ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE PROJECT OF CONSTRUCTION AND REHABILITATION OF MEDIUM VOLTAGE LINES FOR DISTRIBUTION NETWORK SYSTEM STRENGTHENING WITHIN KIGALI CITY

Prepared by

NSHIMIYIMANA Fabien: Team Leader

TUYISHIME Pascal: Environmental Safeguards Specialist/EDCL

Willy UWIZEYE: Social Safeguards Specialist/EDCL

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EXECUTIVE SUMMARY

Rwanda Energy Group through its subsidiaries is planning to rehabilitate and upgrade the existing Meduium Voltage Lines in Kigali City in order to increase the sustainability of electricity supplied in the City and its environs. The project stands to increase the access to electricity services as well as better services delivery in electricity sector. The project will also improve the living conditions of people, as well as the quality of environment and socioeconomic development in Kigali City.

Therefore this EMP report has been prepared in accordance with the RDB's guidance and request and basing on the environment law N° 48/2018 of 13/08/2018 and in accordance with the Ministerial Order N° 001/2019 of 15/04/2019 establishing the list of projects that must undergo environmental impact assessment, instructions, requirements and procedures to conduct environmental impact assessment.

This report gives the findings of the impacts identified when implementing the project of construction and rehabilitation of mv line for distribution network system strengthening in Kigali City and gives in details the proposed and required actions/ measures to better manage and protect the environment and the population.

Objectives of the study

The main objective of this study is to identify the environmental impacts associated with the proposed project of construction and rehabilitation of mv line for distribution network system strengthening in Kigali City and to recommend appropriate environmental management strategy for the project. Thus, a core outcome of the report is an Environmental Management Plan (EMP) for the project.

Approach and Methodology

To conduct this study, care has been taken for the requirements of the conduct of the Environmental Management Plan and considering the objectives, purpose and the scope of works of the project.

The study followed the following approach: (i) field surveys (ii) review of primary and secondary data on baseline information on the project area (iii) review of project documents and (iv) consultations with the city of Kigali and other involved stakeholders. This was completed to collect information and data on various aspects of the project.

Locations, surrounding land cover, proposed project activities and any other associated works were fully accessed to make the task of planning and monitoring easier during the implementation of the mitigation measures of identified impacts.
The prediction of positive and negative impacts, analysis of alternatives, proposal of mitigation measures leading to the preparation of an Environmental Management Plan, were all incorporated in this Report.

Main Impact identified

The project highlights significant social, economic and environmental issues associated with the design, construction and operational aspects of the proposed project. The project is meant to stimulate the socio-economic development and sustainable infrastructure development of in Kigali City specifically and in Rwanda at large. The identified impacts are categorized as negative and positive. The identification of the impacts on the environment showed that during the construction, there will be a number of some negative impacts on environment however the positive impacts associated to the project implementation prime on the negative impact

Positive impacts expected include:

- Job creation and employment opportunities
- Improved electrical supply network System
- Access to reliable electricity Supply
- Increased economic activities and other associated opportunities arising from the project.
- payment of taxes on purchased goods and materials and hence contributing to poverty alleviation
- Transfer of skills from construction activities.
- Beautification of the City of Kigali through replacement of overhead line with underground line

Shortly the project will improve the existing condition of electricity power supply within the city will pave the way for economic development with continued investment in all allied infrastructure development sector.

However the project is also expected to generate some negative impacts on the environment including:

- air pollution through dust and machinery emissions
- Risk of excess soil being eroded and deposited on working area.
- noise pollution by using machinery and other transportation systems on site,
- soil erosion downstream project area and loss of vegetation and soil
- dust emissions which may rise during excavation works

- Pollution of the areas of origin of the construction materials(quarries)
- Possible injuries and incidences from work activities
- Disruption in Daily Living and Movement Patterns
- Disruption of Infrastructure and Services

Mitigation measures were proposed for each of identified adverse impacts to an extent that they can be reduced, limited or eliminated hence manageable and avoided where possible.

This plan recommends the mitigation measures, procedures be followed, and the responsibility to the implementation as well as the estimated cost of implementing each of the proposed mitigation measures.

Conclusion

The project aligns with the Government of Rwanda's policy objectives and visions as well as programs that support the increase of wellbeing of all Rwandans. The proposed project is very important to the city of Kigali residents and its environs. The EMP indicates that the general project negative impacts value is rated as low since the project shall not involve significant deviation from the existing alignment. The identified impacts for the project can easily be reduced, limited and eliminated by the application of appropriate proposed mitigation measures. This EMP has been developed to guide in mitigating the project negative impacts and it is no doubt that the implementation of the recommended measures will entail no harmful impacts provided that they are adequately and timely put in place.

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ACRONYMS

cm	centimeter
EMP	Environmental Management Plan
MDG	Millennium Development Goals
MININFRA	Ministry of Infrastructure
OHS	Occupational Health and Safety
MoH	Ministry of Health
PPE	Personnel Protective Equipment
RDB	Rwanda Development Board
REMA	Rwanda Environment Management Authority
RURA	Rwanda Utility Regulatory Agency
RNP	Rwanda National Police

CHAPTER ONE: INTRODUCTION

1.1 Project background

Kigali is currently experiencing a rapid increase of power demand for the last 20 years due to different development activities that are growing in the City. Rwanda Energy Group is in the process to increase the power supplied in Kigali City and it's environ through construction of new and rehabilitation of the existing electrical networks within the City. The refurbishment of the existing electricity infrastructures will not only be able to satisfy the increasing demand, but also to have a reliable power with flexibility of operations by providing a stable and reliable power supply and participate actively in Economic development of Rwanda. It is in this aim that REG has initiated a project of Construction and rehabilitation of MV lines for Distribution Network system strengthening to improve service reliability and Voltage stability within Kigali city.

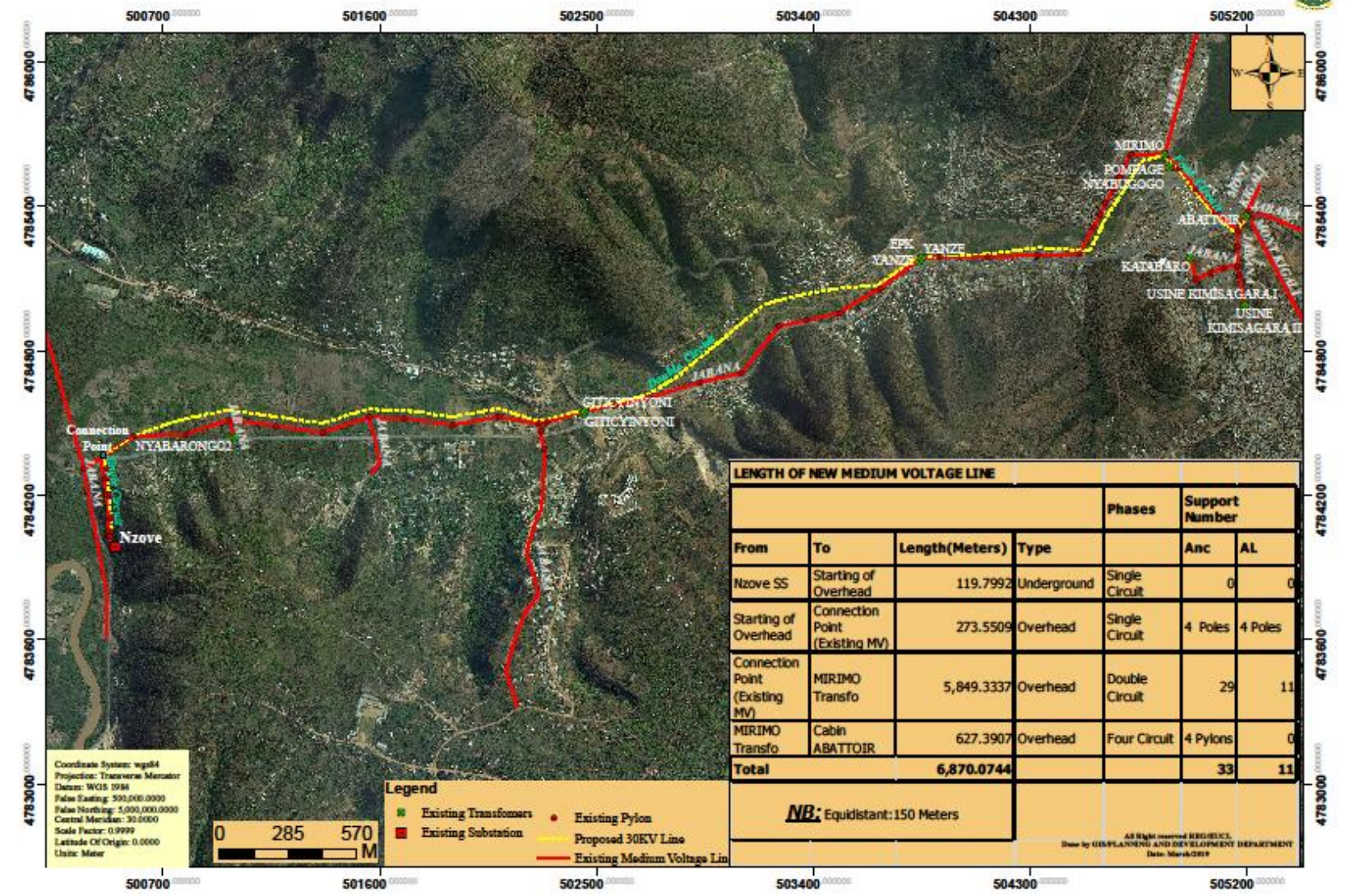
1.2 Scope of work

The scope of work include all designs works, supply of all required material, installation and civil works for the construction of the following Medium Voltage line:

i. Upgrade of Medium Voltage overhead line from Nzove substation to Abattoir Nyabugogo

- Construction of a 4.7km double circuit line along existing overhead line as shown on the map;
- Construction of a 0.5 km four circuit line from the double circuit to Abattoir cabin (only 3 circuit will be equipped)
- Supply and installation of a 400kVA transformer (mounted on tower) and related accessories;
- Supply and installation of MV 240mmsq copper cables and cable accessories to link new lines with the substations on both side
- Shift conductors of the two feeders, Kigali North and Nyamirambo to new erected end tower;
- Addition of one angle poles on the line from Nyamirambo and installation of end poles one for the line towards Kimisagara Water Pumping Station and the other towards Inkundamahoro Commercial building;
- Relocation of exiting MV line tapping from old to the new constructed line, this includes 2 MV lines and 4 distribution transformers.
- Dismantling of exiting MV line from Nzove Substation to abattoir and transport of the dismantled materials to EUCL store in Kigali.

