West African Power Pool

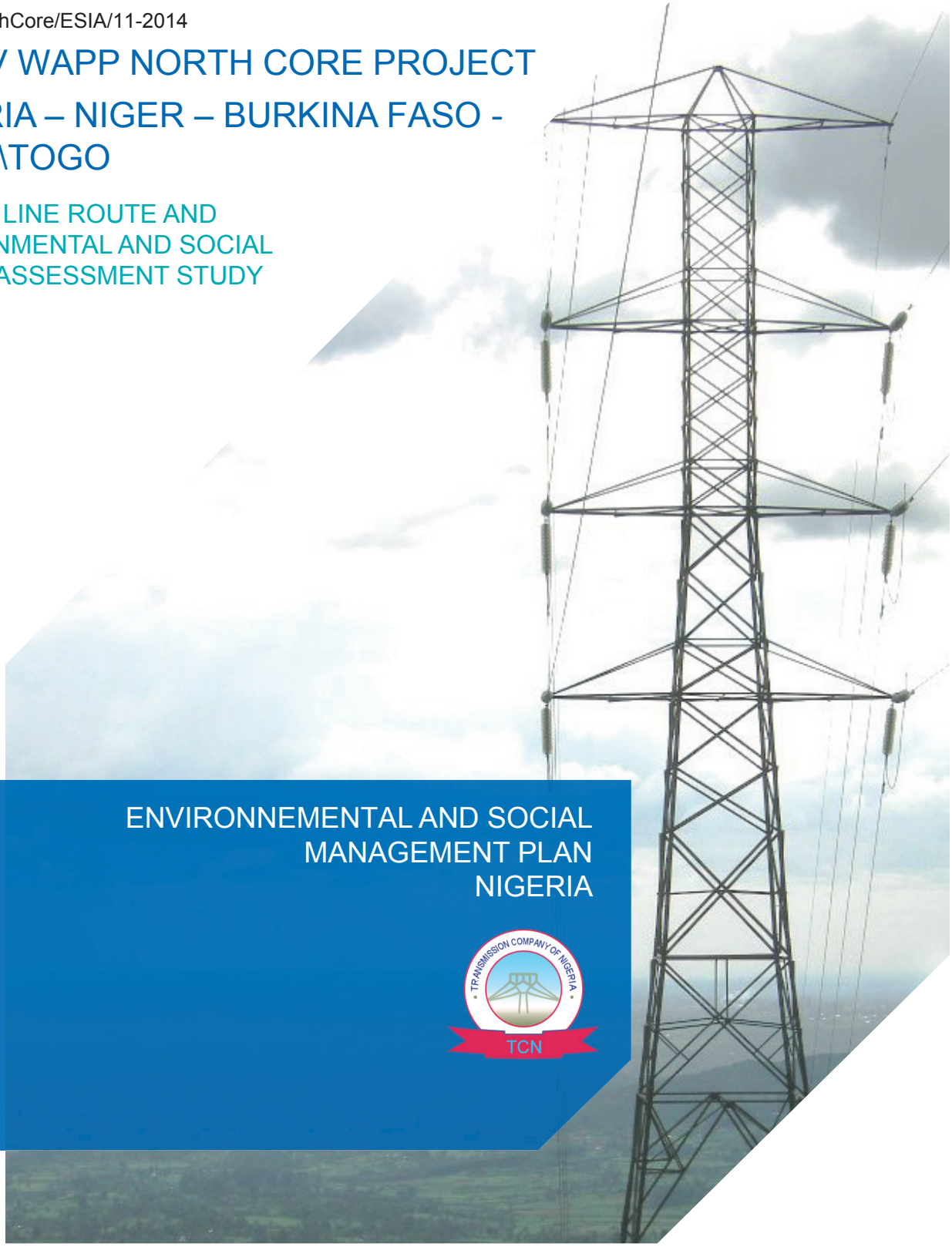
WAPP/NorthCore/ESIA/11-2014

330 KV WAPP NORTH CORE PROJECT

NIGERIA – NIGER – BURKINA FASO - BENIN\TOGO

UPDATE LINE ROUTE AND ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY

May 2018



ENVIRONNEMENTAL AND SOCIAL MANAGEMENT PLAN NIGERIA

TRANSMISSION COMPANY OF NIGERIA
TCN

WSP

West African Power Pool

330 KV WAPP NORTH CORE - NIGERIA - NIGER - BURKINA FASO - BENIN/TOGO

WEST AFRICAN POWER POOL (WAPP)

UPDATE LINE ROUTE AND ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN - NIGERIA

Revised Final Report

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UPDATE LINE ROUTE AND ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN - NIGERIA

Revised Final Report

Date: May 2018

PRODUCTION TEAM

WSP CANADA INC.

