleaned regularly and free of litter, and free of any nuisances that are offensive, injurious to health and possible environmental pollutants.

Under the Act, proponents are prohibited from conducting operations such that any street, road or part of, any stream, pool, ditch, gutter, watercourse, sink, water tank, cistern, water closet, privy, urinal, cesspool, soak-away pit, septic tank, cesspit, soil pile, waste pipe, drain, sewer, garbage, receptacle, dustbin, dung-pit sewer, garbage, receptacle, dustbin, dung-pit, refuse pit, slop-tank, ash-pit or manure heap so foul or in such a state or so situated or constructed as in the opinion of a health officer to be offensive or to be injurious or dangerous. Additionally, the Act protects the quality of water used by the public, by controlling the disposal of polluted water and control of mosquito larvae.

4.1.10 Town and Country Planning Act (1980)

This Act requires development plans for all areas declared as planning areas and promotes environmental protection through the Development Control Code and the Urban Development Standards which establishes planning controls over the development and use of land. The Act also requires local authorities to prepare development plans for all planning areas.

4.1.11 Water Act (1968)

The Water Act primarily provides for the prevention of the misuse and pollution of water through enforcement of penalties. The Act also addresses the ownership, protection and the rights to use ‘pubic water’, and requires that the water resources within the project area and beyond should not be polluted by any matter derived from the mining operation. Under the Act, development proponents must first obtain water rights from the Water Apportionment Boards before any act such as constructing a dam or proceeding to store, use or discharge any effluent into the public water. The process also includes applying for water rights that will provide the permission required to do such. The management of water resources will be facilitated by the provisions of both this Act and the Waterworks Act (1962). Under these provisions it is an offence to pollute or foul any public water by either discharging any substance likely to pollute or by dumping any material in a place where water is likely to flow and carry the pollutants along. Such offences are liable to penalties to be paid by the polluter.

4.1.12 Waterworks Act (1962)

The Act provides for the establishment of Water Authorities mandated with the responsibility of supplying water and other waterworks in townships and areas designated by the Minister as Waterworks areas. The provisions of the Act are such that the water authority have been given a wide range of powers that include the right to acquire rights to take water, to provide waterworks needed to supply water. They also have the authority to entire private property for the purpose of reading water meters, inspecting, repairing, replacing or testing any service without giving prior notice to the owner, making it an offence to obstruct the inspectors/ officers from carrying out their duties. The Act prohibits water pollution and promotes water conservation by also considering the following as offences:

- pollute or cause risk of pollution to any water, or to allow any foul liquid, gas or other noxious matter to enter into the waterworks or any pipe or fitting connected therewith.

- deposit any foul, noisome or injurious matter, earth or excavated material in a manner that it can be washed off and carried into the waterworks

- undertake any activities that can result in silt, sand, gravel sawdust, refuse, waste
- wilfully and purposefully waste water.

4.1.13 National Settlement Policy (2004)

This policy aims to provide a comprehensive set of guidelines for national physical planning and to provide a framework for guiding the distribution of investment in a way that reflects the settlement's size, population, economic potential, level of infrastructure and their role as service centres. Protection of the environment through sustainable land use planning is provided specifically through this policy that aims to:

- provide guidelines and long term strategy for development of human settlements
- rationalize and promote the optimal use of land and the preservation of the best arable land
- provide guidelines for the development of transportation networks to strengthen the functional linkages between settlements.

4.1.14 Electricity Supply Act (1973)

The Act provides for clear rules, regulations and responsibilities related to the supply of electricity. It specifies minimum requirement for electrical installations to adhere to, as well as licensing regulations. The electrical installations covered in the act include standard low voltage systems, high voltage (overhead) lines and installations other then consumer installations (such as substations). The regulations include:

- Technical requirements for materials, conductors, testing and overloading
- Safety requirements for fencing, maintenance, inspections and wind pressure
- Fire precautions and clearance instructions.

4.1.15 Wildlife Conservation and National Parks Act (Act No.28 of 1992)

This act enables gazettement of national parks, game reserves and Wildlife Management Areas (WMA) in which wildlife conservation and use is the primary land use. The WMA Regulations can also be a useful tool for managing wetlands in WMAs.

4.2 INTERNATIONAL CONVENTIONS

4.2.1 Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is the most comprehensive global environmental agreement on hazardous and other wastes.

The Convention has 170 Parties and aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes. The Basel Convention came into force in 1992 (Basel Convention Website www.basel.int).

In Botswana, the waste management facilities are not of sufficient standard to treat hazardous waste. Therefore any hazardous waste must be transported elsewhere for treatment and disposal. The Convention requires that the power corporation company requests the Government of Botswana to provide a written notice to transit states and the destination country importing its hazardous waste. These countries would then have to issue prior written consent before any export could take place. Each approved shipment would have to be accompanied by a movement document.

4.2.2 Kyoto Protocol

The United Nations Environment Programme defines the Kyoto Protocol treaty as a legally binding agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990 (but note that, compared to the emissions levels that would be expected by 2010 without the Protocol, this target represents a 29% cut). The goal is to lower overall emissions from six greenhouse gases - carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs - calculated as an average over the five-year period of 2008-12. National targets range from 8% reductions for the European Union and some others to 7% for the US, 6% for Japan, 0% for Russia, and permitted increases of 8% for Australia and 10% for Iceland (Kyoto Protocol website, 2005).

Although the protocol is not binding on developing countries, such countries have to ensure that they act responsibly and avoid greenhouse gas emissions at levels that have been found to be undesirable. The protocol is not directly related to the construction of an individual powerline. However, it is very relevant when considering overall upgrades of power networks, which ultimately will result in increased power production and consumption.

5 DOCUMENT OVERVIEW

The remainder of this document is organized as follows:

- Chapter 6 defines the scope of the proposed development.

- Chapter 7 provides general information. It describes the scope of the Environmental Impact Assessment, as well as the existing environment in the project area. This section also discusses various other aspects of the environmental assessment, including how the EIA will describe impact predictions, significance criteria, and other terminology to be used in the EIA study.

- Chapter 8 describes the Key Lines of Enquiry (KLOE) and specific Scoping Exercise Results. KLOE are issues raised in question format by the EIA consultants, while the results of the scoping exercise include individual aims and objectives raised by the consultants to be explored within the EIA study. Both are intended to provide an assessment framework, related to items of importance or “red flags” which may arise within the EIA study, to help to inform the inspections and assessments to be undertaken. The KLOE and EIA aims are formulated by Loci environmental consultants, and are intended to be answered through specific environmental investigations carried out within the EIA study. Therefore they are broken down into sections pertaining to each individual environmental parameter (e.g. Archaeology, Avifauna). This Chapter highlights issues or potential impacts, provides an account of why it is particularly relevant, and an account of the consultants’ expectations for addressing them in the EIS.

- Chapter 9 summarises the public consultation exercise that has been undertaken by the EIA team, in the Kgatleng District as part of the Scoping phase for this EIA.

- Chapter 10 investigates the format, aims and objectives of the project EMP and monitoring plan, consistent with DEA requirements.

- Chapter 11 provides information pertaining to the EIA Team, and personnel details.

6 SCOPE OF THE PROPOSED DEVELOPMENT

The scope of the proposal at hand includes the principal development, which is the construction of a new substation as well as tie in of the existing two overhead 220kV powerlines. Aside from the activities directly related to the substation construction, there are indirectly related activities anticipated, such as clearance of site and construction of access road for maintenance.

6.1 TECHNICAL DETAILS

As explained in the introduction chapters of this report, the purpose of the Isang substation is to improve the reliability of power supply to Gaborone and surrounding areas. The planned footprint for the substation is 550 x 900m. The scope of the current construction will not require the full footprint; part of the area is for allowance of future expansions.

It is proposed that the outer boundary of the plot will be fenced with a standard cattle fence. The vegetation of the area for future expansion will be left in place where possible. There will be an inner palisade fence around the actual substation equipment, as per international electricity safety standards. Figure 6.1 below shows the layout for the proposed substation.

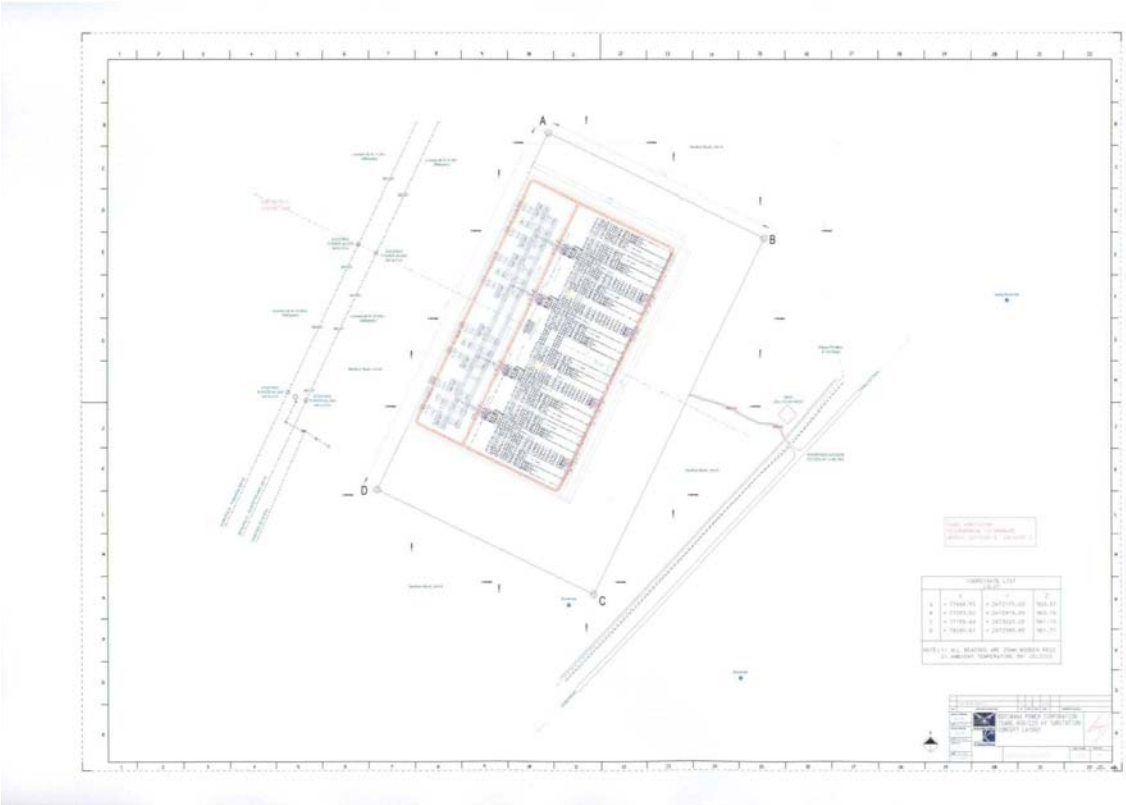

Figure 6.1 Site layout of the proposed Isang substation

The scope of the project includes the installation of 400 kV and 220 kV feeder bays for future powerlines in and out of the Isang substation. These powerlines do not form part of the current scope of the design and assessment, and the feeder bays are the only part included under this project

The design and construction of the project are as per the following technical details:

- Construction of substations in a confined area suitably sized for the power demand. The dimensions will be approximately 900 x 550 x 24m.
- Terrace work and drainage requirements.
- Installation of fencing.
- Installation of equipment foundations.
- Construction of buildings to accommodate secondary plant equipment.
- Installation of transformer and shunt reactor plinths.
- Construction of concrete road within substation boundaries.
- Erection of steel structures with maximum height of 24m.
- Installation of transformers and shunt reactors within oil containment areas.
- Construction of concrete access road from main Gaborone to Francistown road, approximately 400m length.

For comparison purposes, a picture of a similar but smaller substation constructed in Botswana, has been included in Figure 6.2 below.

Figure 6.2 An example of a smaller substation similar in concept and appearance.

The construction of the substation will entail, but not be limited to the following activities:

- The erection of temporary camp sites for construction workers and for storage of construction equipment.
- Bush clearing, earth works and top soil removal or import, depending on results from geological tests.
- Fencing of the plot.
- Construction of equipment bases, substation access roads and storm water drainage systems.
- Construction of transformer and shunt reactor plinths and control buildings.
- Installation of transformer and shunt reactors and switch gear.
- Installation of fire prevention and oil spillage systems.

A summary of the project components has been provided in Table 6.1 below.