Proposed 30 kV MV Line to link Nzove Ss to Abattoir



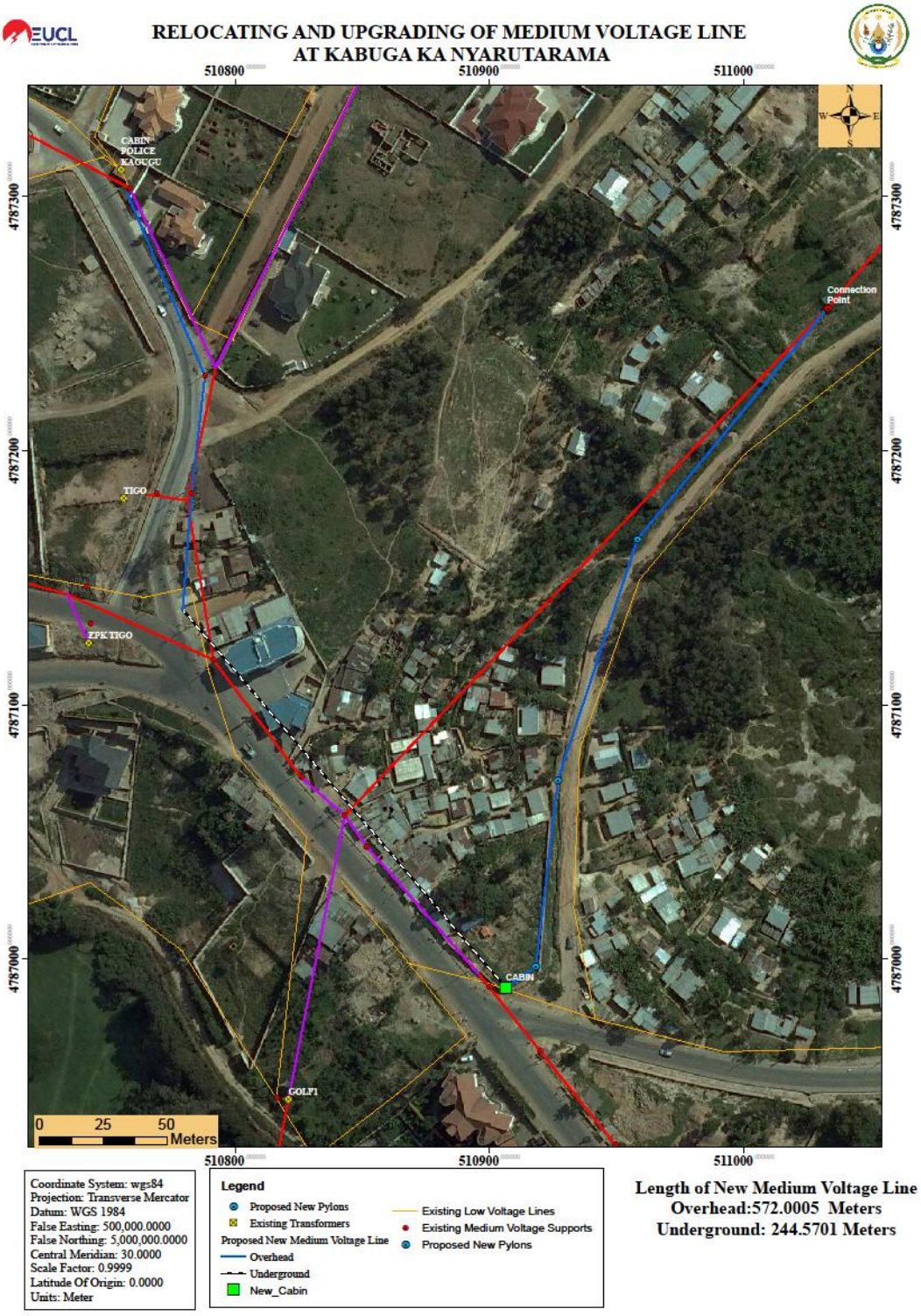
LENGTH OF NEW MEDIUM VOLTAGE LINE

				Phases	Support Number	
From	**To**	**Length(Meters)**	**Type**		**Anc**	**AL**
Nzove SS	Starting of Overhead	119.7992	Underground	Single Circuit	0	0
Starting of Overhead	Connection Point (Existing MV)	273.5509	Overhead	Single Circuit	4 Poles	4 Poles
Connection Point (Existing MV)	MIRIMO Transfo	5,849.3337	Overhead	Double Circuit	29	11
MIRIMO Transfo	Cabin ABATTOIR	627.3907	Overhead	Four Circuit	4 Pylons	0
Total		**6,870.0744**			**33**	**11**

NB: Equidistant:150 Meters

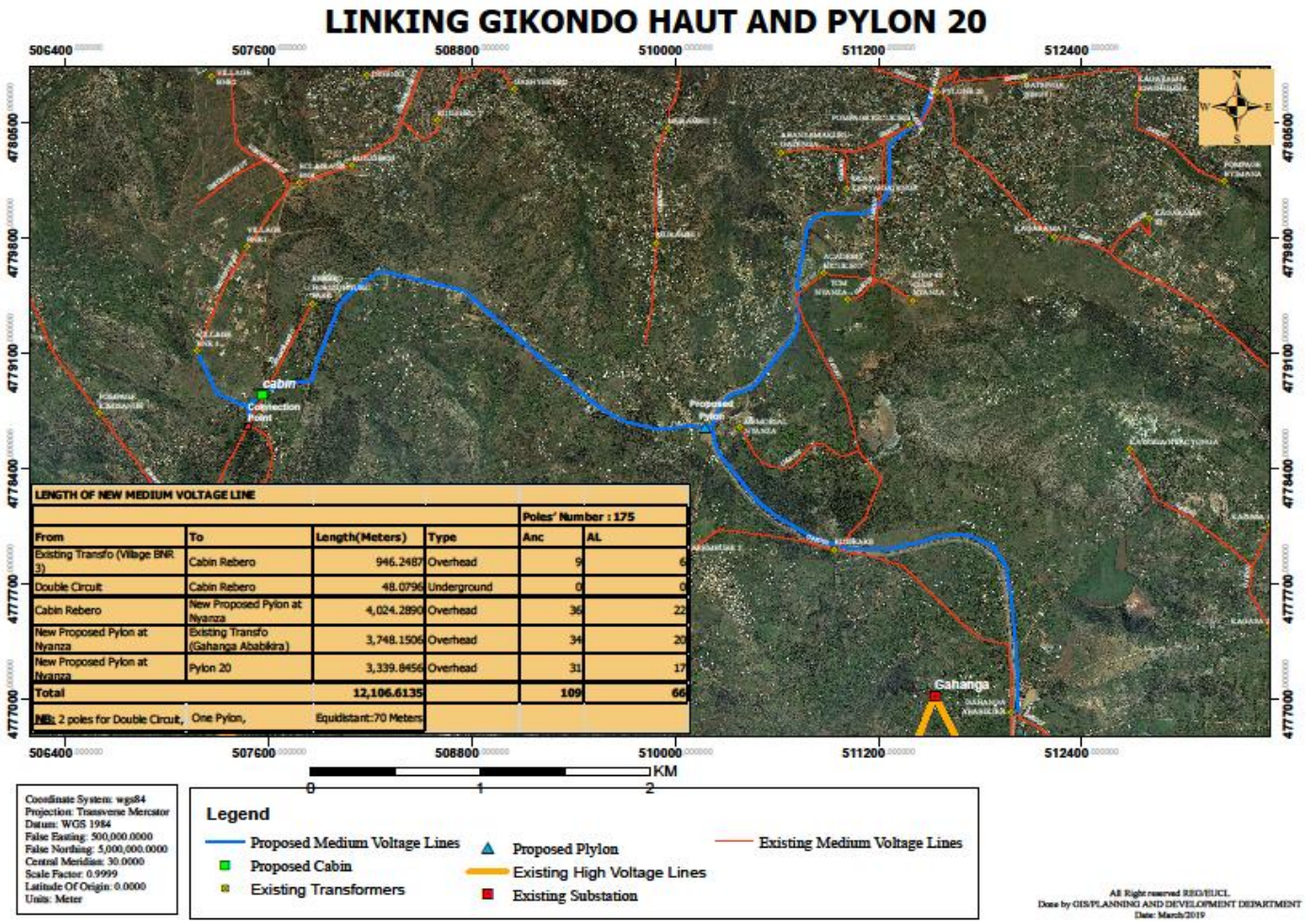
ii. Upgrade of MV underground line at Kabuga ka Nyarutarama

- Deviation of a section of MV line from Kinyinya (350 m of deviation);
- Replacement of a section of 450 for the feeder Kagugu;
- Dismantling and transport to EUCL stores of the existing materials of the upgraded Line



iii. Construction of Medium Voltage overhead line Nyanza -Rebero

- Construction of MV line from Rebero New Cabin and tapping to the existing Pylon 20-Gahanga line.
- Erection of one Dead end pole and laying 120mmsq copper cables towards the new Rebero cabin;
- Extension of Gikondo Haut by 570 m in order to be linked to the new cabin
- Relocation of exiting MV line tapping from old line to the new constructed line
- Dismantling of exiting MV line from Gahanga to Kicukiro District and transport of materials to EUCL store in Kigali