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Coordinator RAP	MOREAU Antoine, M.Sc., Sociologist
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Decisional Geomatic Engineer	GRENIER Jean-Denis, Eng.
Biodiversity Specialist	CHOUINARD Hélène, M.Sc., M.Env. Biologist
Human Environment and Relocation Specialist	BURELLE Marie-Andrée, M.Sc. Anthropologist

EEMS EEMS Limited ISO 9001:2008 Certified Organisation

National ESIA/RAP Coordinator - Nigeria	BELLO, Abubakar Mamoud, Eng.
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GIS/Mapping	BALARABE, Usman Yahaya

NON-TECHNICAL SUMMARY

PROJECT DESCRIPTION

This chapter describes the selected line route as a whole with emphasis on selected the line route in Nigeria, which has been the subject of Environmental and Social Impact Assessment. It presents also the promoter of the project including TCN in Nigeria. It Substations and technical components are then presented in order to understand the characteristics that may influence the identification and analysis of the impacts of the project.

SUMMARY OF ENVIRONMENTAL AND SOCIAL IMPACTS

This section summarizes impact analysis as described in the environmental and social impact assessment report. The summary of Potential and Residual Impacts during Pre-Construction/ Construction Phases are presented are presented in tables A and B.

Table A- Summary of Potential and Residual Impacts During Pre-Construction/Construction Phases

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Physical environment VESC				
Air quality and climate change	– site preparation – implementation of construction sites – construction activities – transport and traffic	– Temporary deterioration of air quality related to exhaust gas and dust generated by vehicle traffic. Construction activities could generate low emissions of GHG	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Noise levels	– site preparation – implementation of construction sites – construction activities – transport and traffic	– Local increase of noise levels anticipated during works. – Emissions of noise from construction works with associated machinery (roller, grader, concrete mixer, generators, trucks, etc.) could reach maximum noise emissions of approximately 100 dB	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Soils and agricultural potential	– site preparation – construction activities – management of hazardous products and residual materials – transport and traffic	– Foundation works for pylons, as well as the construction of access roads and camps will lead to soil erosion and compaction in erosion-prone areas such as strong slopes and wetlands. – Changes in soil chemical properties and risk of soil contamination are foreseen in case of an accidental spill of petrol or fuel oil.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Water resources	– site preparation – implementation of construction sites – construction activities – management of hazardous products and residual materials – transport and traffic	– In-water works and poor management of hazardous material could result in local changes in hydrology and in modifications to surface water and groundwater quality resulting in contamination. – Areas most at risk are the Sokoto River and its floodplain, as well as the intermittent watercourses crossed by the line route	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Biological environment VESC				
Terrestrial habitats, flora and fauna	– site preparation – exploitation of borrow pits – implementation of construction sites – construction activities – work in aquatic environment – management of hazardous products and residual materials – transport and traffic – labor	– Most of the power line ROW consists of agricultural areas including Agricultural-Shrubby Vegetation Mosaic, Cultivated Land and Intensive Cultivation which cover together 66,9 % of the right of way. – A total of 29.1 ha of tiger bush will need to be cut and constitutes permanent loss of natural habitat. – Habitat fragmentation and degradation will result in modification of species composition in flora and fauna communities and the introduction and risk of spread if invasive species.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High
Avifauna	– site preparation – exploitation of borrow pits – implementation of construction sites – construction activities – work in aquatic environment – labor	– Construction activities will lead to habitat losses, modification and fragmentation for some terrestrial and water birds, notably of conservation interest and water birds. – Habitats of higher ecological importance for birds in the study area are the Sokoto floodplain and areas close to the Niger border (not far from the dallol Maouri Ramsar site).	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High
Aquatic and semi-aquatic habitats and fauna	– site preparation – implementation of construction sites – construction activities – work in aquatic environment – management of hazardous products and residual materials – transport and traffic – labor	– During the construction phase, access road construction, vegetation clearing, and pylon construction will cause wetland and riparian habitat loss and could lead to local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances. Sokoto river, its associated floodplain and intermittent watercourses may be affected.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Medium