Table 6.1 Project Components

Proposed Phase	Associated Activities and Features
Construction	Clearance of substation plot and access road for inspection and maintenance.
	Construction of substation, including foundations, fencing, installation of electrical equipment, construction of buildings and testing.
Operation	400/220kV substation at Isang, with associated line bays and high voltage transformers. This substation will provide electricity supply to the proposed Gaborone and surrounding areas. The substation will create opportunity for connection to the proposed Morupule B, Mmamabula and other future powerstations
	Maintenance and clearance of the plot will continue to ensure minimum clearance requirements are adhered to.
	Routine maintenance and inspections will be undertaken for the substation.
Transport	A new access road (concrete) will be constructed from the main Gaborone to Francistown road to the substation.
	The use of vehicles will be employed in transporting supplies to and from site.
Surface Structures	The substation will included a steel frame with a maximum height of 24 m. All installed transformers and switchgear will be lower then this. The existing 220kV lines and the new 400 kV line from Morupule B will be connected into the substation.
	The substation will initially be partly equipped , but is expected to have an ultimate maximum footprint of 900 x 550 meters. The substation structures will include perimeter fences, transformers, shunt reactors and switchgear, lattice steel gantries and control buildings.
Closure	Closure of the project site.
Decommissioning	Decommissioning of the structures and reclamation of the project site.

6.2 PHASING

The Isang substation project is currently at the detailed engineering design phase. The EIA is being carried out simultaneously to the engineering design, and any required changes recommended during the EIA process will be communicated with the engineers, with aim to update designs where possible.

The planned phases for the project are shown in Table 6.2 below.

Table 6.2: Planned stages within the development of the project

Phase	Expected completion date
Engineering Design Phase	June 2009
Tender Phase	October 2009
Contract Award	December 2009
Construction Phase	December 2010
Operational Phase	December 2011

It is notable that for electrical engineering projects, items such as new transformers are on long delivery times. After appointment of a contractor, it usually takes a number of months before a contractor can start the actual work, due to these delivery times for equipment.

7 SCOPE OF THE EIA

Scoping was undertaken by the EIA consultants so as to analyse the receiving environment and establish a baseline against which predicted changes to the environment can be measured, and the potential impacts that may arise from the proposed development can be identified.

7.1 APPROACH

Prior to composing this project's environmental ToR, a variety of scoping exercises were undertaken by the individual consultants using a variety of methodologies described herein, depending on the environmental parameter being investigated at this stage. This included (but is not limited to) the undertaking significant liaison with stakeholders and the general public, as well as examining baseline data from the project area, and other EIA studies done for similar projects, particularly in Botswana.

Part of the scoping done for this proposed development included significant public participation as well as communication and liaison with Interested and Affected Parties (IAPs). All issues raised during the scoping exercise stemming from such consultation are included within this document, in Chapter 9.

The scoping phase also identified the geographical study area on which the EIA would focus. It was established that the geographical zone studied in each specialist environmental parameter within the EIA would be unique to that parameter due to the individuality of the varied environmental impacts that are predicted to arise. The following list applies to the individual environmental parameters assessed:

Table 7.1: Geographical Scope of the EIA: Study Area

Environmental Parameter	Geographical Zone
Ecology	Within site boundaries, and a zone of +/- 500m outside site boundaries / corridor (flora) and 5 km (fauna).
Archaeology	The physical substation site boundary plus 500 metres additional radius around the site
Landscape and Visual Amenity	The Zone of Visual Influence (ZVI), likely to be within 3 kilometres from the project site
Socio-Economic Environment	Zone of 3 kilometres radius from the project site and the community of Malotwana.

7.2 EXISTING ENVIRONMENT IN THE PROJECT AREA

This section describes the current receiving environment predicted to be affected by the proposed development. Assessing the environmental setting prior to commencement of the development is critical as it identifies points of sensitivity examined in the scoping exercise, as well as potential mitigation measures and alternatives that will be investigated throughout the EIA process.

The proposed project site is in an area that is sparsely populated, there are however a number of infrastructure developments surrounding the project site:

1. Two 220kV overhead power lines, running parallel to each other, towards the north-western side of the proposed substation site.

2. The Gaborone to Francistown A1 road to the eastern side of the proposed substation site.

3. The Gaborone to Francistown railway line to the eastern side of the proposed substation site and A1 road.

4. An Orange cell phone tower to the eastern side of the proposed substation site, between the A1 road and the substation site. The cell phone tower is located along the proposed access road.

5. Three boreholes installed by cattle post owners in the area.

A layout of the proposed substation has been provided in the previous chapter, in Figure 6.1. This layout also shows the existing infrastructure described above. The site is currently vegetated with grass and bush type vegetation, a picture is shown in Figure 7.1 below.

Figure 7.1 Current condition of the Isang site.

Along the existing 220 kV powerlines, and within the boundaries of the proposed substation, BPC has already been allocated of the tribal land rights for a smaller 200m x 200m site. This site was used for holding an old transformer. The transformer is not longer in use, and is due to be decommissioned before the start of the proposed Isang substation construction.

7.2.1 Physical Environment

The study area lies on a plateau which is generally characterised by flat to gently sloping terrain. Altitudes range between 960m and slightly more than 961m above see level. The highest point on the site (only referring to the site area surveyed) is located on the south western boundary (at 961.6m) while the lowest point lies near the far north-eastern boundary (at 960.15m). Refer to Figure 7.2 below.

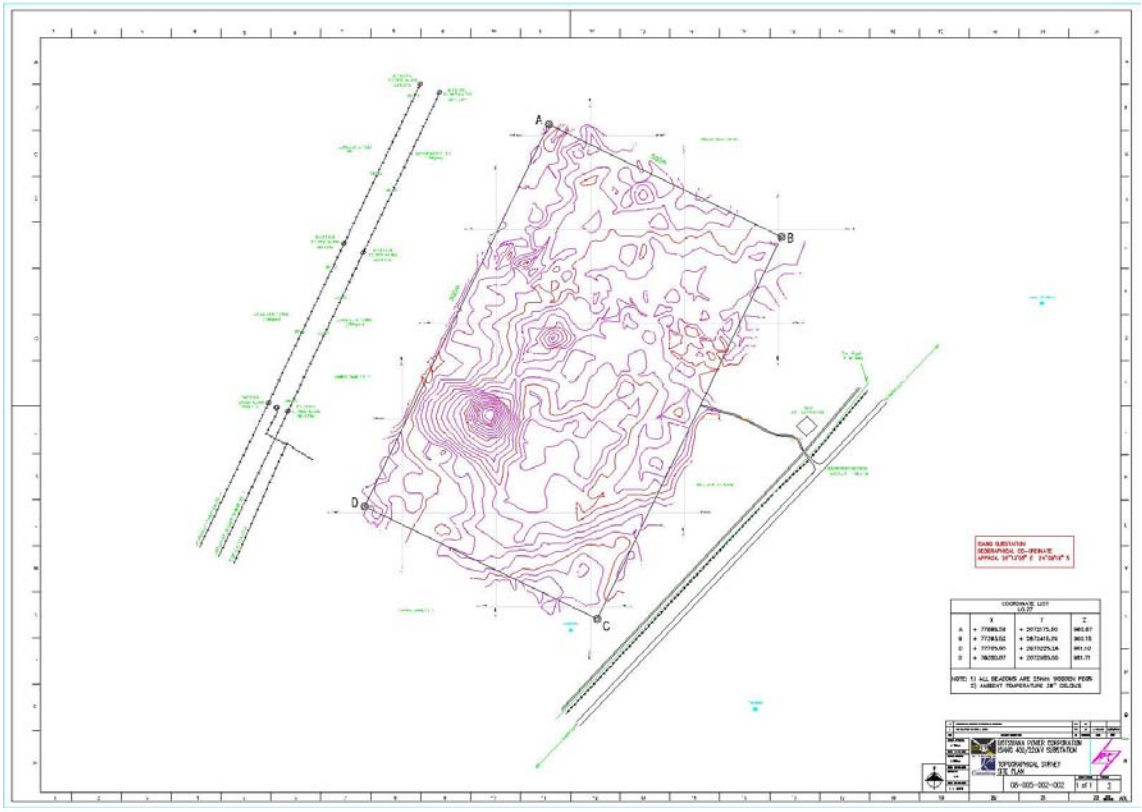

Figure 7.2 Topographical survey of the Isang site.

The area has a slope range of between 0 and 3 percent, with more than 50% of the site lying within 0 and 1 percent slope range. The terrain slopes gently to the east and north.

Due to the general flatness of the terrain this will subject the area to sheet floods in times of very high rainfall. The area and tracks around the substation become difficult to access by vehicle, the current drainage may present a challenge for effective stormwater drainage as well as gravity aided reticulation systems. The provision of stormwater ditches and trenches in the substation designs is further evidence of these conditions.

7.2.1.1 Surface Hydrology

The project area has poor groundwater development prospects. There is a great lack of groundwater largely due to the underlying granite rocks that have very poor secondary aquifer characteristics because of a lack of well interconnected open fracture systems. The hard rock geology has negligible primary porosity and poor secondary porosity, as a result resources are difficult to locate, and generally unpredictable.

Where water is found in fractures or dykes, the static water level ranges from 10m to 100m, depending on the location. Regional groundwater flow, such as it is, is from southwest to northeast. Three existing boreholes were identified in close proximity to the site, but none within the site boundaries. The boreholes are relatively shallow and low yielding boreholes, installed by farmers for provision of water to the cattle posts. The location of the boreholes is shown in figure F.1 in the previous chapter.

Considering the above, water should be measured as a scarce resource and a valuable commodity during all stages of the proposed development at Isang. Water restrictions, water saving devices and water re-use are ways to minimise water usage.

The vulnerability class indicated is “low vulnerability” and described as areas mainly with low potential of ground water resources, the low potential of fractures within the granite formation and the great depth to the water table (>60m) indicates that the study area is associated with low groundwater vulnerability.

7.2.1.2 Geology

Geology in the area is assigned to the Granite Complex of early Proterozoic era Complex (Quarter degree Sheet 2425D Geology Map- Department of Surveys and Mapping). The Gaborone granite intruded the Lobatse Volcanic group in the early Proterozoic era and the cooling of the magma produced concentric lithological zoning in the granite. Granite rocks dominate this major intrusion which covers an area of over 5 000 square km in south eastern Botswana that includes the site area. The geology of the site is primarily composed of different geological units of the Gaborone Granite intrusion. Limited sedimentary deposits found in the area are mainly of sandy alluvium that also overlays granite bedrock. Small isolated areas have dolerite sills and dykes in the areas on the western part of Gaborone dam.

The two geological units typical of the study area are Thamaga Granite (Rapakivi granite with micro granite sheets on the majority of the airport property on the south of the site) and Kgali Granite (medium grained, felsic equgranular granite that covers the northern end).

Concerning to building foundations and construction purposes, Isang presents in general good and stable conditions. Practically there are no serious constraints relating to rock types with intrinsic faults is likely to restrict new developments and improvements of existing physical structures.

7.2.1.3 Soils

The soil type in the area belongs to the group of soils associated with Luvic Arenosols and metamorphic rocks (hardveld).

These soils are developed from sand deposits derived from the weathering of medium grained rocks. The soils are characterised by having low moisture holding capacity and for crop growth, frequent fertilisation is required due to the low fertility status of the soils (Botswana National Atlas, 2000).

Natural vegetation associated with these soils includes medium trees of which some tend develop rooting depths of 60 metres because of the 50 cm thick soils that occur as top layer. The top layers are mostly sandy and or including sandy loam materials. The presence of Acacia tortilis (Name) also usually indicates a good soil layer deeper than 20 cm. The soils are moderately deep to deep, well drained, pale brown to yellowish brown loamy sand. They are also classified as deep to very deep, well to somewhat excessively drained, red to strong brown fine sands to loamy fine sands.

7.2.1.4 Climate

There are no climate details available for the Isang area, the nearest meteorological station is located at SSKA airport in Gaborone. The climate records at SSKA airport compiled by the Department of Meteorological Services (DMS) were made available for this study. A summary of the climate records at this stations is presented in the following sections.

The climate of the greater Gaborone area is sub-tropical semi arid with summer rainfall. The long-term average annual rainfall is 559mm, with almost all rainfall occurring during summer months from October to April. Rainfall tends to be erratic and localised, falling in spells of high intensity. This can result in significant volumes of run-off over very short periods causing soil erosion, and depending on location, downstream flooding.

The maximum temperature ranges from monthly mean of 22 Cº in July to 32 Cº in December and January. However extremes can reach highs of 43 Cº. Minimum temperatures range from a monthly mean of around 5 Cº in July to 19 Cº in January. In extreme cases it can fall to -5 Cº early morning frosts can be experienced between June and August, particularly in low lying areas.

Prevailing winds are east and northeast, although there is a large portion of the year (between 30 – 40% depending on the time of year) when it is still. The wind rose as recorded at SSKA meteorological station, is shown in Figure 7.2 below. South easterly winds dominate in winter early mornings.