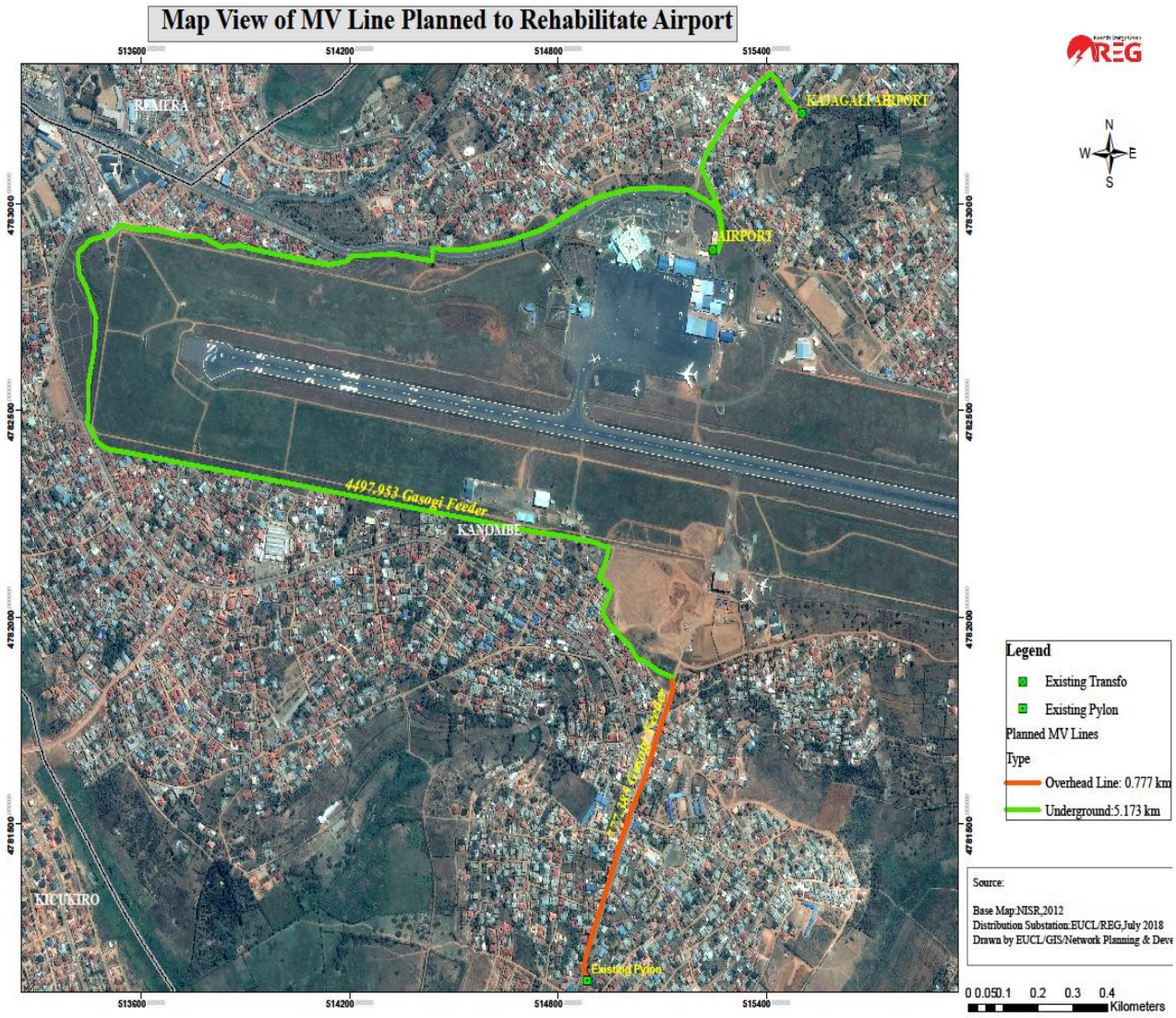
LENGTH OF NEW MEDIUM VOLTAGE LINE

				Poles' Number : 175	
From	To	Length(Meters)	Type	Anc	AL
Existing Transfo (Village BNR 3)	Cabin Rebero	946.2487	Overhead	9	6
Double Circuit	Cabin Rebero	48.0796	Underground	0	0
Cabin Rebero	New Proposed Pylon at Nyanza	4,024.2890	Overhead	36	22
New Proposed Pylon at Nyanza	Existing Transfo (Gahanga Ababikira)	3,748.1506	Overhead	34	20
New Proposed Pylon at Nyanza	Pylon 20	3,339.8456	Overhead	31	17
Total		12,106.6135		109	66
NB: 2 poles for Double Circuit,	One Pylon,	Equidistant:70 Meters			

iv. Upgrade of MV line from Samuduha to Kanombe airport

- Replacement of a section of around 600 m of existing overhead line by a double circuit overhead line;

- Laying 120mmsq underground copper cable (and in respect of guideline of laying MV cable as specified) from SAMUDUHA to Kanombe and from SAMUDUHA to Rubirizi (RAB)
- Connect new upgraded line to existing line and cabins
- Dismantling and transport of material of exiting MV overhead line up to EUCL store in Kigali



v. Extension of MV line at Remera Controle Technique in order reinforce nearby MV line

- Construction of 430 m of MV line as shown on the map;
- Supply and installation of 400kVA, 15/0.4kV distribution transformer with all accessories (Disconnect switch with fuses, LV distribution box, LV cables, and earthing)

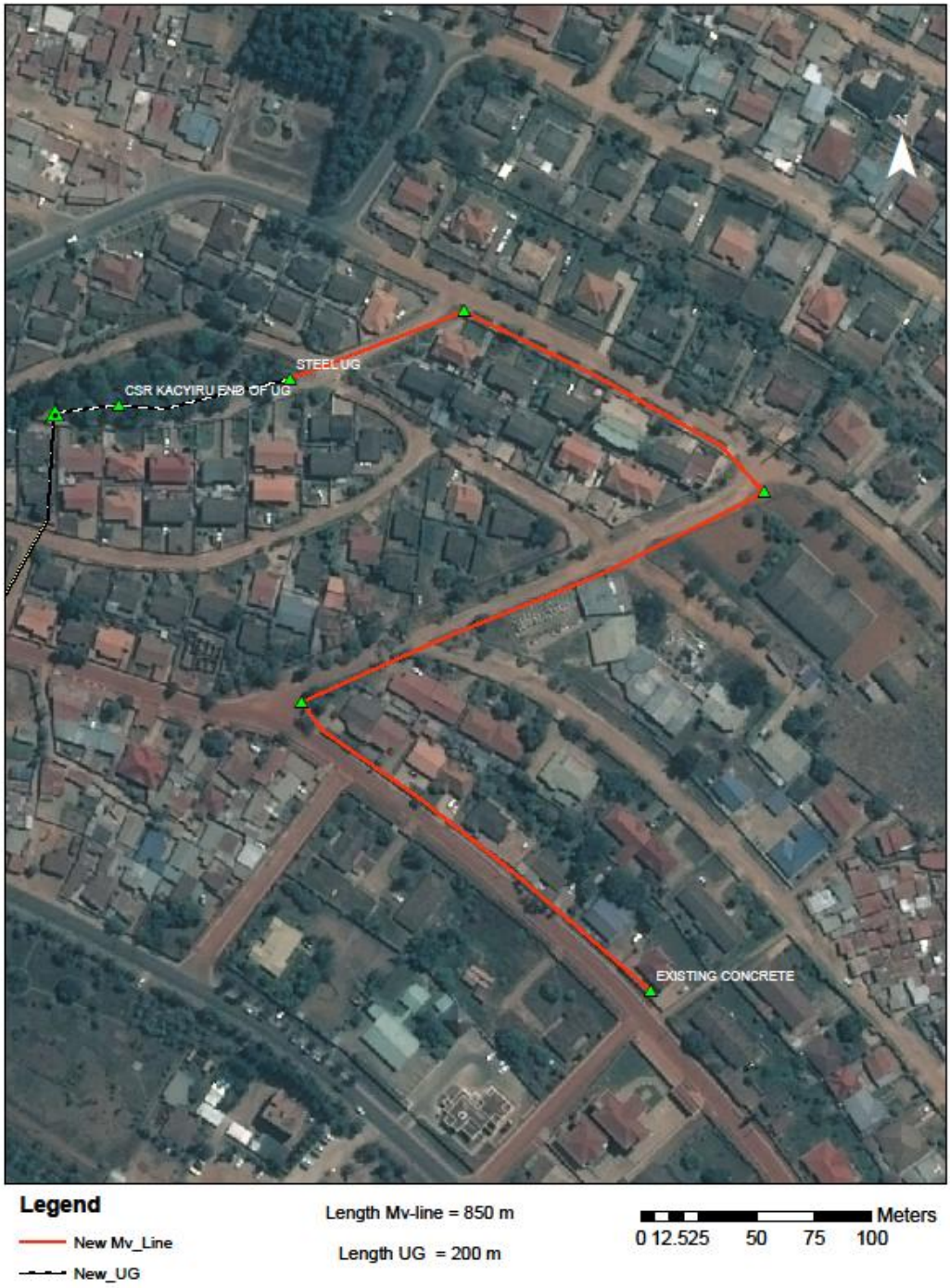
vi. Upgrade of MV line in Kimihurura/Ruhamanya/ATC

- Replacement of MV underground with 120mmsq, copper cable from Pompage Kimihurura to Ruhamanya;
- Construction of 1 km line from Ruhamanya to ATC cabin
- Cut and repair roads to original state of all damages along the line route as specified in the tender document;
- Connection of new upgraded line to existing MV switching substations

vii. Extension of MV line from AMBA UGANDA to CSR Kacyiru switching substation

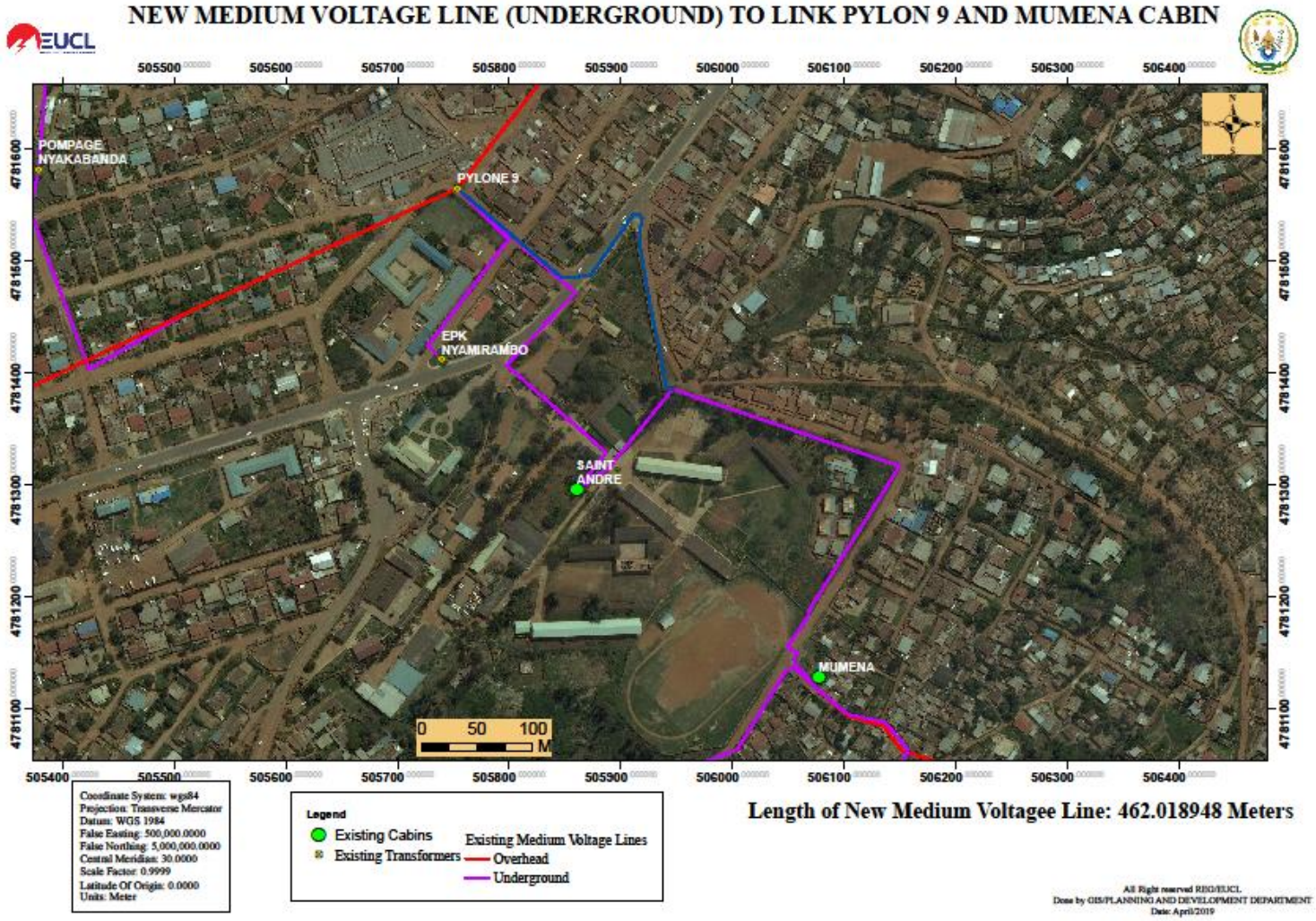
- Construction of 430 m of MV line as shown on the map;
- Supply and installation of 400kVA, 15/0.4kV distribution transformer with all accessories (Disconnect switch with fuses, LV distribution box, LV cables, and earthing)