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Human Environment VESC				
Land planning and use	– site preparation – population resettlement – construction activities	– Loss of land, crops, trees and pastoral zones outside the ROW – 498 households will lose a piece of land entirely or partially. – 537 trees belonging to project affected people (PAPs) will need to be cut down	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Existing infrastructures	– population resettlement – site preparation – construction activities – transport and traffic	– A total of 25 houses, 11 secondary structures, six commercial structures and three community structures will need to be demolished or displaced before construction begin. – On main roads, the presence of vehicles and building materials can lead to an increase in traffic and damage risks. To the extent possible, existing roads will be used as access roads. New access roads (permanent or temporary) could be built only if clearly needed.	Nature: Negative Importance: **Major** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Economy, employment and livelihoods	– Purchase of materials, goods and services – Labor	– Construction activities will lead to the creation of short-term jobs. – Stimulation of local economy by the purchase of local goods and services.	Nature: Positive Importance: **Minor** Probability of impact occurrence: Medium	Nature: Positive Importance: **Minor** Probability of impact occurrence: High
Economy, employment and livelihoods	– presence and operation of the line and substations – wayleave maintenance – population resettlement – construction activities – transport and traffic	– Construction works will lead to the creation of short term jobs and will stimulate local economy by the purchase of local goods and services. This demand can however lead to risks of inflation. – Project implementation will also lead to permanent loss of crops. – Tourism and leisure activities could temporarily be disturbed by noise, dust, traffic and construction works.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Quality of life, health and security	– population resettlement – construction activities – management of hazardous products and residual materials – transport and traffic – labor	– The influx of foreign workers can lead to increased pressure on community health services in the region. Their presence can also increase STD transmission risks, including HIV/AIDS. – The increase in heavy vehicle traffic can increase risk of accidents and physical injuries involving local workers and residents. Construction sites can generate curiosity, especially among children. – Noise, dust, air pollution and risk of accidents can generate stress and disturbances in generally calm rural areas – Environment disruption caused by workers' camps	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Social cohesion and gender	– land acquisition – population resettlement – labor	– Compensation assessment and transfer could lead to conflicts and revive old quarrels. – Tensions with outside workers could also arise because of different value systems. – Also, there is a risk of marginalization of women from the compensation process if they are not implicated in all project steps. – Works can also disturb women subsistence activities.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Vulnerable groups	– land acquisition – population resettlement	– Increased marginalization of vulnerable groups (e.g.: women heads of households, disabled or elderly, etc.)	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Cultural and archeological heritage	– site preparation – exploitation of borrow pits – construction activities	– Potential disturbance or destruction of archaeological sites and / or objects, and of burial and / or sacred sites. No grave or cemetery were identified in the ROW.	Nature: Negative Importance: **Major** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Landscape	– site preparation – construction activities – exploitation of borrow pits	– Aesthetic impacts during the construction phase will be limited to work zones. Deforestation of the ROW will change the landscape	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High

Table B: Summary of Potential and Residual Impacts During Operation and Maintenance Phase