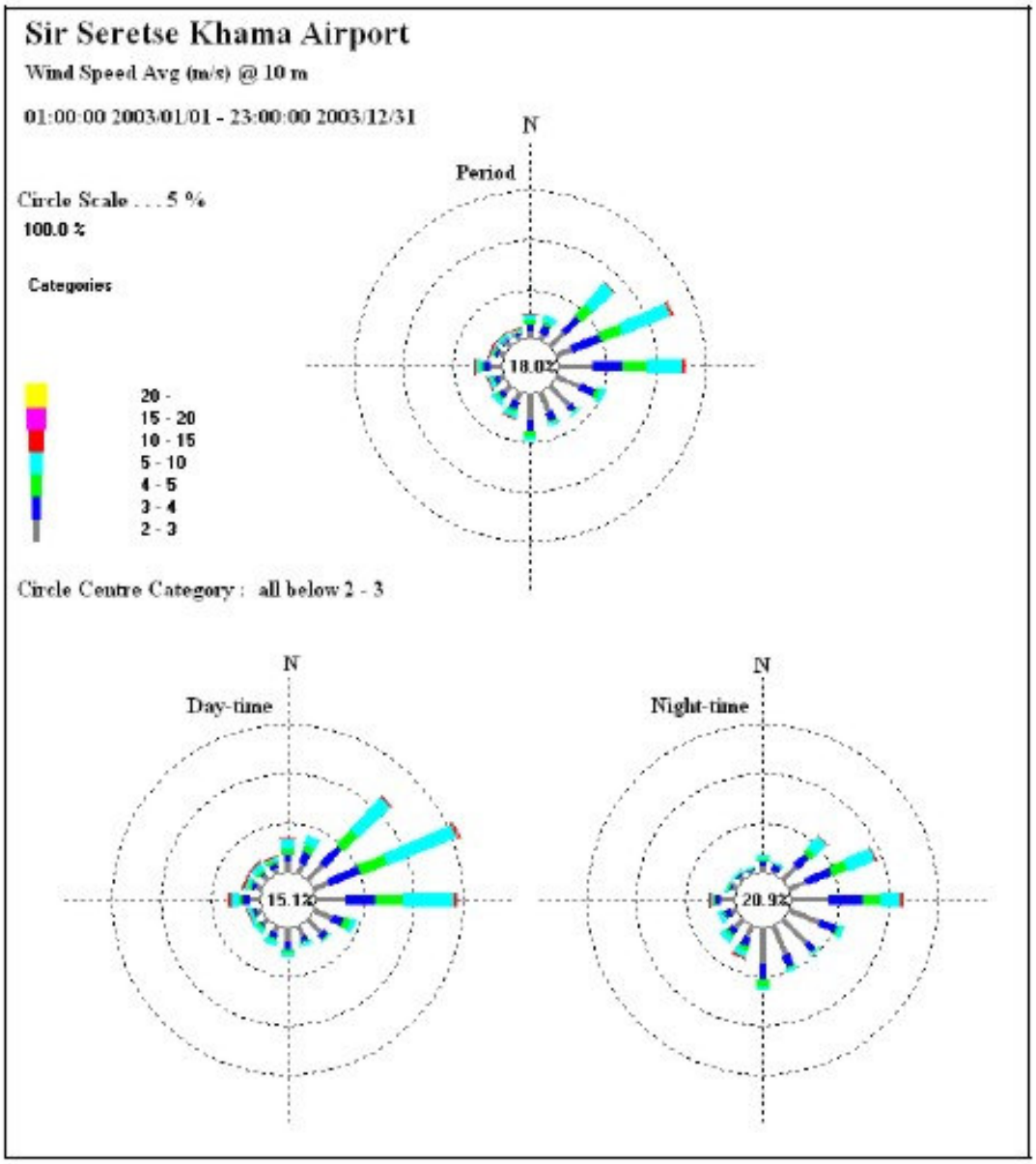

Figure 7.2 Wind Rose, as recorded AT SSKA

Evaporation rates are high with open pan evaporation being in the region of 1732 mm to 1994 mm mm/year, or approximately 3.5 times the annual average rainfall.

Humidity is relatively low, with 55 to 75% recorded for morning and 45 to 25 % for afternoons

7.2.1.5 Ecology

The area contains vegetation and habitats that are well represented outside of the site. It is expected that no rare and endangered animal species occur exclusively on the site.

A short, close canopy shrubland savannah consisting of Acacia and Combretum species dominates the local vegetation. Tree height is generally 3 to 6 metres, while shrubs are generally ~1 to 4m in height. Trees and shrubs are generally distributed in clumps, with 5-15m spaces between the clumps.

Many of the larger trees, and tree clumps provide nesting habitat for birds and small, tree-dwelling animals.

7.2.2 Existing Environmental Issues

As described earlier in this chapter, the proposed site is surrounded by existing infrastructure, including a road, two 220kV overhead powerlines, a railway line, an Orange cell phone tower and a number of boreholes. The existing environmental issues in the study area are largely related to these developments:

- There is fencing installed along the road corridor, which has stopped free movement of wildlife between areas.
- Clearance has been undertaken in the road corridor as well as the powerline corridor.
- The A1 road is the main haulage route from Gabonone to Francistown and further north, and carries a large volume of heavy duty trucks. The traffic is a safety concern for people in surrounding villages, as well as a cause for 'road kill', noise and air pollution.
- The overhead powerlines as well as the cellular phone tower are causing significant visual impacts.
- The railway line is used for regular cargo traffic, this train traffic can cause noise and air pollution. It can also be a cause of collision and accidents with people, cattle and wildlife.

The EIA will address the existing environmental issues, particularly in the context of potentially creating cumulative impacts[1], when considering the potential effects of the proposal.

7.3 TERMINOLOGY

Methodologies used in the assessment of environmental impacts vary between scientific disciplines and consultants. Often prediction of impacts are based on "best practice" and experience in the area of expertise, and in some cases models or tests are run on the characteristics of the existing environment. Such methodologies are highly dependant upon the nature of the development and the scientific discipline being examined. Potential environmental impacts upon landscape and visual amenity, for example, are analysed by site visitation and visual assessment. While potential impacts on archaeology are largely predicted by base map study and literature review on the history of the surrounding lands by a qualified, registered archaeological sub consultant. For this reason, in the project EIS, individual methodologies will be outlined within each section pertaining to distinctive areas of study, when specific models and tests are utilised. Chapter 8 of this document will explore individual methodologies for the EIA in more detail.

[1] Cumulative Impacts are the addition of many individual impacts to create one larger, more significant impact.

Notwithstanding this, the general Loci Environmental methodology for undertaking an EIA conforms to the philosophy that the end product:

- is relevant to the specific characteristics of the project and of the environmental features likely to be affected by it, and
- the information it contains may reasonably be gathered having regard to current knowledge and assessment methods.

To this end, Loci's "best practice"-based methodology ensures that all environmental impacts which are likely to be significant are assessed. There is no specific definition in Botswana environmental guidelines of what constitutes significance of impact in this context, but the following factors should be considered:

- The relative importance of the environment i.e. is it of national, regional, district, local, or site-specific importance;
- The scale of the change e.g. positive, neutral, or adverse (refer to Table 7.3).
- A degree to which the environment is affected e.g. enhancement or impairment (refer to Table 7.4);
- Whether the effect is temporary or permanent and if temporary its duration (refer to Table 7.5);
- The degree of mitigation that can be achieved, and how.

Impacts may be wide-ranging in nature. This includes the potential to be direct or indirect, secondary, cumulative, short, medium or long-term, permanent or temporary, positive or adverse effects. Therefore, in an effort to construct a methodology for impact assessment terminology, Loci uses the following scales when referencing ***nature of impact***:

Table 7.3: Description of Scale of Change used in Impact Assessment

Scale of Change	Description of Scale
Adverse/Negative	A change that reduces the quality of the environment
Neutral	A change that does not affect the quality of the environment
Positive	A change that improves the quality of the environment

Table 7.4: Description of Severity Levels used in Impact Assessment

Severity Level	General Description[2]
Insignificant/ Negligible	Environmental parameter will remain largely unaffected by positive or adverse impact. Impact unnoticeable in general.
Slight	Environmental parameter minorly affected by the positive or adverse impact, to a point whereby the impact may or may not be noticed by the receptors affected. Mitigation can alleviate all or most slightly adverse impacts.

[2] General description that can be refined as per scientific discipline for specific purposes as appropriate.

Moderate	Development causes a degree of impact that will cause a noticeable change in the environment by a majority of receptors affected. Mitigation measures should overcome most moderately adverse impacts.
Significant	Potential change in the daily experiences of all receptors due to the impact caused by the development. The impact would require a significant change in management practices with associated costs. This level of impact would require considerable mitigation measures and not all adverse effects may be overcome.
Profound	Impact affects 100% of receptors, with no mitigation measures applicable. An environmental parameter may be completely obscured, made void or invalid, or destroyed completely, due to profound adverse effects.

Table 7.5: Description of Change Duration used in Impact Assessment

Duration	Approximate Length of Impact Predicted
Temporary	Predicted to occur for approximately one year or less
Short-Term	Predicted to occur for approximately 1 - 9 years
Medium-Term	Predicted to occur for approximately 10 - 19 years
Long-Term	Predicted to occur for approximately 20 - 60 years
Permanent	Predicted to occur indefinitely
Construction Period	Predicted to occur for the length of construction phase only

The EIS will be written in clear terms and aims to be as understandable as possible. However, where unavoidable, any complex scientific and environmental issues addressed using necessary technical language and terms, will be defined and explained within a glossary addressing any technical words and acronyms.

8 KEY LINES OF ENQUIRY AND SCOPING RESULTS

Key lines of enquiry (KLOE) are detailed questions stemming from various scoping exercises that provide a framework for the EIA consultants to investigate during the comprehensive environmental assessment. They are formulated by the consultants familiarising themselves with the proposal and existing environment, through scoping and baseline analysis of the proposed development and study area. Each issue or potential impact raised through KLOE and scoping will be investigated in detail by specialist consultants during the EIA study. Therefore they are categorized by environmental parameter within this chapter. The environmental parameters discussed below are those that arose from scoping the initial project for facets of the environment that are likely to be disturbed by the proposal: Ecology, Archaeology, Landscape and Visual Amenity and the Socio-Economic environment.

During the scoping, past, present and future projects and activities in the area that will be carried out and could interact in combination with the development of the substation project were identified and characterized for consideration in the analysis of the contribution of the proposal to cumulative environmental effects. These are identified within the following sections relating to the specific environmental parameter potentially affected.

8.1 GENERAL EIA ISSUES

The EIA will identify the purpose of the proposed development and provide justification for the project to allow for an evaluation of the positive and negative environmental effects.

The EIA will also provide a complete description of the proposal from planning through decommissioning (including any post-decommissioning activities), supported with appropriate maps and diagrams. Emphasis will be placed on describing those aspects of the proposed substation with a reasonable probability of occurrence that could be expected to affect the environment.

The EIA will address the existing environment of the project site, and provide answers to the following general environmental KLOEs:

- What is the terrestrial physical environment, including topography, geology, hydrology, soils and groundwater resources?
- In what state or quality is the terrestrial biological environment, including species at risk and their habitats (flora and fauna), species migratory patterns, ecologically sensitive or significant areas, and protected areas or important habitat features?
- What is the current use of land and resources?
- What is the existing public sentiment about the project?

8.1.1 Developer's Alternatives

One of the major Key Lines of Enquiry to be addressed in the EIA is evaluation of alternatives to the proposed substation development. Specifically, the project must examine the ability of each alternative to achieve the project objectives, and whether or not the alternative is favourable or unfavourable to the overall project, environmentally or otherwise. This requires the description of alternatives to the development and of alternative means of carrying out the project.

It is envisaged that The Client should analyze the alternatives identified, and how such alternatives would alter any predicted impacts. Therefore the EIA will provide a reasonably detailed analysis of alternatives to the original development plan, components or activities, including but not limited to the list that follows, which includes those alternatives that were raised by the consultants during the scoping phase:

- Alternative locations for the Isang substation;
- Alternative substation structure types;
- Alternative employment strategies during construction and operation;
- Alternative inspections and maintenance methods and schedules;
- Alternative access road location or design;
- Alternative clearance methods and schedules;
- Decommissioning and reclamation methods; and
- Other alternatives that BPC may have considered already in past projects or may be considering

When discussing alternatives the study will also provide an overview of how environmental conditions have influenced the project design, and will not limit alternative means for carrying out the development to alternatives the developer currently considers feasible. Ultimately, the EIS will list and explore all alternatives identified by the developer, environmental consultants, and any other parties involved. This includes those alternatives considered and potentially dismissed during the design and feasibility phases, and will investigate any reasons given for dismissal.

The “no-development” alternative will be included in the alternatives description. The analysis of this alternative will evaluate the need for the project.

8.2 ECOLOGY

The following KLOEs will be addressed through an in-depth study of the biological environment:

- What is the state of forest/vegetation cover, existing wildlife (flora and fauna), rare or endangered species, sensitive habitats, species of commercial importance, migratory paths of birds, nuisance species and pests, in the area?

The ecology investigation will be prepared following an initial study of relevant literature, maps and aerial photographs followed by a field visit. The following paragraphs will describe the steps followed.