AMBA UGANDA_CSR KACYIRU



viii. Replacement of MV underground line between Saint André and nearest pylon in Nyamirambo

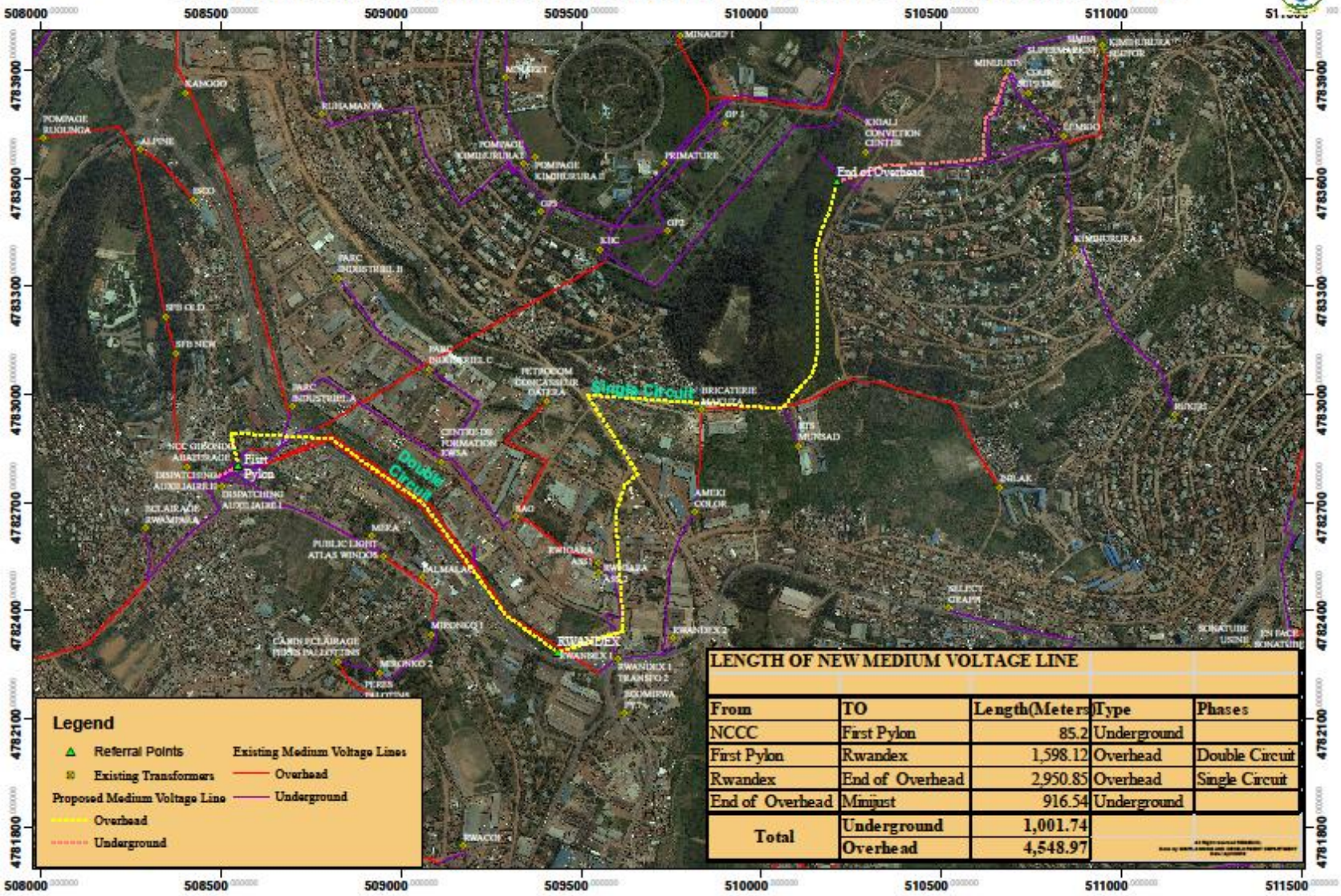
- Laying MV cable 240mmsq between Saint Andre Nyamirambo and nearest tower as indicated on the map;
- Connection of new MV cable with existing 240mmsq copper cable;
- Cut and repair roads and restoration to normal surface all damages



ix. Reinforcement of distribution network in Kimihurura (Gikondo-Rwandex-MINJUST)

- Construction of a double circuit line for a section from Gikondo NECC to the tower at Rwandex, 1600m;for the two circuits one will be used as Parc industrial feeder and will be extended up to MINIJUST, the other will be used as Gasogi feeder;
- Construction of a single circuit line section Rwandex to Minijust, 3,000m;
- MV underground cable 240mmsq for a section of 1,000 from the end the line to MINIJUST substation;
- Lay new MV cable, 240 mmsq for Parc industrial feeder and Gasogi feeder;
- Link the new upgraded line to existing line of Gasogi;
- Installation of MV underground copper cable 240mmsq cable with civil works as described in the document from end pole near Kigali Convention Centre to MINUJUST and connection on both ends.
- Installation of MV underground copper cable 240mmsq cable from indoor GIS at Gikondo to the first double circuit tower and connection on both ends cables
- From the existing masonry fence to the indoor GIS, MV cables will be laid into a reinforced concrete cable trench and covered with concrete cover.
- Dismantling the upgraded section of Gasogi feeder and the line from Gikondo NECC to Aggreko.

PROPOSED MEDIUM VOLTAGE LINE TO LINK NCC TO MINIJUST CABIN



LENGTH OF NEW MEDIUM VOLTAGE LINE				
From	TO	Length(Meters	Type	Phases
NCCC	First Pylon	85.2	Underground	
First Pylon	Rwandex	1,598.12	Overhead	Double Circuit
Rwandex	End of Overhead	2,950.85	Overhead	Single Circuit
End of Overhead	Minijust	916.54	Underground	
Total	Underground	1,001.74		
	Overhead	4,548.97		

1.3 Project activities

i. Organization of works

Work will be performed sometimes in the vicinity of energized lines. During the construction and installation, the contractor must use methods in order to reduce to the minimum the need to de-energize the lines, furthermore when crossing high voltage lines the contractor will use methods which avoid de-energizing the high voltage lines. The Contractor shall make provisions to be able to shift teams and equipment in order to continue work at other sites if the shut-down cannot be granted for the requested period at the requested dates. He shall be able to resume the works scheduled during shut-downs when they are granted, with a reasonable advance notice. The required interruptions shall be kept to a minimum in terms of length of the shut-down.

ii. Tarmac roads crossing

Works of road crossing will include:

- Removal of existing asphalt;
- Demolishing of existing pavement structure of the road;
- Excavation up the required level;

Cables will pass in a reinforced service pipe with inner diameter of at least 80 cm with manhole on both side of the road; manholes will be covered by a manhole cover made in ductile iron material.

- The reinforcement concrete pipe will be laid on a concrete base of class C25-30 with a minimum thickness of 10cm
- Backfill will be done using lateritic material
- Each circuit will have its own pile and manholes

iii. Above Ground Cable Markers

Permanent above ground cable markers shall be installed along a cable route in order to mark the location of cables. The average distance between two markers is not more than 300m.

iv. Burn bricks and Warning tape

Warning tape will be laid at a depth of 300 mm between the cable and warning tape for MV underground cables. Burnt bricks will be laid along MV underground cables in order to protect the cables. Estimates of brick to be laid per linear meter are 36.

v. General Environmental protection

Consistent with economy and efficiency in the execution of the project, the Contractor must prevent, minimize, or mitigate environmental damages during all erection activities. The natural landscape should be preserved to the extent possible by conducting operations in a manner that will prevent unnecessary destruction or scarring of the natural surroundings.

Except where required for permanent works, storing and processing areas, all trees, saplings, and shrubbery should be protected from unnecessary damage by Contractor's operations.

After unavoidable damage, replanting, or restoration are required promptly to prevent further damage (e.g., erosion), and to restore quasi-original conditions where appropriate.

The Contractor's facilities, such as warehouses, and storage areas, should be planned in advance to decide what the area would look like upon completion of work. These facilities should be located so as to preserve the natural environment (such as trees and other vegetation) to the maximum extent possible. Temporary buildings, storing and processing areas should be landscaped and planted according to an ecological design to provide some substitute area for lost natural habitats.