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Physical Environment VESC				
Air quality and climate change	– presence and operation of line and substations – facilities maintenance – ROW management	– Slight degradation or air quality felt locally due to maintenance activities, particularly ROM maintenance and vegetation clearing activities. – Transport and traffic associated with maintenance activities are also likely to generate dust, especially during dry periods – Emissions of greenhouse gases from machinery in very small quantities.	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Noise levels	– presence and operation of line and substations – facilities maintenance – ROW management – transport and circulation	– Maintenance activities conducted near pylons, substations, transmission line or ROW could lead to an increase in noise levels – Operating transmission lines and substations emit a permanent background sound which is audible and which may also disturb communities in the vicinity to the line or substation . Noise propagation is generally higher during rainfall and be especially noticeable during nighttime.	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Soils and agriculture	– presence and operation of line and substations – facilities maintenance – ROW maintenance – transport and circulation – management of residual/hazardous material	– Maintenance activities will be limited during the operation phase, but are more regular at substation facilities. Oil leaks resulting from equipment breakdown and/or accidental spills of hazardous substances could lead to soil contamination	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Water resources	– presence and operation of line and substations – facilities of maintenance – ROW management – transport and circulation – management of residual/hazardous material	– Maintenance activities of the powerline will be limited during the operation phase, but could be more regular at substation facilities. Oil leaks resulting from equipment breakdown and/or accidental spills of hazardous substances could lead to ground water and surface contamination	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Biological Environment VESC				
Terrestrial habitats, flora and fauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – presence of workers	– Maintenance of the ROW requires regular clearing of vegetation in order to reduce short-circuit risks caused by electric arcing. This means no vegetation will be allowed to grow above 4 m within the ROW. This continuous alteration of natural habitats will maintain ROW habitats in earlier vegetation development stages, leading to habitat loss for some terrestrial fauna species and causing a barrier effect for small fauna, limiting their movements or making them more vulnerable to predation. – There are risks of collisions and electrocution with bats – Presence of the access road in previously inaccessible areas could lead to an increase in natural resources exploitation and a reduction of species communities with a higher use value.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High
Avifauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – presence of workers	– Collision risks of birds with the ground wires are high and can cause injuries or death. Risk are greater for waterbirds near wetland or rivers, and for large birds. No species susceptible to collision surveyed inside the study area are threatened. – The Sokoto floodplain is certainly an area prone to bird collisions, as it is a wetland in proximity to the Niger river where birds are known to concentrate.Modification and disturbance of bird habitats, with associated changes in bird communities	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Medium

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Aquatic and semi-aquatic habitats and fauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – transport and circulation – presence of workers	– Hydrological conditions modifications that could potentially be caused by the presence of pylons in the floodplain and of access roads could cause modifications in aquatic habitats and its associated fauna – Potential introduction of invasive alien species	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Low	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Low
Human Environment VESC				
Land planning and use		– No negative impact on land use, and planning is expected during the Operation Phase since the PAPs will have been displaced before construction	n/a	n/a
Existing infrastructures	– presence and operation of line and substation	– Transmission lines do not usually interfere with television and radio signals. In some cases, interference can occur very close to the ROW due to low broadcast signals or poor reception of the equipment.	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Economy, employment and livelihoods	– presence and operation of line and substations – facilities maintenance – ROW management	– Potential for economic development associated with electricity access originating from the project – Jobs will be created	Nature: Positive Importance: **Major** Probability of impact occurrence: Medium	Nature: Positive Importance: **Major** Probability of impact occurrence: High
Quality of life, health and security	– presence and operation of the line and substations	– The project can lead to electrocution risks caused by equipment failure, illegal connections, steel theft and any other forms of dangerous contacts. – Based on a recent comprehensive review of scientific literature, there is no evidence to date concluding that an exposure to electromagnetic fields (EMF) of low intensity is harmful to human health. However, – perceptions of risk remain.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Social cohesion and gender	– presence of workers – ROW maintenance	– The loss of crops (annual and perennial) due to maintenance activities can affect women more than men. In fact, women are usually in charge of subsistence activities and struggle to provide their household when crops are limited.	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Vulnerable groups		– No negative impact on vulnerable groups is expected in the Operation Phase	n/a	n/a
Cultural and archeological heritage		– No negative impact on the cultural and archaeological heritage is expected during the Operation Phase	n/a	n/a
Landscape	– presence and operation of line and substation	– The overall aesthetic effect of a transmission line is likely to be negative for some people, especially where the proposed lines cross natural landscapes. The tall steel structures may seem out of proportion and not compatible with agricultural landscapes. The consultations conducted with the local populations have not raised the visual aspect as a negative impact	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High

APPLICABLE MANAGEMENT MEASURES

Mitigation impact hierarchy has been applied as part of the project. Two tables present management measures that will allow to avoid, mitigate, compensate or enhance impacts that were identified in the previous chapter. One table presents management measures planned during pre-construction/ construction phases whereas another table presents measures to be implemented during the operational phase.

RESETTLEMENT ACTION PLAN

The Resettlement Action Plan (RAP) presents the stakeholder's eligibility to compensation aspect and resettlement program details for the local community and PAP. Given the approval of the RAP by the competent authorities and the Transmission Company of Nigeria (TCN), a comprehensive framework of measures were presented to the PAPs during local community consultations. The information provided during the consultations reduced any concern that may be raised by the PAPs, favoring their approval and their collaboration through the census and socio-economic survey. Further consultation and information activities will be performed during implementation of the resettlement compensations.