A literature review will be conducted in order to assess the environmental sensitivity of the area and to identify any ecological and/or biodiversity hot-spots within or close to the site location. In addition, issues such as habitat fragmentation, impacts of the project on animal migration routes, and facilitation of hunting/poaching along the site will be assessed in terms of level of significance to the integrity of the wildlife and vegetation resources of the area.

The ecology impact assessment study will conduct the following activities:

- Describe the current state of flora and fauna in the study area, outlining important characteristics which may be influenced by the proposed infrastructure or which may influence the proposed infrastructure during construction and operation.

- Identify Red Data species, and other bird species of conservation or other (such as 'avitourism') importance potentially affected by the proposed activities.

- Identify any rare or endangered species or sensitive habitats.

- Identify potential impacts (positive or negative, including cumulative impacts if relevant) of the proposed development on ecology during construction and operation. Particular attention will be paid to safety of fauna and bird collisions and preventative measures since this is the main direct mortality effect of power lines of this size.

- Identify mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of the proposed transmission lines).

- Formulate a simple system to monitor the above impacts, and manage them where necessary during the construction and operation of the proposed power line.

- In addition, the ecologist specialist will identify any other aspects related to flora and fauna in the study area that should be incorporated into this EIA.

8.3 ARCHAEOLOGY

Notwithstanding the inherent need for scoping to be undertaken as required by the EIA Act, it is required by the *Monuments and Relics Act* of 1970, that the project archaeologist will undertake an Archaeological Impact Assessment (AIA) at the site.

Natural, scenic and cultural landmarks such as archaeological heritage sites are equally important resources that can enhance economic development, in particular tourism development and offer recreational facilities. The need to preserve these resources is a primary concern in general environmental protection. The protection of such cultural and historical heritage is regulated through the provisions of the *Monuments and Relics Act*. In spite of these provisions, the scenic and cultural heritage of the country is often times threatened due to lack of gazettement and documentation and by encroachment of various land uses.

As with the other environmental parameters being studied throughout this EIA, the archaeological component will also entail a degree of scoping to be carried out during the undertaking of the AIA. Prior to commencing field work, a desk study is conducted by the team which entails summarising existing knowledge of the area, including prehistory, historical attributes of the region, potential importance of scientific research in the project area, specific details of the development and its potential damage to the archaeology of the area. This is done by:

- Conducting an inventory of historical and archaeological resources in and around the project area.
- Collation and documentation of existing written reports and oral information.
- Identification of areas of maximum sensitivity.

KLOEs stemming from the baseline and desktop study information include:

- What is likely to be found on site during field work?

- What mitigation strategies or any alternative actions can be put into place within the project EIA to protect any monuments and relics already known to be on-site? (This also applies to those that may be further discovered through field work to be conducted.)

Field work and further impact identification will be conducted in the following manner:

- Foot survey of the proposed project site, utilising GPS, aerial photographs and available maps
- Identification of individual threats to the cultural, historical, and archaeological resource
- Assessment of the proportion of sites to be impacted
- Assessment of the direct and indirect impact on the resource
- Oral interviews conducted.

Finally, data analysis and reporting will be undertaken by the archaeological team and will include:

- Laboratory analysis of any archaeological finds
- Designation of identified sites with numbers upon concurrence with the National Museum
- Production of scaled photographic documentation of the resources
- Assessment of the significance of potential impacts
- Evaluation and interpretation of the findings according to the National Museum grading system:

1 = Preserve at all costs
2 = Preserve if possible, otherwise extensive salvage work
3 = Test excavation, or in the case of natural monuments, sufficient specific sample is submitted to determine whether further work is necessary
4 = Systematic representative sampling sufficient
5 = No further archaeological work is required.

Within the assignment of a grade, consideration will be given to the current degree of damage, how common the sites are, uncertainty of its status or importance, likely development impact, research potential, and whether the find is of national or regional importance.

The AIA will cumulate in integral input into the overall project EMP, particularly addressing means of impact avoidance and mitigation measures for implementation if artefacts or sites are found throughout the construction phase of the project. The final report will be submitted to the National Museum for approval.

8.4 LANDSCAPE AND VISUAL AMENITY

The following potential visual and landscape character impacts were identified through the scoping exercise, which looked into the physical various components of what the project would include:

- Substation location.
- Amount of clearance for the site.
- Type of substation structures.
- Access and maintenance tracks.
- Tie in connection to existing 220kV powerlines.

Based on these findings, the following methodology is proposed for an appropriate and thorough measurement to be made of the identified impacts:

- The landscape and visual assessment within the EIS will follow the methods described in the Landscape Institute and IEMA Landscape and Visual Assessment Guidelines 2002. The report will set out to make a comparative assessment of the likely landscape and visual impacts associated with the proposed substation development.

- The appraisal will begin with a description of the existing landscape setting to establish baseline conditions.

- The landscape character section of the assessment will assess the impact the proposal will have on the landscape character and quality. Assessment will be undertaken through analysis of up to date maps and aerial photography in conjunction with detailed plans and sections of the proposal.

- The landscape will be appraised to allow it to be described and classified into landscape character types which enable the categorisation of landscape quality. The proposed components of the substation and physical characteristics are then applied to this baseline and potential landscape impacts recorded.

- The capacity of a landscape to accept change of the type proposed will be assessed. The key landscape components are landform, vegetation and historical and cultural components. Landform relates to topography, drainage and geology. Historical and cultural components include historic landscapes, listed buildings, conservation areas, historic designed landscapes and mythology.

- General viewshed analysis from site visits and cartography study will be included in the assessment, primarily to identify from how far away the development will be visible, who the visual receptors will be, and how severe this impact will be on them.

Ultimately, any mitigation measures that can be proposed to alleviate adverse impacts on the landscape character and visual amenity of the area will be explored. Residual impacts remaining post-mitigation will also be discussed in depth, and a severity assigned to allow comparison with forecasted un-mitigated impacts. These will be further compiled within the project EMP, for attention during the design, construction, operational, and decommissioning phases of the project.

8.5 SOCIO-ECONOMIC ENVIRONMENT

Typically an EIA includes information pertaining to potential socio-economic impacts and proposed mitigation measures which are intended to rectify or enhance the impacts identified. Results, predicted impacts, mitigation measures, and cumulative impacts identified this process will be adopted into the EIA within the Socio-Economic Impacts chapter of the EIS, and mitigation/enhancement measures will be included within the project EMP for attention during the various phases of the project.

The environmental team has already conducted interviews at the national and sub-national level with informed persons, with the aim of soliciting insights into social impacts, securing available materials and data, and collecting factual data.

Key issues to be investigated during the SIA include, but may not be limited to, the following:

- Impacts on communities proximate to the substation site.

- Opinions of affected communities about the substation.

- Recommendations from affected communities about the substation.

- Development context.

In considering these impacts, the following should be investigated:

- Settlement.
- Migration.
- Employment and incomes.
- Expectations about construction, operations, decommissioning.
- Concerns about construction, operations, decommissioning.
- Possible social and health risks associated with living and working close to the substation.
- Recommendations about construction, operations, decommissioning.

The Loci team considers the social impacts of the nature of construction and operations, and make recommendations accordingly. Policy documents from the Botswana Power Corporation (e.g., wellness policy, HIV&AIDS policy, corporate social responsibility policy, environmental policy, etc.) are also reviewed.

9 STAKEHOLDER AND PUBLIC CONSULTATIONS

The EIA Act requires that a public consultation be carried out during the second phase of the EIA process: the Scoping stage. This Chapter provides the details of the stakeholders and public consultation exercise at length.

That which has been done to date in the interest of EIA scoping is outlined and discussed within this document. Continued consultation and cooperation specifically with local farmers, and authorities working on the project is anticipated throughout the length of the EIA study.

9.1 PUBLIC CONSULTATION TO DATE

A public participation meeting was conducted at the *kgotla* in the village of Malotwana. The meeting was held on the 16th of February 2009 and the attendance was satisfactory as many of the local residents turned up to attend the *kgotla* meeting. The names of the attendees were recorded in an attendance register which shows that nearly 70 residents attended the meetings.

21 days prior to the meeting date, an advertisement for the public meeting was placed in the *Mmegi* newspaper, in compliance with the EIA Act. It is the EIA Act's regulation that an advertisement must be placed in the local newspaper at least 3 weeks before the date of the meeting. A copy of this advertisement can be found in Appendix B. In addition to the advertisement, posters were displayed in Malotwana and surrounding villages to raise awareness about the meeting.

The public participation meeting was facilitated by the representatives of Loci Environmental Mr. Johannes Westra, with the interpretation support of Loci Environmental consultant Mr. Eric Mohale. The client TAP/KEC was represented by Mr. Norman Ford and Mr. Ron Coney, and representing the Botswana Power Corporation (BPC) was Mr. Chere Mabiletsa, who provided technical answers to the questions raised.

The key comments and concerns raised during the meetings are outlined in the paragraphs below.

<u>Introduction by Mr. Johannes Westra</u>

> "The EIA Act was legalised in the year 2005 in consideration of the environment, to assist in the development of infrastructure in the country of Botswana. There are several stages that are followed in the EIA process, one of which is Scoping, under which public consultations are undertaken. The eventual report produced from the EIA process is a document called an Environmental Impact Statement (EIS).
>
> The BPC intends to develop a substation in Isang, which is located on the between Malotwana and the village of Artesia. The footprint of the substation will measure 500 x 900m. The perimeter will be fenced off with 2 fences placed strategically. There will be an inner and an outer fence which will secure the substation equipments and also prohibit livestock and unauthorised persons from entering. The substation will connect with transmission lines from Morupule power station, as they continue on to connect to locations such as Gaborone and in future, neighbouring villages.
>
> [Mr. Mabiletsa showed the group pictures of a substation, similar to the proposed one]
>
> It has been established that the development of the substation will bring about positive and negative impacts on the natural environment and social environment.

Loci and BPC have considered carefully, these impacts on the environment and are determined to establish the necessary mitigation measures. The positive impacts that are foreseen from the substation development include improved power reliability in neighbouring locations, creation of temporary jobs for the residents of Malotwana and the provision of firewood from the removal of vegetation according to the layout of the designs.

The negative impacts of this development will include the loss of grazing land for the livestock within the vicinity, the blocking of paths used to traverse the area, the visual impact due to the substation intruding upon the existing landscape and construction impacts such as creation of dust. Despite the negative impacts, there is need to recognise the positive impacts of the development for country as a whole. Mitigation measures will be implemented to minimise the negative impacts.

We are here today to obtain your views and opinions on the matter, due to these potential local impacts."

Questions and Answers

Following his presentation, questions were solicited. The main issues raised during this session included:

- Construction commencement: The people are keen on knowing when the project will begin and are anxious to have it commence in no time. It was explained that work is expected to begin in 2010.

- Security measures: Issues about efficient security were raised in order to find out if the livestock and the public within the area will be safe from the power in the substation. Of which it was announced that 2 types of fences will be erected to keep trespassers out.

- Expected construction period: Due to complaints about the period of most construction jobs being too short for good employment, the public were eager to know how long the project will take from start to finish. The people were informed that the length of the project will be 12 to 15 months.

- Compensations: The people asked if there will be compensations from the government, to people who might lose their lands due to this construction. The people were then explained to that the land that is being acquired is virgin land that belongs to no one.

- Labourers: It was mentioned by the people that sometimes during construction works, authorities do not source the skill of the local labourers to improve rural development but instead come with workers from elsewhere. The answer given was that BPC has a strict policy of encouraging rural development by hiring local workers where construction is taking place.

Conclusion

The people welcome the proposed development and expressed their gratitude towards BPC, as they will now have improved livelihoods due to sufficient power from the substation. They desire that the project proceed as soon as possible so that they may start enjoying the benefits now.

Issues about HIV/AIDS were raised as concerns that might impact the society during construction. Therefore people must exercise caution to protect themselves.

Concerns by other individuals, regarding the welfare of the livestock in the area, were brought up and it was noted that a separate meeting will be conducted with the farmers' syndicate for the Isang cattle posts. The meeting will iron out any issues involving the safety and wellbeing of the livestock within the proposed substation vicinity.

It was further elaborated that an Environmental Management Plan will be drawn up so that strict measures are followed in ensuring that positive impacts are enhanced and negative impacts minimised. One of the ways of ensuring this will be successful is to carry out inspections for compliance during construction.

9.2 STAKEHOLDER CONSULTATION TO DATE

Stakeholders in the local area were briefed individually about the project and their comments and views were recorded. The interested and affected parties that were reached are included in the list below.