The Contractor's operations should be so performed as to prevent accidental spillage of contaminants, debris, or other pollutants, especially into streams or underground water sources. Such pollutants include untreated sewage and sanitary waste, tailings, petroleum products, biocides, mineral salts. Waste-waters must not enter streams without using settling ponds, gravel filters, or other processes, so as not to impair water quality or harm aquatic life.
The Contractor should ensure proper disposal of waste materials and rubbish**.**

CHAP TWO: STUDY AREA DESRIPTION

2.1 Geographical context of the study area

Kigali is the capital and most populated city of Rwanda. Kigali city is located in the central of the Country and covers an area of 730 km^2 of which only half can be built up due to topographical, environmental and planning restrictions of the City. The City is bordered in Eastern Province by Rwamagana and Bugesera districts, in Northern Province by Gakenke and Rulindo districts and in Southern province by Kamonyi, Ruhango and Nyanza districts, as shown in Figure below: (Map showing Kigali City).

2.2 Administrative entities of Kigali City

Administratively, Kigali City is made up of three districts namely Gasabo, Kicukiro and Nyarugenge (Table 1). Gasabo is divided into 15 sectors which are: Bumbogo, Gatsata, Jali, Gikomero, Gisozi, Jabana, Kinyinya, Ndera, Nduba, Rusororo, Rutunga, Kacyiru, Kimihurura, Kimironko and Remera. Kicukiro district is made of 10 Sectors namely: Gahanga, Gatenga, Gikondo, Kagarama, Kanombe, Kicukiro, Kigarama, Masaka, Niboye and Nyarugunga. The sectors of Nyarugenge district are Gitega, Kanyinya, Kigali, Kimisagara, Mageragere, Muhima, Nyakabanda, Nyamirambo, Nyarugenge, and Rwezamenyo.
The table below illustrates the administrative entities of city of Kigali.

Table 1**:** Administrative context of Kigali City

Province	**Districts**	**Surface area covered (km^2)**	**Number of sectors**	**Number of cells**	**Number of villages**
Kigali City	Gasabo	429.3	15	73	494
	Kicukiro	166.7	10	41	355
	Nyarugenge	134	10	47	327
TOTAL		**730**	**35**	**161**	**1,176**

Source: Adapted by Author

2.3 Topography

The topography of Kigali is made of transitions between mountain ridges and valleys in between. Kigali's altitude is ranging from 1,300 to 1,600 masl and this terrain has implications on the works for water supply systems as well as for the sewerage infrastructures and eventual discharge of effluents.

The city center area is surrounded by a series of hills, the highest of which is Mount Kigali at 1,850 m. The slope of Kigali city varies in gradient from inclinations of up to 45 or 50 %, to those in wetland valley areas with slopes of less than 2 %.

2.4 Slop analysis

Kigali City is built on hilly landscape sprawling across ridges and wetlands with an altitude varying between 1300-2100m. The Nyarugenge District is dominated by strong linear ridge running north-south with a maximum altitude of 1900m and softens towards the flat alluvial planes of the Nyabarongo River on the west. The Gasabo District constitutes of more aggressive relief due to the tight rectilinear ridges oriented northwest with a maximum altitude of 2100m to 1900m and gentle relief along the Nyabugogo River and southern part of the district.

The Kicukiro District is composed of gentle slope plateaus, averaging less than 1700m of altitude and the slopes gently settle into the alluvial plains of the Nyabarongo River.

In Nyarugenge District 37%, Gasabo District 37.5%, Kicukiro District 6.8% area occupied by steep slopes. The slopes of Kicukiro District are relatively gentle compared to other two districts with 15,562 ha land below 20% slope available for development compared to Gasabo District (26891 ha) and Nyarugenge District (8401.4 ha).

2.5 Wetlands in City of Kigali

The Kigali City contains a complex system of wetlands, present along the low-lying valleys adjacent to the rivers. These wetlands cover 14% of the total land area of the city, approximately 10,000 hectares. According to the IMCE classification, wetlands of Kigali are the Central Plateau Swamps mostly present on the altitude of 1400m to 1800m. These wetlands possess mineralized soil type (clay sandy, limono sandy) and the dominant vegetation is Polygonum pulchrum, Cyperus papyrus, Commelina diffusa, Cynodon dactylon, Eicchornia crassipes, Pennisetum purpureum etc. The main function of wetlands within the city is to act as a water reserve and agricultural production.

Most of these wetlands in Kigali are surrounded by densely populated steep slopes, intensively used for settlement structures and cultivation. These developments alter the watershed, increase soil erosion and siltation in the wetlands. The principal threats to wetlands of Kigali are linked to agricultural (mainly rice and sugarcane), livestock activities, human settlements, industries and sand quarries.

2.6 Geology and soil

The City of Kigali is underlain by granitic and meta-sedimentary rocks. The degree of metamorphism undergone by the sediments is generally low. Primary rocks observed in the city are schists, sandstones and siltstones. The surface of the city is dominated by lateritic soil along the hillsides and alluvial soil along the marshlands. There are four general types of soil found in Kigali; lateritic soils, arkosic sands, colluvium (slope wash) and alluvium (river deposits). The valley of Nyabugogo and Nyabarongo River provide a fertile belt of alluvial soil suitable for agriculture whereas the hilly slopes have undergone soil erosion for a long time, leaving them bare and less productive

Nyabugogo area (one of the sections of the project sites) is dominated by quartzite and schist/shale basement aquifers with other lithology classes including shale, granite, pegmatite and alluvial material in valley bottoms. Aquifers associated with quartzite and schist, have average storage and transmission properties hence groundwater recharge rates, base-flow and recession behaviour are expected to exhibit average values.

2.7 Climate of Kigali City

Kigali has a tropical wet and dry climate, which is modified by its high elevation. The average temperature is 20ºC with monthly variations of about 1.5ºC. However the temperature trend for the urban area of Kigali in three meteorological stations between 1971 and 2008 showed an increasing annual mean temperature of 0.2^0C for a period of nearly 40 years. Mainly, for the last 10 years a warming in Kigali is evident. In the first instance, this development could be attributed to global warming, because more or less rising temperatures could be recognized all over Rwanda during the last decades. But it could also be related to the ongoing urbanization, because the temperature trend of Kigali is much higher and faster than in other parts of the country. Total average annual rainfall is around 1,028 mm and it follows the typical bimodal pattern found in other parts of Africa. The rainfall pattern is influenced by the Inter Tropical Convergence Zone (ITCZ).

2.8 Precipitation

The city of Kigali has an altitude of 1,567m and experiences a long rainy season that extends from mid-February to mid-May with another rainy season from mid-September to mid-December. However the rainy season may extend for some weeks into the dry season and vice versa. In general, the average precipitations range from 65 mm to 200 mm per month. In times of extreme storms and rainfall, there can be a danger of flooding in the city, especially where urban developments have created impervious surfaces or changed hydrological conditions in rivers. Kigali, is one of the major flood prone areas in the country, where almost every year flood events are recorded. Figures below show the temperature averages for Kigali.

CHAP THREE: DESCRIPTION OF PROJECT ACTIVITIES AND PHASES

The project shall have different activities which shall be carried out in for different phases namely pre-construction, construction, operation and decommissioning phases.
The activities of the project include but not limited to

- Site clearance and earthworks
- Excavation to remove unsuitable materials
- Electrical cables laying and stringing
- Backfilling the excavated cable trenches with approved materials as specified
- Improvement/construction of drainage facilities
- Repairs and/ construction of damaged roads
- Tower election for the overhead lines
- Cables stringing

3.1 Activities of Pre-construction investigations

The activities of the pre-construction phase will start with detailed investigation of the site's biological and physical characteristics in order to minimize any unforeseen adverse impacts during the project cycle. This phase also entails mobilization of labor force, equipment as well as acquisition of various permits as required by the law. The investigation of the sites intervene to develop a baseline data bank that shall guide in impact monitoring.
The main activities to be involved in the pre-construction phase include:

- Line surveys;
- Maps reproduction
- Geo-technical investigation (soil test) where applicable;
- Materials analysis including soil, stones and sand tests;
- Mobilization of the labor and equipment's
- Permit acquisition if necessary

3.2 Activities of construction phase

Staffing and employment

This project will be the most source of job creation for local community, skilled and unskilled people. It will generate a number of jobs since it is expected to employ a maximum of more than 100 employees in total and this number will be attained when the project is fully operating.

Site preparation

Manpower will be used to clear the project site and trenches excavation and trucks and other machinery will be used to transport materials and personnel to the project sites. The indicated place where excavation will take place for the overhead lines will be rehabilitated and restored accordingly.

Sourcing and transportation of construction materials

Construction materials and other equipments (cross arms, cables, stubs, transformers, wires, aggregates, stones, sand, bricks, cement etc.) will be transported by trucks to the construction sites and greater emphasis will laid on procurement of local materials.

Storage sites

The project is expected to have only one temporally storage site for material and machinery parking as it will be implemented by one contractor. The selection of the location will be made based on the availability of adequate land for establishing the storage site, including parking areas for machinery, stores and easy access to working site and an appropriate distance from environmental sensitive areas. Some of the materials from borrow pits like sand and stones will be used directly after delivery and as such no piling up is expected. Other materials like aggregates and sand will be stored at the operation site ready for use. Cement will be stored in special storage rooms. No Fuel will be stored in the project area since all machinery will use the approved petrol stations in the area. .

Storage of materials

The storage will be properly made to avoid any soil/ water contamination or environmental pollution. Bulky materials such as rough stones and sand will be brought to site only when needed due to space constraints. To avoid stacking large quantities of materials on site, the contractor should order bulky materials such as sand, gravel and stones at crusher& asphalt plant sites.

Excavation and foundation works

Excavation will be carried out to prepare the cables trenches and tower legs. The excavated soil will be re-used to backfill the excavated trenches after cable laying as well as backfilling the tower legs after election.

Demolition works

Any wastes or debris arising from any demolition works will be transported to their respective site disposals.

Landscaping

To improve the aesthetic value or visual quality of the sites once construction ceases, the contractor will be required to restore the damaged areas. The landscaping will include establishment of roadside tree planting, backfilling and vegetating of abandoned quarry sites. Some sections of the road will have to be landscaped as construction proceeds to reduce erosion.

3.3 Operation phase

The operation phase is made of power transmission and maintenance of the lines when deemed necessary. No major activities are expected to be carried out during the operation phase. Maintenance will include replacement of old and/ or damaged materials, activities which are considered not to be harmful to the environment.

3.4 Occupation health measures for workers and the general public

During project implementation, some diseases and work accidents may occur. For this matter, safety measures must be observed and respected. These include but not limited to the following:

Personal Protective Equipment (PPE)

- The use of appropriate personal protective equipment (PPE) such as helmet, gloves, reflectors, protective boots etc, have to be mandatory for all site workers during project implementation.
- Workers will be trained on proper use of personal protective equipment (PPE) regardless of their prior working experience elsewhere.
- Workers have to be informed and sensitized on the relevance of using adequate PPE.
- First aid equipments will be made available and staff will be trained on their use.
- Warning notices will be put on working site for the safely of workers and persons passing nearby
- Power cuts will be communicated one week prior to their execution.