Table 9.1: Interested and Affected Parties

No.	Name	Organization	Designation
1	M. Lentswe	Tribal Administration	Chief Mochudi
2	I. Mabiletsa	MP's Office	Kgatleng East MP
3	R. Modipane	MP's Office	Kgatleng West MP
4	R. M. Kedimotse	Landboard	Board Secretary
5	M. Lepina	District Office	District Officer
6	Rev. M. Moruakgomo	Kgatleng District	Council Chairman
7	J. Nsala	Kgatleng District	Council Secretary
8	K. Ntapu	Kgatleng District	Council Physical Planner
9	M. Segokgo	Kgatleng District	Council Environmental Officer
10	M. Mutaoriwa	Kgatleng District	Economic Planner
11	D. Aniku	Department of Environmental Affairs	Director
12	G. Matlapeng	National Museum	Archaeologist
13	S. El-halabi	Department of Public Health	Director
14	M. Motlhatlhedi / Madisa	VDC	Chairman
15	W. Seone	Department of Water Affairs	Station Manager
16	T. Tuelo	Department of Roads	Senior Technical Officer
17	K. G Maselesele	Department of Tourism	Director
18	H. Mhotsha	Department of Lands	Board Clerk

19	M. M. Senombe	District Agricultural Office	District Co-production Coordinator
20	D. Ntwaagae	Botswana Railways	Director Engineering Services
21	T. S. Molefe	Department of Forestry and Range Resources	Coordinator
22	M. Debele	Orange Cellular Service Provider	Network Planning, Maintenance
23	N. Lebotse	Cattle Posts Syndicate	Chairlady

The comments and queries of the stakeholders were recorded and are depicted in the paragraphs below. However, consultation with the cattle posts syndicate is still ongoing and the results of the entire interviews will be discussed and analysed during the EIA phase of the project.

Comments and Queries

Subsequent to the consultations, the following comments and queries were raised:

- Vegetation clearance: The consultation revealed fears from the stakeholders, about the amount of vegetation that might be lost in the process of creating space for the substation.

- Loss of farmland: The stakeholders raised concerns that, with vegetation being cleared, there will be a loss of farmland and livestock might suffer in feeding.

- Visual amenity: The presence of the substation and its transmission lines will bring about aesthetic intrusion on the natural environment. Concerns were raised by the stakeholders that the substation might interfere with the landscape around the Orange transmission tower.

- Effects of substation: The stakeholders were curious to know how the following effects: vibrations, sound, heat and radiation, which might occur from the substation, are going to be mitigated. There were no fears from the Orange stakeholders, about interference of the substation with the existing Orange transmission tower which is located near the proposed substation.

- Livestock concerns: Concerns about the well being of the livestock and wildlife found in the in the vicinity of the substation were also raised, as the stakeholders feared that the substation might be secured with an electric fence/line.

Conclusion

Overall the stakeholders welcomed the project and warned that the above mentioned issues must be taken seriously to avoid disastrous situations on the natural environment and human environment. As mentioned previously, consultations with the farmers in the Isang area are still ongoing and the results will be incorporated in the EIA phase of the project.

10 ENVIRONMENTAL MANAGEMENT, MONITORING

Loci Environmental has a 10 year history of being active in the environmental management of development projects, and since the passing of the EIA Act of 2005 has had approximately 20 EMPs approved by the Department of Environmental Affairs, both within EIA projects and as stand-alone documents requested by the DEA. Loci is also currently involved in a large number of environmental monitoring projects for a variety of developments throughout Botswana, including but not limited to the SSKA International Airport extension, Francistown Sewerage Upgrade, and BOTA Head Offices in Gaborone.

The following is taken from the DEA document: "Draft Guidelines (2008) for Preparing Environmental Impact Studies", and forms the basis for the aims and objectives of the EMP to be included in this project EIS.

> *Environmental Management Plan:*
>
> *The environmental impact assessment report shall include an appropriate Environmental Management Plan (EMP) that would serve as the framework for implementing the mitigation measures during construction and operation of the proposed development. If a decommissioning stage is envisaged it should also be included in the EMP. The report should provide an institutional mechanism for monitoring and recommend steps for its implementation.*

Although the guidelines from which the above have been taken have not been officially published by the DEA, it has been observed by Loci Environmental that structured EMP tables and structured tabular-format Monitoring Plans are becoming a requirement by the department, when authoring EMPs for any type of development. Therefore, Loci proposes the following format/structure to be used in the project EMP, which forms part of the EIS:

Mitigation Plan:

Phase	Activities	EMP issue or Environmental Aspects	Mitigation measure/ action	Estimated cost	Responsibility. Implementing agency

Monitoring Plan:

Impact	Location	Parameter to be monitored	Objective	Key Performance indicator	Responsibility	Frequency	Resources	Reporting structure	Threshold/ standards	Mitigation

10.1 CODE OF CONDUCT

As per the above mentioned DEA draft guidelines, a Contractor's Code of Conduct (CCC) will also be included within the project EMP. The purpose of such a code is necessary as commitment from the project proponent during project construction and operation is vital in the avoidance or minimisation of negative environmental impacts. Therefore a written CCC authored by the project environmental consultant and included in the project EIA must be adopted as part of the project contract documentation.

The CCC provided in the EIA will outline the environmental expectations of the contractor when he/she is carrying out the work that the development of the Isang substation project entails.

11 EIA TEAM

The **core** team that will manage and undertake this commission is as follows:

Project Manager / Environmental Engineer	Mr. J. Westra, Loci
Archaeology	Ms. P. Sekgarametso, Loci
Environmental Consultant / Landscape and Visual Specialist	Ms. J. R. Westra, Loci
Environmental Consultant	Mr. E. Mohale, Loci
Ecology (Flora and (Avi)Fauna) Specialist	Mr. J. Burgess, Loci
Engineering substation specialist	Mr. R. Coney, KEC

Project Manager: Johannes Westra is the Director of Loci Environmental with 7 years experience, and a qualified and environmental engineer (MSc) with experience in the fields of agriculture, environment and industry. Johannes has managed a variety of environmental projects in and outside Botswana, including work related to power upgrade and development, infrastructure development, brewery construction, large-scale airports, and water softening plant development. He provides expert advice in management planning and orchestrating of Environmental Impact Assessments and Environmental Management Plans.

Registered Archaeologist: Princess Sekgarametso-Modikwa. Princess Sekgarametso (BA, BSc Hons) is an extensively published archaeologist registered with and approved by the National Museum, to undertake archaeological investigations in Botswana. Princess has carried out Archaeological Impact Assessments for Loci on a wide range of EIA projects, all of which have been evaluated and approved by the National Museum, and are compliant with the Monuments and Relics Act of Botswana. Ms. Sekgarametso is former secretary of the Botswana Archaeological Society, as well as an active member of the Botswana branch of the International Council of Museums, and Southern African Association of Professional Archaeologists.

Environmental Consultant, Landscape and Visual specialist: Ms. Jill R. Westra. Jill Westra is a Director of Loci Environmental, and a specialist in the field of Landscape and Visual Assessment. Qualified as an Environmental Scientist (MSc) and Associate Member of the Institute of Environmental Management and Assessment (IEMA), Jill has 10 years of experience in the environmental field, all of which have involved work in the field of Landscape Planning and Environmental Consulting. She has managed and contributed to a variety of consulting projects in Botswana, Ireland and Australia including assessments for large-scale commercial developments, power lines and substations, roads and highway designs, and municipal facilities. Jill has extensive experience in presentation of environmental information at public consultation sessions, and has also been called as an expert witness in oral hearing testimony in the field of landscape and visual assessment before An Bord Pleanála (Planning Board), Republic of Ireland.

Environmental Consultant: Eric Mohale. Eric is employed by Loci as an environmental consultant. He has nearly 2 years experience on major development projects in Botswana, including mining projects, powerline and substation projects, infrastructure projects, sewerage and sanitation developments, airport projects and commercial developments. Eric has been actively involved in collection baseline information, coordination and assisting public meetings, and compiling EIS reports and EMPs. Mr. Mohale is also undertaking regular environmental monitoring visits on a number of Loci projects.

Ecologist: Jeremy Burgess. Jeremy is a professional ecologist with a wealth of experience working throughout Africa and specifically Botswana, on environmental impact assessments covering a broad range of industries. His recent experience of relevance includes ecological consulting on national and regional projects involving rural livelihoods, sustainable natural resources use and management, Eco-tourism development, planning for private individuals, as well as National Policy Reviews and recommendations for EIA and EMP on urban and rural infrastructure developments. Jeremy also provides specialist expertise on impacts of fire on mountain water catchments, biodiversity and clean water production. An organisational chart is shown in Figure 11.1 below:

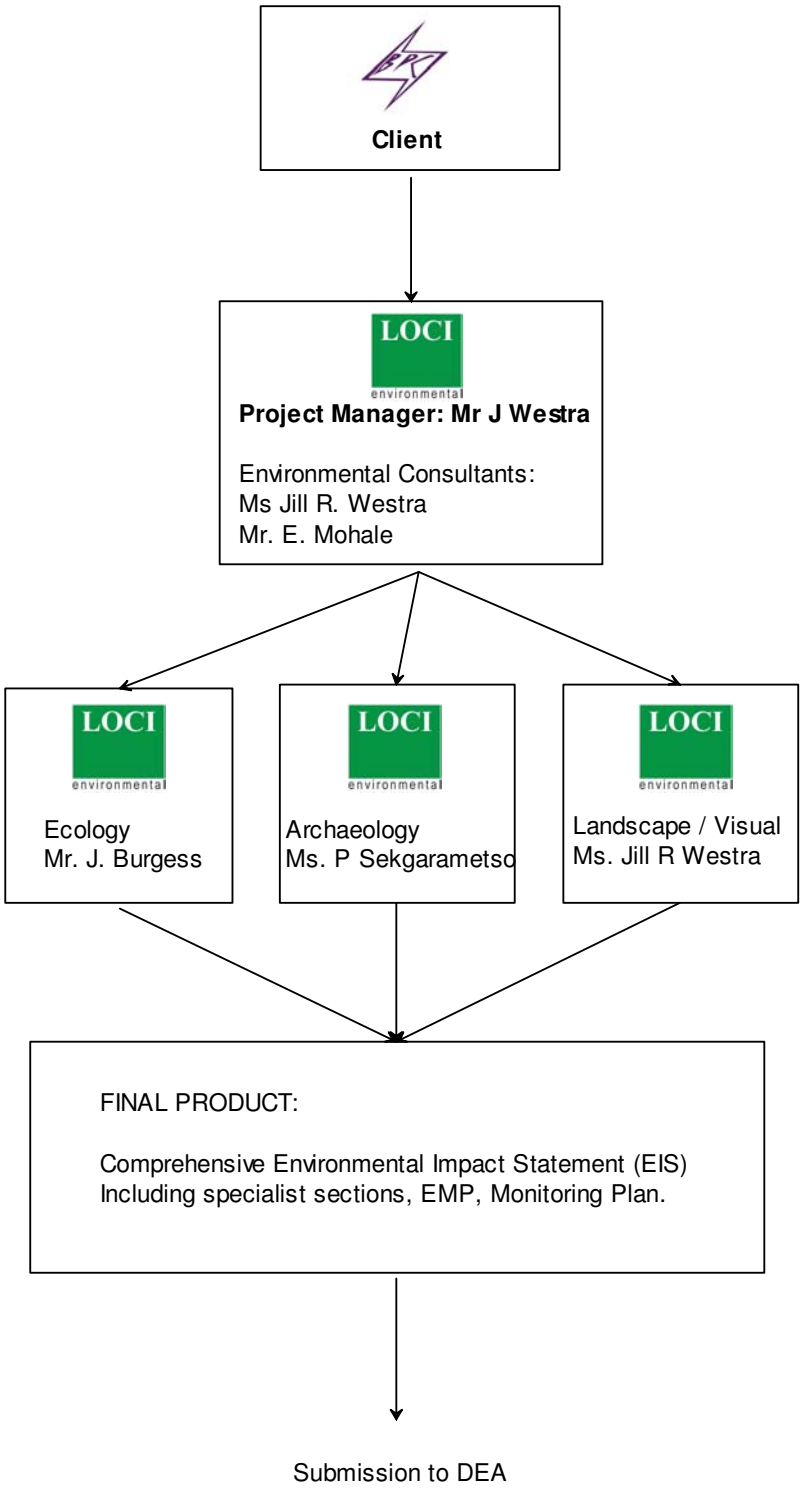

Figure 11.1: Organisational chart for Isang substation EIA studies

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APPENDIX C

Public Consultation and Advertisement

Africa braces for global shockwaves

***ERNEST HARSCH**

When several US investment houses collapsed last September, unleashing a chain of crashes in major markets around the world, brokers at Kenya's Nairobi Stock Exchange anxiously watched the listings on their own boards. As feared, Nairobi share values did drop and by late October were down 18 per cent from the start of the year. But that decline was far less steep than those in New York, London, Tokyo and other global financial centres.

The limited impact prompted Nairobi Stock Exchange Chairman James Wangunyu to explain that "the low level of development of our market and its minor presence in the global context has ensured that Kenya does not suffer a direct contagion effect." But about the wider economy Wangunyu was less optimistic: "Kenya is part of an increasingly integrated global economy and the effects of the financial system turmoil in the United States and Europe is bound to have an effect, albeit a lagged one."

For some Kenyans, there has been no lag at all. In the wake of political violence at the start of the year, Esther Kangogo has been struggling to recover from the damage to her Rift Valley home. For months, a daughter working in Texas regularly sent her money to help. But now, with harder economic times in the US, Kangogo told the UK's Financial Times, her daughter "can't afford to send money back home."

As economic growth slows worldwide and with some major industrial economies in recession, it has become clearer that the repercussions of the global financial crisis will be felt throughout Africa's "real economy" - beyond the narrow realm of stock trading. Dwindling financial remittances from Africans working abroad, lower world prices for Africa's exports, scarcer and more costly commercial credit and less generous flows of foreign aid will inevitably dampen productive activity across the continent.

African ministers of finance and planning, meeting in Tunis in November, warned that the global downturn "constitutes a major setback at a time when African economies were turning the corner." The impact of the global financial crisis, in combination with high food prices, volatile oil markets and the repercussions of climate change will worsen conditions for millions of poor Africans. "We are facing a human as well as financial crisis."

While serious, Africa's current economic situation is not as dire as it once might have been. Seven consecutive years of relatively high growth have allowed a number of countries to build up their monetary reserves and improve external financial balances, providing a cushion against short-term difficulties. In addition, economic reforms to enhance the productivity and efficiency of Africa's farms, factories and markets have made its economies more resilient, notes Louis Kasekende, chief economist of the African Development Bank. "African economies have become more flexible than in the past," Kasekende argues, "and are in a better position than before to absorb shocks."

The International Monetary Fund (IMF) predicts that economic growth in all regions will slow markedly. But Africa's performance will still be relatively strong, with 5.2 percent average growth in gross domestic product (GDP) projected for 2008 and 4.7 percent for 2009.

That compares favourably not only to the hard-hit industrialized economies, but also to the growth rates of some other developing regions, such as Latin America and the Caribbean.

One reason the global turmoil will have a less severe impact in Africa is that capital controls, good banking supervision and strong financial regulation have kept the continent's banks focused on domestic deposits and relatively secure investments. They therefore had little exposure to the sub-prime mortgages and other dubious loans that brought down banks in the US and Europe.

For many poorer African countries in particular, extensive debt write-offs in recent years have contributed to stronger balance sheets. The continent's total official debt fell to $144.5 billion in 2007 (from $205.7 billion in 1999). **(UN Africa Renewal)**

***Ernest Harsch is the managing editor for United Nations Africa Renewal magazine**

APPENDIX D

Ecology - Site photographs

Photo 1: Entrance to the site past the Microwave Transmitter Tower

Photo 2: **View along the main A1 to the south**

Photo 3: **View along the main A1 to the north of the site**

Photo 4: **Western side of the site looking south**

Photo 5: **Access track through the central section of the site**

Photo 6: **View into the central area of the site – open savanna shrubland with moderately good to good grazing for livestock**

Photo 7: **Facilities at the SW corner of the site between the two 220Kv power supply lines**

Photo 8: View to the south across the central portion of the site

Photo 9: **Large Acacia erioloba (Mogotlo) tree on the NE boundary of the site – preferably to be left undisturbed**

Photo 10: **View across the very small pan in the central portion of the site**

The right hand path leads to the small pan

APPENDIX E

AIA and National Museum Approval

BOTSWANA
national
museum

Department of National Museum,
Monuments and Art Gallery

331 Independence Avenue
Gaborone, Botswana
Private Bag 00114
Tel: (267) 3974616
(267) 3610400
Fax: (267) 3902797
Email: national.museum@gov.bw
Website: www.national-museum.gov.b

Our reference:

NM 6/3/1 V (123)

22 May 2009

To: A.R.MS.
P.O.Box 601271
Gaborone

Dear Madam

RE: Archaeological Impact Assessment report of proposed Isang BPC Substation near Artesia- Kgatleng District.

Your client, Botswana Power Corporation is given a planning consent for the proposed substation near Artesia village at Isang cattle post in the Kgatleng District. This planning consent is given on the understanding that there were no archaeological materials found at the proposed Substation plot.

However, In case of chance finds being discovered during ground breaking and clearing stage, this Department should be informed as soon as possible.

Thank you

Yours faithfully

O. Ntebang
For/Director

An Archaeological Assessment Report for the Isang BPC Substation near Artesia. Kgatleng District, Botswana.

May 2009

Prepared by:

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1.0 Introduction

The Botswana Power Corporation proposes to establish a substation near Artesia village at Isang cattle post or grazing lands, in the Kgatleng District of Botswana. Thus, in compliance with the mandated requirements of the Environmental Impact Assessment Act of 2005 and the Monuments and Relics Act of 2001 of the laws of Botswana an environmental impact assessment study was commissioned to evaluate the potential effects of the proposed developments on the natural and cultural legacy of the project areas.

The Environmental Impact Assessment Act is geared towards the assessment of the potential effects of planned developmental activities; to determine and to provide mitigation measures for effects of such activities since they may have significant adverse impacts on the environment. As such it aims to put in place sustainable monitoring processes and evaluations of the environmental impacts of implemented activities; and to provide for matters incidental to the foregoing activities.

The Monuments and Relics Act aims to protect and promote the cultural diversity that manifests itself in different environmental settings upon which planned developments take place. The act stipulates that it is illegal for any unauthorized person to alter, destroy or damage ancient sites or monuments, or to remove archaeological materials from their sites of discovery. On that note, Archaeological Impact Assessment (AIA) study was commissioned so as to investigate the probability of archaeological resources or cultural heritage within and around the project area. The legislation provides for an archaeological impact assessment to be carried before any form of alteration to the landscape takes place in any given area in Botswana. **Appendix 1** shows the map layout of the project area

2.0 Synopsis

This report therefore presents the findings of an archaeological survey that was carried out for the proposed substation accordingly. By and large, Archaeological Impact Assessment (AIA) is an integral part of the development process and is undertaken as part of an umbrella Environmental Impact Assessment. The object of an archaeological impact assessment is to identify archaeological sites within the proposed development area so that appropriate mitigation strategies can be implemented to care for the identified archaeological and heritage resources.

It is only after the impact assessment has been carried out and the results made available to the Botswana National Museum that the developer may be given permission to proceed basing on the recommendations of the report. As a result, an archaeological reconnaissance survey was conducted to determine whether or not there are any significant archaeological remains within or near the proposed development area.

Since the planned project activities for instance, during construction will involve disturbing the landscape, it was therefore necessary to carry out the survey before any activity to determine how the development activities would impact the archaeology in the area under investigation.

Archaeological remains are a material consideration in the development planning process. Archaeological sites provide very useful information on the history of mankind. Their protection must be balanced against the need for economic growth and development. Archaeological remains are a finite and non-renewable resource, and should therefore be regarded as a part of the environment to be protected and managed. The historic environment of the southern African county has evolved through many centuries of human activity, comprising the earliest prehistoric human settlements. On that note, archaeological sites are the main source of information about the Botswana's past and the only tangible evidence of that past. The protection of such sites is, therefore, significant in safeguarding the national heritage and this is done under the auspices of the Monuments and Relics Act of 2001 as expressed earlier.

This Act, which is implemented, monitored and enforced by the National Museum, protects all archaeological sites (ancient monuments) and artifacts (man-made objects or 'relics') dating before 1902, whether or not they are known and registered with the National Museum, as well as any historic structures and objects since 1902 that have been proclaimed a recent historic monument, historic landscape or recent artifact, as well as natural features that have been proclaimed a natural monument.

This AIA involved the physical survey of the project area so as to obtain and provide an inventory of sites within the project impact zone. The impact of the development on the sites will be assessed. Recommendations will then be made on whether or not a site may be destroyed, or whether mitigation, such as mapping, excavation dating, etc will be required.

3.0 Archaeological Background

The archaeology of the kgatleng District is known from a few researches and a number of archaeological impact assessments that have been done in the area. Very little is known about the Early Stone Age of the area around Artesia. Middle Stone Age tools have been excavated in areas around Artesia such as at Bokaa Dam (van Waarden, 1998). Middle Stone Age tools are associated with Homo sapiens (Neanderthal) as they represent a greater variety of specialized tools suggesting a wider range of activities and resources that were exploited. Robbins (1990) interpreted Middle Stone Age tools as being suggestive of base camp activities.

Later Stone Age tools are said to have been made of small flakes such that the tools are often referred to as microliths. These were made out of stones that formed very sharp blades. The site of Matsieng near Mochudi has been associated with the Later Stone Age period. This site of Matsieng has footprints, which are believed to have belonged to Matsieng the first human to enter the world through a hole (Walker, 1997).

Early Iron Age sites have been reported in the Mochudi area by Segobye (1987) dating to the 10th century A.D. According to Segobye (2000) Southeast settlements have been found to be few and less elaborate in their architecture, size and range of material culture associated with them. A number of Iron Age sites have been reported around Mochudi, which include those of Raserura, Oodi hills and Modipe hill.

The Iron Age period in South Eastern Botswana has often been associated with the coming of farming communities. These sites were identified by new ceramic styles that appeared which are today referred to as Moloko and Eiland. Moloko has been associated with the first Sotho-Tswana groups that entered Botswana. This group is said to have displaced the groups of Bakgalagadi living in the South East and occupied their land. This is when such groups such as Bakwena, Bangwaketse and later Bakgatla came to occupy the Southeastern parts of Botswana (Campbell, 1991: van Waarden, 1992).

4.0 Historical Background

Towards the end of the 15th Century, according to Tlou and Campbell (1997) a group, whose founder was Mokgatla, broke away and moved northwards. They moved first to live with the Bapedi to whom they were related and later to live on their own. In the 16th Century, merafe (groups) are said to have continued to grow large and split up. The Bakgatla split up and one group moved southwards towards the Vaal River to become the Batlokwa, while the main group remained living in the north near the Bapedi (Tlou and Campbell 1997).

Bakgatla who had been living in Rustenburg split up in the 17th century. Thabane and his large group moved to the North and his elder brother Mogale moved eastwards to Pretoria with the rest of the group. Mogale, had a son, Matshege who died in 1650, leaving two children; a daughter in the first house and a son in the second. It is with these two children that further divisions occurred. Some Bakgatla followed the daughter, Mosetlha, and others followed the son Kgafela. Those that followed Kgafela are the ones known today as Bakgatla ba ga Kgafela who reside in Mochudi and surrounding areas including Artesia and those who followed Mosetlha were already living in the southeast Ramotswa initially, then later moved to Moshupa, Thamaga and Gamafikana in Kanye. This group is known as Bakgatla ba ga Mmanaana (Tlou and Campbell 1997).

In Mochudi, around the 1870s, Kgamanyane had Bakgatla to settle in Mochudi where the current Kgotla is. The kgotla is an institutional center pin of Tswana society- court and point of reference. Traditionally the physical components of the Kgotla were the open area available for the assembly of large numbers of people with a shelter (leobo) for community leaders, a cattle kraal and Chief's house.

Over the years, the Chief's Kgotla in Mochudi has undergone extensive change. When the Bakgatla first settled in Mochudi, two houses were built by Chiefs Kgamanyane and Linchwe I. One of these is used today as an office for the Tribal Police and the other is a private home. The Kgotla itself was entirely encircled by compounds (malwapa) occupied by Kgosi Kgamanyane's 52 wives; most of them were demolished in the 1930s and 1940s when the Kgotla was made accessible by road and a new stone walled kraal and office for the Chief and small Tribal Administration staff office was constructed. Today there remains only a single lelapa of all those which were once occupied by Kgosi Kgamanyane's wives- fittingly; it is owned by Phuthadikobo Museum.

On the wall of the kraal can be seen a plaque which records the burial there of the two Chiefs, Linchwe I and Molefi. In other respects too the Kgotla has seen significant change. In 1981, the old timber leobo (shelter) was demolished and replaced, the cattle kraal now is only occasionally used, the tribal office has been much extended and the assembly area, which was normally vacant, has become a much used car park.

Undoubtedly the most important event to occur in the Kgotla was the enquiry in November 1934 into the differences between Kgosi Molefi and the ex Regent, Isang. The six day meeting was attended by the British Resident Commissioner and by many of the Dikgosi, including Tshekedi who arrived in Mochudi accompanied by 200 horsemen. Isang was found guilty of showing disrespect to the chief and of undermining his authority. He was fined 350 pounds and ordered to stay at his cattle post for six months. Molefi was censored for his drunkenness and irresponsible conduct and six 'guardians' were appointed to ensure that he attended properly to his duties (Tlou and Campbell 1997).

5.0 Survey Methodology

5.1 Desktop study

Before field survey was carried out, archival material kept at the Botswana National Museum, Botswana National Archives, University of Botswana and the National Libraries were consulted to gather relevant information on the general archaeological, historical and cultural background of the proposed project area.

The Botswana National register of archaeological sites kept at Botswana National Museum was also consulted to find out if there were any reported sites at or near the proposed project area. The following table show reported archaeological sites as recorded by the Botswana National Museum.