3.5 Wastes Generation and Management

The proposed project shall generate a substantial amount of waste both degradable and non-degradable. The contractor should provide facilities for handling them by providing adequate waste management facilities like dust bins, and mobile toilets will be made available on site where applicable. Storm water from the project area shall be channeled into the storm water drainage system with consideration of downstream effects.

Types of waste to be generated by the project activities and their management methods are summarized and provided in the table below:

Waste	**Types**	**Amount**	**Treatment/ Disposal**
Solid Waste (bio-degradable)	Vegetation and remnants of Timber.	To be determined	They can be used as source of energy for cooking
Solid Waste (Non Bio-degradable)	Food remains, cardboards and papers	To be determined	Collected in a large skip bucket at site then disposed at the authorized dumpsite or decomposed for use in adding nutrients to

	Top soils		landscaped areas and planted trees or manure
	Tins, glasses and plastics	To be determined	Sold to recyclers and those that cannot be sold due to their quality should be collected in a large skip bucket at the campsite then disposed at the authorized dumpsite
Liquid waste	Sewage	To be determined	considering the extent of the project, mobile toilets will be provided at construction sites where applicable

Table 2: Type of waste to be generated by the project activities

3.6 Project activities closure

Upon completion of the works, the contractor shall remove all of its tools, materials and other articles from the construction area. The Contractor shall also clean areas where he worked, remove foreign materials and debris resulting from the project activities and shall maintain the site in a clean, orderly and safe condition. Materials and equipment shall be removed from the site as soon as they are no longer necessary to minimize the demobilization work after completion of the project. Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to leave the area aesthetical clean.

CHAP FOUR: IMPACTS IDENTIFICATION

The potential environmental impacts of any project depend on its location and its type as well as the volume of the interventions due to the proposed development. The project activities such as road cutting, clearing of vegetation, construction of culverts, cable tranches excavation, tower election and other related operations are bound to cause some environmental impacts (positive/negative).

The impacts can be minimized or avoided, if appropriate management measures are adopted during design, construction and operation phases. In our case the identification of potential impacts was done based on field inspection of existing power lines. The impacts identified for both positive and negative are presented in the following sections.

4.1 POSITIVES IMPACTS

Based on project's existing environmental conditions, potential positive impacts have been identified that are likely to result from the proposed project implementation. Positive impacts have been identified for different phases of project cycle and are presented below:

i. Employment opportunities

During the planning and design period, new jobs will be created in the form of skilled and unskilled labor in the community to conduct topographical and geological investigations. A majority of unskilled labor will be sourced from the local residents and hence this will create employment. Women will also have an opportunity to employment. During the construction phase it is estimated that about 150 people will be working as labor both skilled and unskilled such as engineers, electricians, labors etc. Indirect employment will be in the form of suppliers and other forms of sub-contracted works that will be required for the project components.

ii. Skills transfer

The consultant will associate with local counter parts. In the process of planning and design the local technical manpower will work with the experts. This process of working together will transfer design and planning tools, computer software uses and other useful guidelines which are used in similar conditions countrywide.

iii. Boost to Industrial Activities

During construction phase, the country in made products will be utilized such as cement, gravel, sand, stones, bricks, etc. The consumption of these materials will give an increase to industrial production of material manufacturing organization.

iv. Increase to public revenue / taxes

The implementation of the project will increase revenue and taxes collection for both the central (Rwanda Revenue Authority) and local authorities. The project will fully participate in increased payments of taxes from suppliers of construction materials and other associated objects

v. Gender balance enhancement

It is expected that during the project implementation women will also equally benefit as men in terms of employment benefits. This will contribute to the government vision of fighting against gender inequality and ensuring that women are given equal opportunity in terms of employment.

vi. Improved electrical network System

With the improvement of electrical infrastructure within Kigali city, this will also improve electricity supply and stability in the project sites and its vicinities.

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vii. Access to reliable electricity Supply

The long-term direct positive impact for the resent project is access to reliable electricity supply, which will lead to better provision and easier management of goods and services, and enable new facilities for the Kigali residents. Electricity would support overall investment and strengthen the ongoing effort of capacity building to overcome critical constraints in the implementation of development programs. As a consequence of the project implementation, the quality of life and extent of economic opportunity will be changed for the better.

4.2 NEGATIVE IMPACTS

The present project is vital, positive and necessary intervention project, however it has some negative impacts which are described below:

i. Change of Land Use Pattern

The development in the study area will definitely bring substantial change in the land use patterns (especially on overhead lines) as rehabilitation of the line will require additional land. Excavations of earth from borrow areas may also lead to loss of topsoil and soil erosion problem during rain seasons.

ii. Soil loss and Pollution

The soil loss will be in terms of top soil from cable trenches and borrow pits of tower legs as well as on areas of storage of material. Excavated earth materials will be reused to fill the laying areas and hence its disposal is not likely to have impact on the environment. To prevent the soil erosion, during rainy season, works are likely to be stopped. The soil pollution may take place due to improper disposal of waste material on the open ground. Appropriate waste disposal

methods have to be adopted. Proper care should be taken while locating the above facilities so as to minimize the soil pollution. The impacts are of short duration and will be reversible.

iii. Injuries of workers

During construction activities, workers will be subject to situations that could be harmful to their health and safety. Among risks that can occur include injuries caused by poor handling of construction materials and equipments injuries from walking on or using sharp objects, transmission of diseases; injuries from electricity manipulation and connections etc. This impact is also of medium significance in terms of magnitude since it directly affects the humans. Injuries are common in such kind of project but can be reduced to an extent with safety precautions taken.

iv. Air Pollution

Although, air quality impacts are of short duration, but it does not mean that these should not be considered. Consumption of diesel during construction activities will be the principal cause of incremental air pollution. Diesel powered trucks required for the haulage of earth and other materials and running of construction machinery are the major sources of air pollution in the project area.

v. Water Pollution in Nyabarongo catchment

Soil erosion from borrow areas, may increase sediment load in the nearby water bodies ultimately impact the water quality of Nyabugogo river. The short-term increase in runoff with sediment may also occur due to the removal vegetation cover and top soil. The suspended sediments and the associated pollutants may get washed into these water sources leading to change in water quality. Contamination of water bodies may also due to spilling of construction materials, oils and greases. But the quantity of such spill will be negligible. However, care needs to be taken when conducting the excavation works.

vi. Noise Pollution

The magnitude of impact during construction phase will depend upon the types of the equipment used, the construction methods and the scheduling of the works. Noise generation associated with the present project has three main sources: a) vehicles; b)driver behavior and c)construction and maintenance activity .

Poor vehicle maintenance is a contributing factor to this noise source. Drivers contribute to noise generation by using their vehicles' horns, by playing loud music, and sudden braking or acceleration.

vii. Diseases from construction activity

During construction, some communicable disease such as STDs and other hazards may occur due to interactions among the workers or with service providers such as food vendors, dust from clearing and excavation works and fumes from vehicles and other that might cause respiratory

dysfunctions, etc. This impact is also of medium significance in terms of magnitude, since it directly affects the humans and the project being of short time.

viii. Impacts on water quality

During the construction works, water quality downstream may be deteriorated in terms of higher turbidity levels due to increased sediments. Depending on the type of suspended material, this effect will continue over a short period.

ix. Impacts on Climate Change

Factors likely to lead to climate change due to project implementation are;

- Emissions from vehicles, machines and equipments due to inefficient combustion systems and use of unclean fuels. These emissions have different impacts on the atmosphere leading to climate change, acid rain and impacts on human health.
- The project should establish the transport management plan for project activities such as workers, materials, equipments and other supplies. If not well planned the emissions levels from the gadgets shall be high thus contribute to climate change.
- Clearance of vegetation: Vegetation plays a natural role in cleaning the air of pollutants thus its clearance shall have an impact on the areas micro-climate. Ozone depleting substances (ODS) due to the use of halogenated compounds chlorofluorocarbons (CFCs), hydro chlorofluorocarbons (HCFCs), methyl bromide, carbon tetrachloride, and methyl chloroform found in cooling system in the vehicles and, refrigerators, fire extinguishers and other machines and equipments.

x. Disruption in Daily Living and Movement Patterns

It is anticipated that the construction activities will result in some intrusions and disruptions in the daily living and movement patterns. Such disruptions are anticipated to be of high significance, but of a short-term nature, and could be caused by temporary road cutting, the movement of construction vehicles and frequent entries to the project sites.

xi. Disruption of Infrastructure and Services

Without the implementation of appropriate management measures, general services (such as underground pipes, existing distribution lines) could be damaged during the construction period. Any disruption in the services (especially in the local electricity supply) could potentially have a negative impact on local enterprises (e.g. businesses activities). The nature and extent of the impact will depend on the length of the interruption in general services. The contractor is expected to undertake the rehabilitation works and construction works sometimes in the vicinity of energized lines.

Mitigation measure of the identified impacts are summarized in the table below:

Impacts	Mitigation measures
Fail in proper designing of the project component (design, line routes) could lead to the fail of the project implementation	Development of the designs and line routes of the project must be compatible with the existing slope conditions of the project area, the existing infrastructures and structures as well as the existing environmental considerations of the project intervention.
	The project should use appropriate and experienced personnel in the domain.
Poor planning for tower locations and cable trenches may negatively impact on the environment	Project activities shall not be done near surface water sources especially near Nyabugogo river.
	Locations and line route have been approved by competent authorities prior to their exploitation (EUCL and the City of Kigali).
The project might influence migration and settlement if labor requirements are not planned in advance	Local and surrounding people with the necessary skills shall be employed for the project works;
Failure of advanced planning of safety requirements	Development of safety procedures and operational manual has to be available before project implementation.
	Acquiring of PPs materials has to be done before project implementation
Soil contamination due to improper storage of materials and poor waste disposal	Waste disposal should be done in proper way and in appropriate designated areas.
	Storage of construction materials should be done in protected surfaces to prevent contamination
Exposed soil during excavation works prone to erosion by water or wind	Limitation of earth moving to dry periods
	Protection of susceptible soil with appropriate protectors such as iron barriers
	Protection of drainage channels by stone pitching.
	Installation of sedimentation basins where applicable
Soil erosion and degradation	Exposed soil should be avoided by selective soil stripping
	Clearing shall be limited to the site approved for the project
Loss of vegetation due to site clearing.	Less vegetated areas shall be preferred.
	Careful site planning.
	Proper implementation of this EMP mitigation measures.
Surface and Ground water contamination especially at Abattoir Nzove overhead line	Generated Waste should be carefully managed to prevent contamination
	Proper setting of the construction sites

	Proper siting of pit latrines away from water logged areas
	Good hygienic standards and proper maintenance of pit latrines.
Pressure on existing socio-economic nature.	Local people with the necessary skills shall be prior employed by the project
Temporary and casual sex relationships and more chances of transmission of STDs due to interaction of project workers with local communities.	There shall be provision of education both to the local community on STDs and HIV/AIDS
	Recruitment of workers shall be done to local people who may return to their home immediately after work
Lack of enforcement of safety and health regulations could impact negatively workers and local community.	Enforcement of Public health and safety regulations.
	Use of adequate and required sign posts where necessary.
	Enforcement of the use of PPs.

Table 3: Mitigations measure for identified project impacts

CHAPTER FIVE: ANALYSIS OF ALTERNATIVES

During the project analysis, different options were explored and were weighed from all considerations such as cost, environment, and ease of implementation. The aim of alternative analysis is to arrive at a development option which maximizes the benefits while minimizing the adverse impacts. Alternative analysis is also a form of mitigation measures. The two alternatives were considered “With Project Scenario” and “No Project Scenario”.

5.1 With project alternative

The implementation of this project will contribute to socioeconomic improvement and will have positive impacts on residents’ life quality. The project alternative has the following advantages:

- Job creation,
- Income generation,
- Electricity power supply increases
- improved and assured power supply sustainability
- Electricity Infrastructure development etc.
- etc

However, this alternative may cause negative impact on air pollution, and on water pollution during construction phase. The alternatives to mitigate the adverse impact include proper project designs, proper management of cable trenches and pits areas, proper disposal of wastes, stabilization of excavated soil, provision of adequate sanitation facilities, provision of protective equipments to workers, use machinery and truck in good condition and during daytime, proper re-use of the excavated soil after cable laying etc.

5.2 Alternative Routes

An analysis of alternative routes was undertaken through mapping and involvement of Kigali City and they were selected among the possible ones, based on the following general sitting criteria (which are related to economic and environmental values):

1. Location of the existing lines to be upgraded
2. Avoidance of restricted zones;
3. Location of the targeted infrastructures being developed in Kigali city;
4. Shortest distance from the taping point
5. Route with constant slope;
6. Minimization of infrastructure crossing (paved roads, other power lines, etc.).

5.3 On-Grid Electrification

Provide on-grid electrification.
This is the alternative that is proposed by this project. Through the project all target area will be provided with electricity from the existing grid system.

This alternative will contribute positively to improving the lives of the target communities increased communication via use of mobiles and opportunities for seeking alternative livelihood options. Local government institutions will also benefit through reduced time and money spent on sourcing firewood from local communities, as well as increase in accessibility to information through various media sources, internet and improved communication.

5.4 Without project alternative

The No Project option in respect to the proposed projects implies that the status quo is maintained. This option is suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing environmental conditions especially in Nyabugogo area. This option will however, involve several losses on socioeconomic condition both to the local population and the nation as a whole. The electricity users will continue to face the constraints they are experiencing due to power cuts and inadequate and reliable energy supply and the targeted economic development of the country and of Kigali specifically will remain unattainable.

The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- The socio economic status of the residents of the area of intervention would remain unchanged.
- The old electricity networks will remain undeveloped and hence worsened
- The social interaction connected to the project implementation would not exist.
- No employment opportunities will be created for local population who would have otherwise worked at the project area.
- Reduced infrastructure development will remain and be aggravated.

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CHAP SIX: ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) presents the implementation schedule of the proposed mitigation measures for the project's impacts. It also includes the associated costs needed to implement the recommended mitigation measures. The implementation will involve the contractor, the City of Kigali, infrastructure users and the local communities at large. Both parties should take stock of the contents of the present report and implement the proposed mitigation measures as much as possible and improve them based on their practical implementation. The EMP of the present project is given in the following tabular form:

6.1 Pre-construction phase

Table 4: Environmental Management Plan of the pre-construction phase

Activity	Impact	Mitigation Measure	Responsible	Time Frame	Cost (Rwf)
Planning	Possible loss of property	-Develop and implement site and land acquisition plan before project implementation -Restrict clearance to road reserve	Contractor REG CoK	Before and during project starts	No budget required
Storage site selection	Failure in selecting the materials storage site	Selection of storage sites must be done in consultation with CoK and Districts Storage facilities should be located far from general public and water resources.	Contractor REG CoK	Before project starts	No budget required
Procurement	Contactors selection criteria	- REG/EUCL procurement unit should develop selection criteria that take into consideration the ability of contractor who will be able to implement environmental conservation criteria - All tender applications should be submitted with documents in support of the status of the machines and equipments such inspection certificates, calibration certificates among others·before tender ward.	Contractor REG CoK	Tendering Phase	Covered in tender evaluation fees
Planning	Inadequate Knowledge of Environmental Management Issues	-Organize campaigns and morning briefs of staff on environment protection aiming at environment protection and safety.	Contractor REG CoK	Daily	covered in project implementation

Design	Climate change	Incorporation of "green/clean development mechanism" in all project components. The contractor should possess project equipments and machinery that are designed to avoid pollution and its impact on climate change Ensure that machines and equipments for the project are used with maximum precaution measure to mitigate climate change Where need be provide adequate day natural lighting and use energy saving bulbs	Contractor REG CoK REMA/ RNP	Design phase	5,000,000
Planning	Health and Sanitation	Before project implementation it is mandatory to the contractor to Develop a sanitation management plan that includes appropriate sitting of sanitation facilities/or providing mobile toilet facilities along the project site. Develop eco-friendly sanitation facilities with capability to recycle water and reuse of sludge	Contractor REG CoK/ REMA	Site mobilization ,	3,000,000
Planning	Insecurity and prevention of road accidents	Provide adequate security measures on site. Mitigate against rivalry among the locals employment. Plan to screen for alcohol among all workers on site)bserve traffic rules	Contractor REG CoK RNP	Through project implementation	500,000
Planning	Land degradation at query sites	Purchase of all raw materials and construction inputs from approved sources by competent Authority.	Contractor REG CoK	During implementation	No budget required

6.2 Construction phase

Table 5: Environmental Management Plan of the construction phase

Activity	**Adverse Impacts**	**Proposed Mitigation measures**	**Responsible**	**Time frame**	**Cost (Rwf)**
Site installation and Site clearing	Soil erosion	All earthworks for site preparation and trench excavation have to be carried out during the dry season of each implementation phase. Use only the approved line route during the surveying exercise.	Contractor REG/ EUCL CoK	Construction phase	under construction budget
	Soil Loss	Excavated earth material should be reused in backfilling tower legs and cable trenches.	Contractor REG CoK	Construction phase	450,000
	Loss of biodiversity	Replace the damaged trees and replant new species especially in Nyabugogo area. ***Compensation of affected or damaged assets by the project should be done before project implementation and by respecting the provisions of Rwanda Expropriation Law in place.*** Restrict clearance to road reserve and Nyabugogo River. Project sites, storage areas and vehicles movement should be concentrated in sites with minimal stand of vegetation.	Contractor REG CoK	Construction phase	1,200,000
Excavation	water pollution and damaging downstream project area	Backfilling and leveling of the borrow pits to prevent water percolation and accumulation Adequate drainage systems have to be developed to minimize the impact on downstream project area Use the area dedicated to only project activities	Contractor REG CoK	Construction phase	25,000,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
	Road Side	The roads cross and side drainage systems shall be periodically checked and cleared so as to ensure adequate storm water flow.	Contractor REG CoK	Construction phase	12,000,000
Construction works	Health and Sanitation	Develop sanitation facilities and adequate management plan of waste on place Provide eco-friendly sanitation facilities with capability to recycle water and reuse of sludge Provide adequate protective equipments to all workers Adopt disease control measures	Contractor REG CoK	Construction phase	600,000
Construction works	Possible vandalism	Fencing off the project critical areas and limiting movements and entrance of the non-authorized personnel to the working areas. Installation of sign posts at working area	Contractor REG CoK RNP	Construction phase	860,000
Construction	Water pollution and Soil Erosion	Create contour drains during construction activities near Nyabugogo river Adequate soil erosion management strategies will be provided Soil works should be done in dry seasons; Rehabilitation works are also recommended. Solid and liquid waste must be handled as prescribed by law Discharged waste water into the environment should meet recommended standards All waste have to be collected and disposed to approved waste disposal sites	Contractor REG CoK	Construction phase	1,890,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Compaction	Vibration	Provide advance notice to local communities when activities likely to cause vibration are to be undertaken Use of sign posts to alert local residents and other personnel Restrict construction activities to normal working hours (from 7h00 to 17h00). Acquire license from competent Authority before project activity	Contractor REG CoK	Construction phase	35,520,000
Construction	Air Pollution	Construction equipments shall meet emission standards and have to be maintained and operated in a manner that ensures relevant air discharge regulations. Regular maintenance of construction vehicles and equipment is recommended. Water should be sprayed when deemed necessary during all along the construction ph ase to avoid dust emission	Contractor REG CoK	Construction phase	6,650,000
Construction	Road accidents	There should be traffic management plan before project implementation. Speed limits should be available along the working areas. Enforcement of traffic laws. Installation of speed control devices like humps where necessary Screen for use of alcohol among workers, drivers and machine operators.	Contractor REG CoK RNP	Construction phase	To be with the project budget

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction works	Noise Pollution	Noisy activities have to be scheduled to occur within prescribed normal working hours (from 7h00 am to 5h00 pm) and limited to day light only. Proper choice of equipment and qualified personnel in the use of machinery.	Contractor REG CoK	Construction phase	6,600,000
Construction	Increased Spread of HIV/AIDS and other STDs	Health Safety and Environment induction course should be provided to all workers. Awareness campaigns against HIV/AIDS and other transmitted diseases should be provide to all workers. Employ a large number local communities to minimize number of new comers in the project site. Provide and train all workers on the use of first aid kit on site Provide appropriate working gear and adequate PPEs to all workers. Provide adequate sanitary facilities on the site. Provision of firefighting equipments on the site. Hygiene and sanitation standards should be respected by proving adequate clean water for drinking and domestic use.	Contractor REG CoK	Construction phase	5,000,000
Construction	Equipment /Vehicles /Machinery	All construction equipments/vehicles and machinery should be in good working condition. All equipments and machinery should be removed from the site immediately at the end of defects liability period.	Contractor REG CoK	Construction phase	6,500,000