Table 1 List of reported sites by the Botswana National Museum

Site Number	Name	Type	Location
46-A3-1	Matsieng	Rock Engravings/SA	07 06
46-A3-2	Bokaa Dam	MSA	398 000E 729 00N
46-A3-2b	Rasesa	IA	067 036
46-A3-3	Bokaa slag site	Recent	400 500E 729 6900N
46-A3-3b	Raserura	IA	117 057
46-A3-4	Mathobenyane	IA	105 053
46-A3-5	Raserura East	IA	125 052
46-A3-6	Mochudi	Cultural	131 039
46-A3-7	Mochudi	Cultural	144 040
46-A3-8	Phuthadikobo Museum	IA	142 032
46-A3-9	Tshele Hill	IA Ruins	014 052
46-A3-10	Morwa Hills	LIA	052 990
43-A3-11	Morwa Hills	LIA	048 990
46-A3-12d	Morwa Hill south	IA circa AD1700?	-
46-A3-13a	Morwa Hill	IA Circa AD1700?	-

5.2 Detailed archaeological survey

This comprised comprehensive and systematic field walking of the area earmarked for the establishment of the Isang substation. The survey was mainly based on filed walking. As such, the entire project area was thoroughly walked with detailed surface inspection of the ground. This stage of assessment was done in order to confirm the presence or absence of archaeological signatures; their character, extent and possible impact by the development. A hand held GPS instrument was used to mark the locations or positions of important features encountered in the project areas. As mentioned earlier, the survey relied entirely on field walking as the primary method of locating archaeological resources or remains in the vicinity of the proposed project areas. A digital camera was used to take pictures of important features within the project area.

5.3 Brief Oral interviews

To supplement data obtained from the desktop study and field walking this study intended to conduct some oral interviews among a few households around project area to gather first hand information on the archaeology of the area. However, it was found that there were no households near and around the proposed development area. On that note, only two custodians at the Orange network tower were consulted since they were the only ones near the proposed Isang substation project area.

.

Figure 1: Interviews with Mr. Bonamile and Maphalala at the Orange network tower

Table 2: List people consulted during the brief oral interviews session

Name of interviewee	Age	Archaeological/historical knowledge
1. Bonamile Mathuntsha	27	-None
2. Tlhalefang Maphalala	22	-None

6.0 Results of the survey

The focus of the archaeological investigation was within the primary area where the proposed substation extension is to be. As mentioned earlier, the proposed site was systematically walked to assess the probability of archaeological sites. Nonetheless, no archaeological sites or artifacts were encountered within the proposed area. The Botswana National Museum has a site classification system, which is used to assess archaeological sites' relative importance as follows:

1 = Preserve at all costs
2 = Preserve if possible, otherwise extensive salvage work,
3 = Test excavation to determine whether further work is necessary,
4 = Systematic representative sampling sufficient
5 = No further archaeological work required.

This system was to be used to grade site(s) encountered within the proposed project area.

The following figures illustrate features that were encountered within the proposed Isang substation area.

Figure 2: Some markings in the project area

Figure 3: Some animal burrows within the project area

7.0 Summary and Management Recommendations

This report has presented the findings of an archaeological assessment survey that was conducted at the proposed Isang substation project area near Artesia village in the Kgatleng district. The following is a summary of the whole archaeological investigation together with the resultant recommendations to be adhered to by the developer.

- Nothing of archaeological significance was found during this survey. However, the absence of archaeological material on the surface of some areas does not mean that they are unlikely to encounter during development when the area is excavated.

- The contractors should keep a watching brief, and should anything of archaeological significance be found they should immediately inform the Botswana National Museum, as is required under the Monuments and Relics Act 2001. They should also be reminded that a development permit must be obtained (either by them or the developer) prior to any clearing or construction-taking place.

- All these would be done to meet the requirements of the Monuments and Relics Act (as amended, 2001) of the laws of Botswana. This act protects all archaeological and or historic monuments and sites in the country whether they are recorded in the National Museum site register or not. The act also recommends that upon encountering archaeological material, relevant authorities should be informed. Section 18 prohibits any alteration, damage or removal from original site any national monument, relic or recent artifact. The act also recognizes the fact that the alteration, damage or removal of monuments and relics may be occasioned through authentic developments. Section 19, therefore, provides for predevelopment archaeological impact assessment and mitigation where planned developments are likely to disturb the earth's surface.

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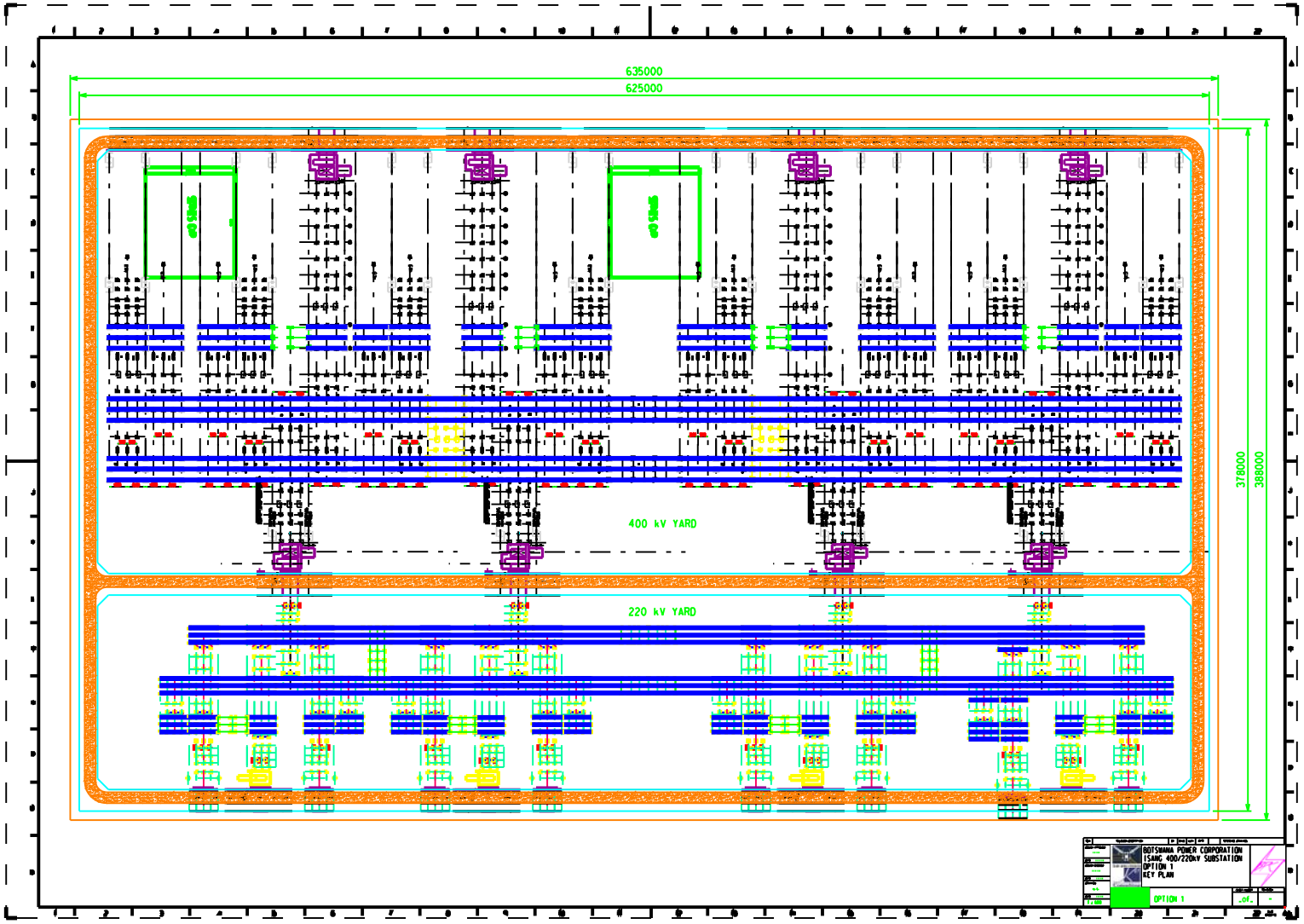
APPENDIX F

Technical Drawings


635000
625000
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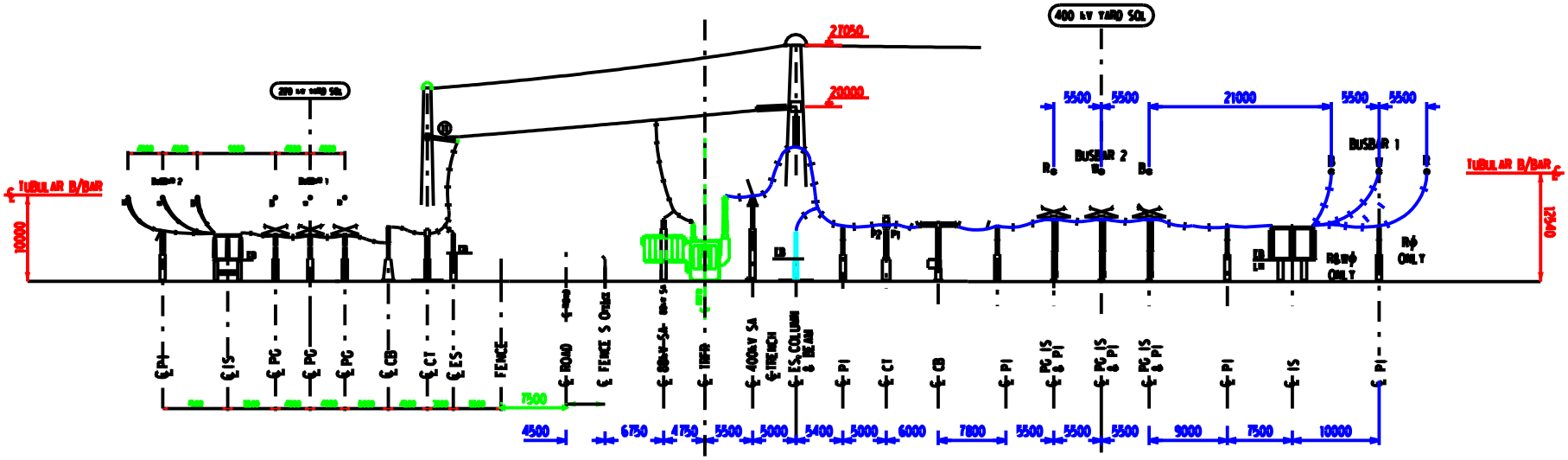
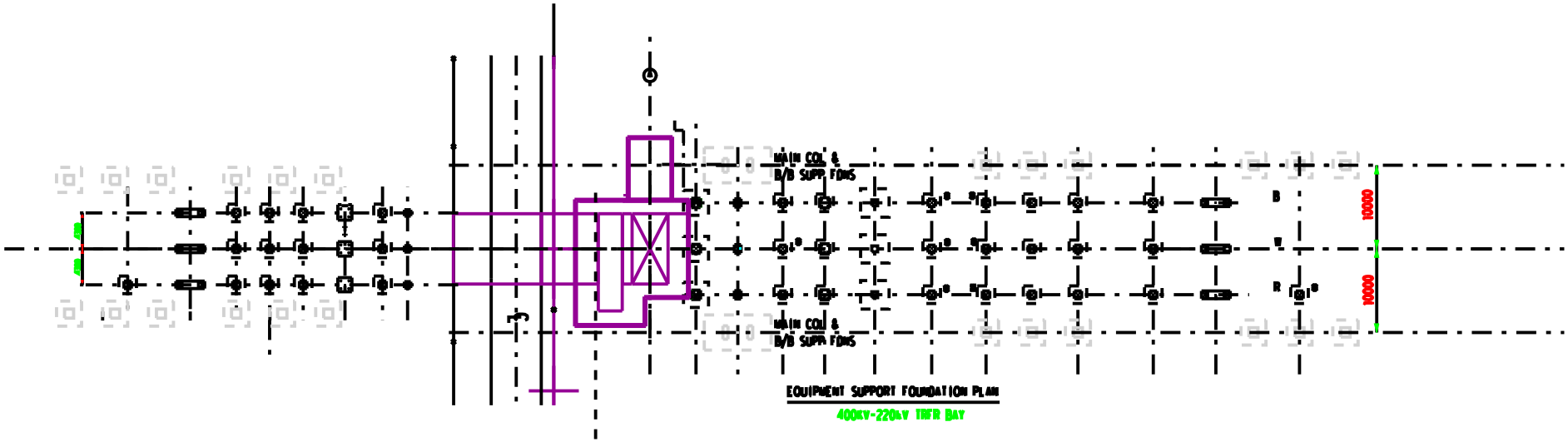
388000
400 kV YARD
220 kV YARD
BOTSWANA POWER CORPORATION
15MVA 400/220kV SUBSTATION
OPTION 1
KEY PLAN
OPTION 1