Activity	Adverse Impacts	Proposed Mitigation measures	Responsible	Time frame	Cost (Rwf)
Construction works	Poor waste management	Staff to be regularly sensitized on appropriate waste management. On site adequate sanitary facilities have to be provided and properly maintained and satisfactorily decommissioned after the project. Garbage should be segregated, biodegradable composted based on their type. All unused materials have to be properly handled Regular monitoring of waste collection and management is required	Contractor REG CoK	Construction phase	1,200,000
Construction works	Road Accidents	Traffic management plan incorporated in the designs should be implemented by all road users. No total closure of the road should be allowed even during construction works. Installation of proper road signs and regular inspections for their presence is mandatory. Installation of speed control devices like humps must be respected. Provision of pedestrian paths, at areas of high human presence is required.	Contractor REG CoK RNP	Construction phase	9,540,000

6.3 Operation phase

Table 6: Environmental Management Plan of the pre-construction phase

Activity	Impact	Mitigation Measure	Responsible	Time Frame	Cost (Rwf)

Electricity Supply	Incidents	Capacity building to all electricity power users. Enforcement of laws in place related to electricity regular maintenance of the installed infrastructures Regular checks on site the presence of installed warning sign posts	Contractor REG CoK	During construction and operation phases	8,000,000

6.4 Decommissioning phase

Table 7: Environmental Management Plan of the pre-construction phase

Activity	**Impact**	**Mitigation Measure**	**Responsible**	**Time Frame**	**Cost (Rwf)**
Removal of Construction Equipment/Vehicles/Machinery	Environmental pollution	All construction equipments/vehicles and machinery should be removed immediately from the site at the end of defects liability period. The removed materials should be transported and kept in safe place for use by the Contractor in other works. The area should be cleaned and all domestic wastes, debris/waste metals, grease and oils must be cleaned up and disposed of in a manner approved by competent authorities	Contractor REG CoK REMA	After construction works	3,000,000

6.5 Specific mitigation measures and associated monitoring plan

i. Occupational Health and Safety management plan to prevent accident

The contractor

The contractor is responsible for:

- preparing, updating and implementing the occupational Health and Safety Management Plan, including all associated procedures;
- identifying OHS training required for an activity;
- having insurance of all works during the project life span
- identifying and observing all legal OHS requirements;
- ensuring that all works are conducted in a manner without risk to workers;
- planning to do all work safely;
- ensuring workers undertake identified OHS training;
- communicating and consulting with workers;
- investigating hazard reports and ensuring that corrective actions are undertaken;
- Dispute resolution.
- complying with any direction given to them by competent authority
- undertaking site-specific induction before starting work and signing off that they have completed the induction
- Ensuring that all workers have the correct tools and equipments and well served to and in good conditions.

Workers

All workers are responsible for:

– Use personal protective equipment in accordance with manufacturer's instructions and where directed and in accordance with site signage.

– Taking reasonable care of their own health and safety and make sure that their conduct does not adversely affect others.

– Complying with instructions given to them.

– Cooperating with reasonable notified policies or procedures.

– Keep working areas clean and tidy at all times.

– No smoking on site except the provided place.

– No fighting, bullying or aggressive behaviour.

– No drugs or other illegal substances are permitted on site or are to be consumed on site.

– Place all rubbish in bins provided.

ii. General EHS information

Hazard identification, reporting and accident procedures

- All works related injuries, illnesses and dangerous events and incidents will be reported to site manager who will record and investigate the cause.
- Workers are responsible to inspect machinery, equipment, tools, excavations, confined spaces to ensure they are safe and without risk to the health and safety of themselves or others before using or entering them.
- All hazards, unsafe conditions, defective items or equipment are to be reported to site management, or are removed from service immediately they are detected. Risk assessments will be undertaken prior to commencing any task to assess the risk of injury.

Emergency preparedness and response

For environmental and social performance of the project, emergency situations will be managed according to the Emergency Preparedness and Response Plan that have to be prepared and separately to this plan.

That plan should cover the:

- Emergency preparedness
- Emergency procedure
- Management of modifiable incidents
- Management of first aid cases
- Emergency communication

iii. Induction and training before works

Workers induction

The contractor will ensure a site specific induction is provided every day for all workers before starting.

This induction must outline:

- the expectations outlined in Environmental Health and Safety Management Plan;
- the site rules
- the facilities
- any site specific hazards
- high risk construction work activities

Visitor's Induction and safety

All visitors if any must undergo a visitor's Induction prior entering the site and they must be accompanied by the Site Manager or a designated contractor’s representative at all times whilst

on the workplace. Before entering the site, visitors will be provided with appropriate PPEs in order to ensure their safety during the visit tour.

Workers training

The contractor will:

- ensure workers are trained and are competent for the work they carry out
- ensure workers are trained to deal with any risks associated with the work and understand the control measures in place
- ensure on-site training and supervision is provided
- Communicate with subcontractors to ensure their workers are appropriately trained and competent.

Disciplinary procedures

During both the construction phase, if any worker does not comply with the requirements of the EHS plan, the following will apply:

- **First violation**: verbal warning (and advice providing)
- **Second violation**: written notification (and advice providing)
- **Third violation**: complete removal/suspension from the project.

For a serious breach of safety, workers can be immediately dismissed or removed from the site without notice.

iv. Construction waste management plan

The Waste Management Plan (WMP) sets out how resources will be managed and waste controlled during construction works and operational phase.

The construction activities of this project will generate waste, of different categories including mainly clearing and excavation debris, unusable construction materials, etc. The contractor will refer to the standard waste management hierarchy for efficiency; whose priority relies on avoidance, reusing and recycling. Mostly important to note is that the excavated soil will be reused to backfilling the holes after cables are laid.

v. Safety management plan

The contractor is committed to the safety of vehicles and machinery that will be involved in the project; they will be operated only by authorized persons who meet the driver criteria and licensed by the relevant authority.

- Employees who drive on company vehicles must follow all instructions provided to him. They must do a walk around inspection of any vehicle before driving it and they must not use those vehicles for personal business unless it is approved, in writing by the Project Manager.
- When operating company vehicles and machinery, employees should remember that their driving habits reflect on all employees.
- Employees are strongly encouraged to plan mini-breaks during long periods of driving

and to allow for no more than 10 hours driving per day in good driving conditions.

- ❖ Smoking is not permitted in company's vehicles.

vi. Accidents management plan

All hazards, accidents or incidents, must be reported immediately to the EHS Staff. In the event of an accident vehicles should not be moved unless their location poses a hazard to other vehicles, personnel, or the environment in the area.

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vii. Air quality management plan

During construction phase, it is expected that there will be increase of dust in project sites; dust will be the principal air quality concern. The construction activities will also generate air pollutants such as NOx, SOx and particulate matter. Those air contaminants have potential effects on human life especially workers and locals.

This air quality management plan addresses, at a minimum, the following requirements if applicable:

- ❖ Control of emissions of fine particulate matter
- ❖ Dust shall be controlled on unpaved roads using water (water pouring by a water bowser)
- ❖ Limit general site traffic to established haul routes
- ❖ Covering of trucks/dumpers to avoid spillage; compacted roads and speed control on vehicles.
- ❖ As a safety measure, all workers must be provided with Personal Protective Equipment
- ❖ Use modern machinery and commercially with low sulphur fuels
- ❖ Minimize engine wasting to the extent feasible
- ❖ Optimize trucking loads to reduce the number of trips between the source and destination of materials

viii. Security management plan

The contractor is committed to maintaining the security and well-being of employees, visitors, and the surrounding community. The security management responsibilities will include:

- ❖ Ensuring that security is maintained in the sites and its surrounding
- ❖ Enforcing disciplinary actions as needed
- ❖ Adequate, day-time night-time lighting shall be provided.

ix. Decommissioning plan

Upon completion of works, the contractor shall remove all of its tools, materials and other articles from the construction area. The Contractor shall also clean areas where he worked, remove foreign materials and debris resulting from the contracted work and shall maintain the site in a clean, orderly and safe condition. Materials and equipment shall be removed from the site as soon as they are no longer necessary to minimize the demobilization work after

completion of the project. Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to leave the area aesthetical clean.

All natural drainages must be restored and excavated materials must be used to fill excavated areas. The damaged areas must be restored to make it compatible with future use. Natural drainage must be preserved during rehabilitation and restoration works, ditches must be created to facilitate water run-off by installing drains and derivation ditches perpendicular to the slopes.

The compacted soils must be cut to at least 15 cm deep to loosen it and facilitate vegetation growth where applicable.
The solid waste dumping site must be cleaned, leveled and returned to a regular form. All wastes in the dump site should be thoroughly covered with a layer of soil. The Contractor must ensure that no wastes are visible and no surface water drains into the site.
The eliminated dry materials should form a stable slope and must be in harmony with the surrounding landscape.

x. Training Requirements

The effective implementation of the EMP requires that all persons working for the project be aware of the importance of environmental requirements of the project. They should also be aware of the significant actual or potential environmental impacts of their work activities; the benefits of improved performance and the consequence of not complying with environmental requirements.

The following entities shall need to be trained:

- All persons working for the project
- Persons whose actions can affect compliance
- Persons with environmental responsibilities
- Construction workers
- Persons involved in emergency procedures

The following shall need to be trained:

- Legislative framework, applicable laws, regulations, standards and technical guidelines. The training should also include policies or procedures of the implementing agency which is applicable to the project.
- Environmental monitoring compliance Records keeping and reporting.
- Communication methods and procedures
- Dealing with complaints to maintain good relationship with stakeholders; understanding the needs, traditions and behavior of local communities

CONCLUSION

The present project will cause some impacts on air, soil and downstream waters. The identified negative impacts can be reduced by adopting eco-friendly technologies and enhancing proper implementation of this EMP. The identified positive impacts will strengthen the implementation of the present project. In order to mitigate impacts on the environment to a level of low significance, it is vital that all mitigation measures listed within this EMP are adhered to. Key recommendations are that

- ✓ All management measures made in this report be strictly adhered to.
- ✓ Implementation of the proposed project will entail no detrimental impacts provided that the recommended mitigation measures are adequately and timely put in place
- ✓ A rehabilitation plan of the damaged properties must be drawn up and be implemented.
- ✓ Local communities should be full involved in all activities.
- ✓ The project should recruit an environmental and Social Safeguard who shall follow the implementation of environmental management mechanisms

This can be achieved by effective implementation of the necessary mitigation measures as stipulated in this report.