ELEVATION ON ELECTRICAL EQUIPMENT



EQUIPMENT SUPPORT FOUNDATION PLAN

400kV-220kV TRFR BAY

FOR INFORMATION PURPOSES ONLY

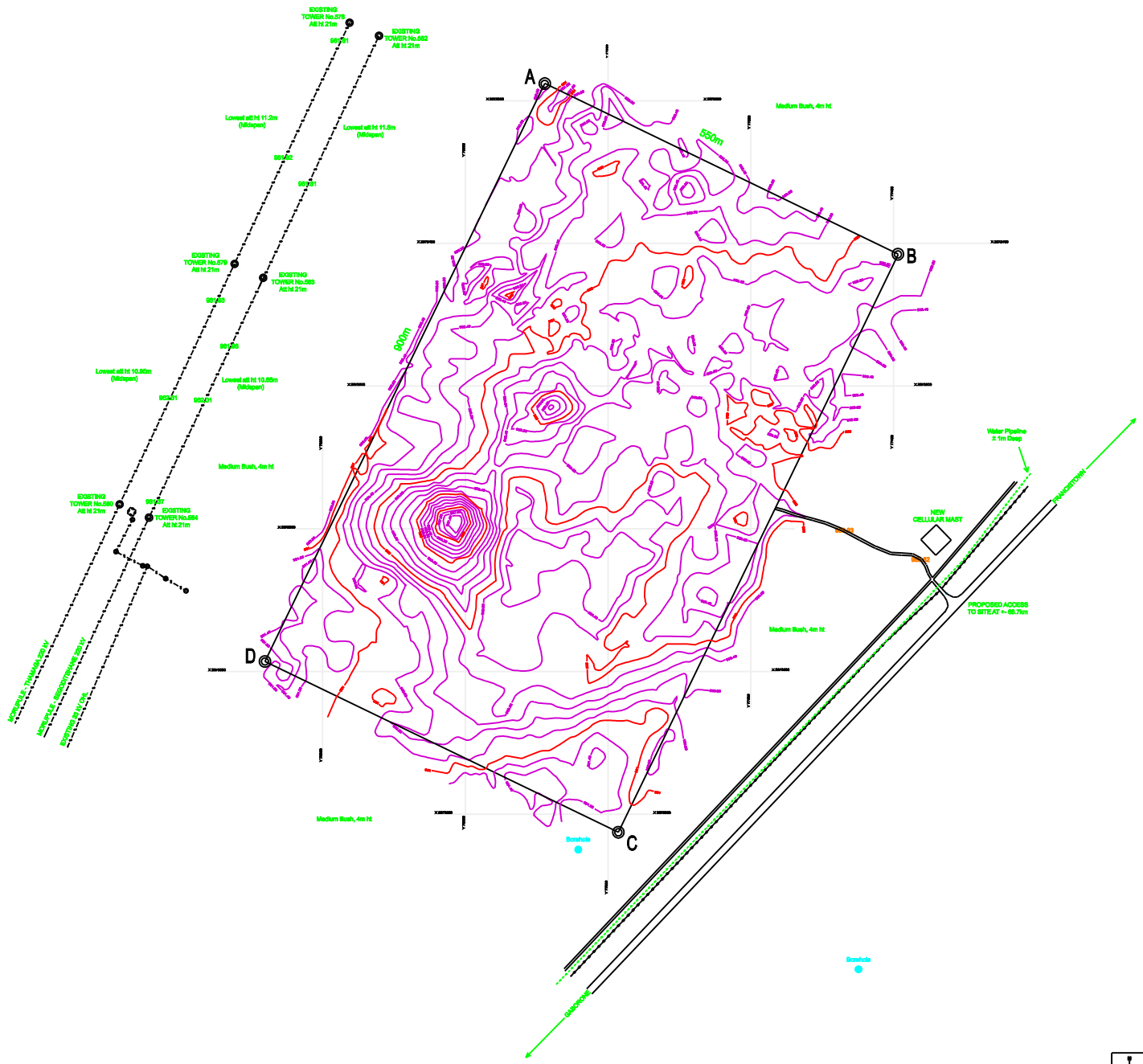
BOTSWANA POWER CORPORATION
ISANG 400/220kV SUBSTATION
OPTION 1

TYPICAL SECTION

OPTION 1

1 of 1

0



ISANG SUBSTATION
GEOGRAPHICAL CO-ORDINATE
APPROX. 26° 15'55" E 24° 09'19" S

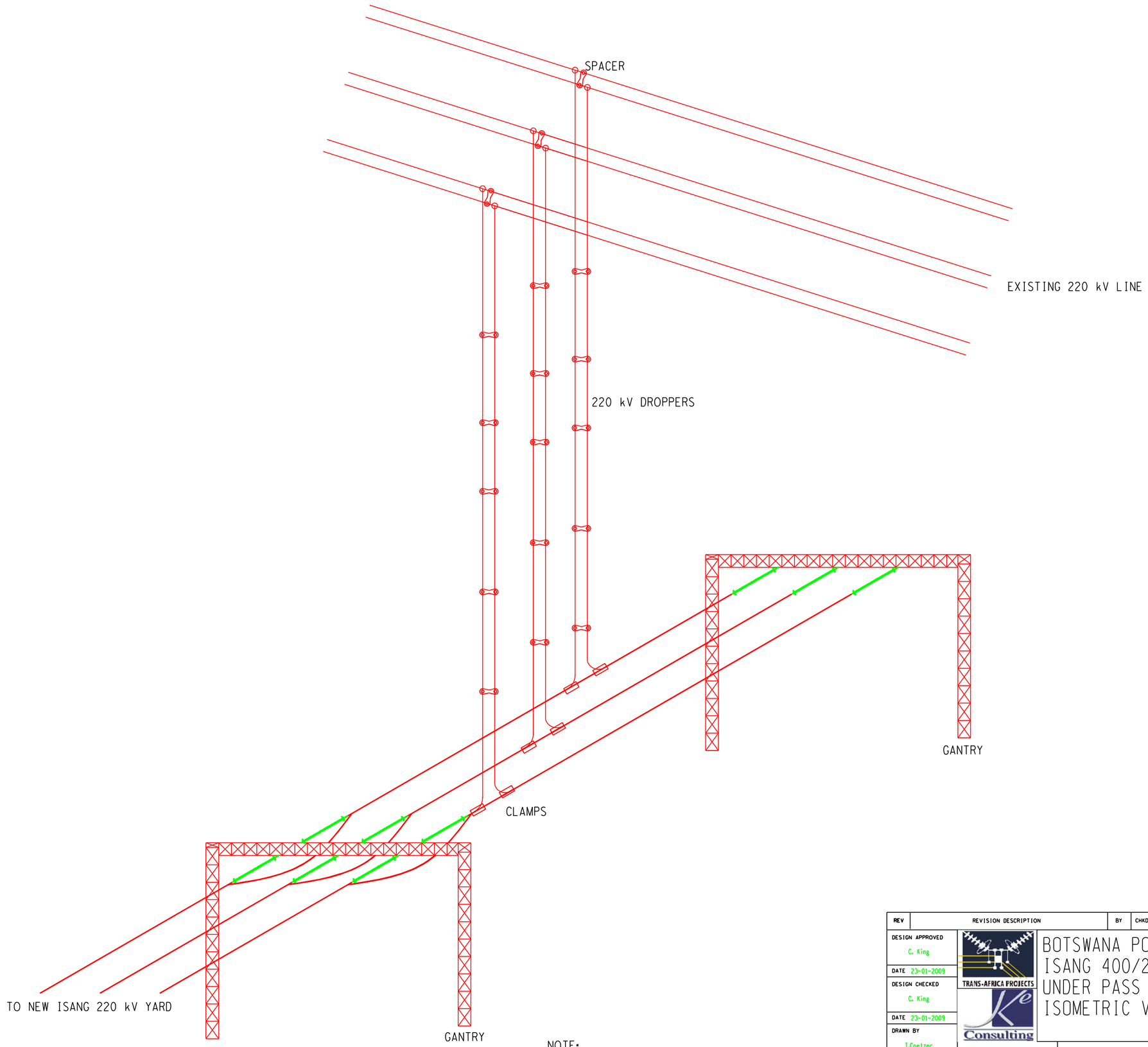
COORDINATE LIST LO.27			
	X	Y	Z
A	+ 77888.59	+ 2672175.60	960.87
B	+ 77393.52	+ 2672415.09	960.15
C	+ 77785.60	+ 2673225.28	961.10
D	+ 78280.67	+ 2672985.85	961.71

NOTE: 1) ALL BEACONS ARE 25mm WOODEN PEGS
2) AMBIENT TEMPERATURE 38° CELCIUS

BOTSWANA POWER CORPORATION
ISANG 400/220kV SUBSTATION

TOPOGRAPHICAL SURVEY
SITE PLAN

08-005-002-002 | 1 of 1 | 2



NOTE:
ALL 220 kV ELECTRICAL STANDARDS AND CLEARANCES
TO BE IN ACCORDANCE WITH IEC STANDARDS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE		REFERENCE DRAWINGS

DESIGN APPROVED C. King
DATE 23-01-2009
DESIGN CHECKED C. King
DATE 23-01-2009
DRAWN BY T.Coetzer
DATE 17-11-2008
NTS

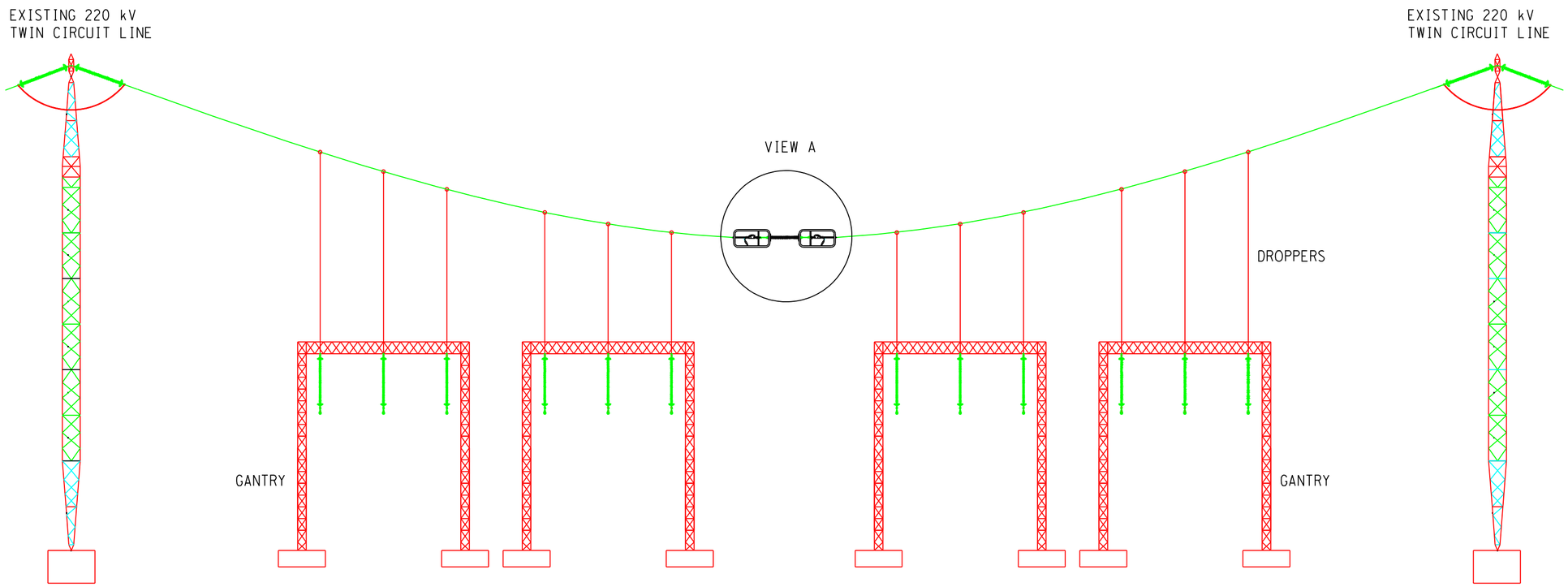
TRANS-AFRICA PROJECTS
Consulting

BOTSWANA POWER CORPORATION
ISANG 400/220 kV SUBSTATION
UNDER PASS DETAIL
ISOMETRIC VIEW

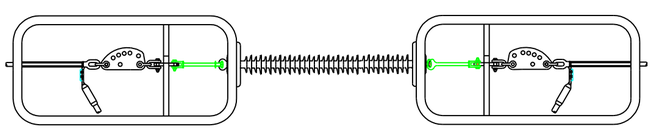
08-005-002-003

SHEET NUMBER 1of2
REVISION 0

SIZE GROOTTE A2L



VIEW A: TYPICAL FLYING INSULATOR



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Consulting

BOTSWANA POWER CORPORATION
ISANG 400/220 kV SUBSTATION
UNDER PASS DETAIL
SIDE VIEW

SHEET NUMBER	REVISION
2of2	0

08-005-002-003

SIZE GROOTTE A2L