The evaluation of the social impacts of resettlement, carried out through field surveys, documents and stakeholder consultations and socioeconomic census of Project affected persons (PAPs) and assets, revealed that the North Core project had impacts on 448 PAP and the following assets:

- → 25 houses and related secondary structures;
- → 6 commercial structures;
- → 3 community structures (1 Islamic school and 2 Mosque);
- → 1 cooperatively cultivated marshland;
- → 121.9 acres of land (531 parcels affected) will be expropriate for the ROW;
- → 443 trees need to be destroyed and compensate

SPECIFIC MANAGEMENT PLANS

This chapter presents the Specific Management Plans. It presents the Waste Management Plan, the Vegetation Management Plan, the Physical Cultural Resources Management Plan, the Stakeholder Management Plan, the Emergency Management Plan and the Remediation Plan.

ENVIRONMENTAL AND SOCIAL PERFORMANCE MONITORING

The environmental and social performance monitoring provides an outline to ensure the project's environmental and social compliance during pre-construction-construction and operational phases, tracks environmental and social performance and provides an analysis framework to implement corrective actions, as needed. It should be implemented and kept up to date by the environmental and social management committee of the project management unit.

INSTITUTIONAL FRAMEWORK FOR IMPLEMENTATION

In summary, a Project Management Unit (PMU), consisting in a Technical Committee and in an Environmental and Social Management Committee, will be set up for the project implementation will be put in place by TCN. The PMU will create a Technical Committee and an Environmental and Social Management Committee. The Technical Committee should be composed of engineers and technical experts able to ensure compliance with the construction standards provided in the plans and specifications, bidding documents and contracts. The Technical Committee will oversee the Supervising Engineer who will supervise the Contractor responsible for the project construction. The Supervising Engineer will ensure that the Contractor (and its subcontractors) successfully implement the environmental and social clauses included in the contracts. The Supervising Engineer will have to recruit an Health and Safety expert (HSS) with an OHSAS Certificate 18001: 2007 as well as a senior environmental specialist and a senior social specialist, which must have experience at the international level. The Supervising Engineer will be also responsible for day-to-day supervision of the Contractor as to ensure ESMP implementation as well as Health and Safety aspects during

construction. The Supervising Engineer will also make sure that the Contractor recruits an Environmental expert and a Health and Safety expert with an OHSAS Certificate 18001: 2007 with experience at the international level as well as a liaison officers which will provide support for communications with local communities. The Environmental and Social Management Committee should be composed of an environmental expert, a resettlement expert as well as an Health and Safety expert (HSS) with an OHSAS Certificate 18001: 2007. The different specialists will be located in the project area, especially during the pre-construction / construction phase. These specialists will be supported by one or more liaison officers with the local communities and will have to master the local language (s).The Environmental and Social Management Committee will also comprise experts from the professional TCN staff, and from departmental and local authorities that need to supervise the ESMP and RAP implementation.

In addition, the Environmental and Social Management, as mandated by the TCN, will work closely with the Project Implementation Unit (PIU) created for the RAP implementation. The PIU will be in charge of the followings activities: estimation and delivery of compensation packages; livelihood restoration and vulnerable group assistance measures to affected households; reconstruction of community affected structures; implementation of the Community Compensation Fund's (CCF) funded measures.

CAPACITY BUILDING AND TRAINING

The successful implementation of the ESMP, which relies on stakeholders' enhanced understanding of their responsibilities and individual implications regarding environmental and social management, is based on an institutional support and capabilities building program. This program is presented in this chapter.

SCHEDULE AND BUDGET

A detailed ESMP powerline and substation implementation schedule is presented in this chapter as well as well as a summary of the main costs for the implementation of plans, programs and main management measures

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APPENDIX

1 INTRODUCTION

The Environmental and Social Management Plan (ESMP) identifies more specifically the targeted objectives and the management measures to be implemented in order to ensure the optimal environmental integration of the North Core Power Line project, in compliance with national bylaws, but also with international best known practices applied in similar projects. The ESMP is intended to be useful, practical and operational.

The project's components are strongly linked with the conclusions from the environmental and social impact assessment study report. The ESMP encompasses the global methodology for the environmental and social management during the pre-construction/construction and the operational phases. It also comprises guidance in case of installations dismantlement. It clearly defines specific approaches that managers, employees and subcontractors should adopt. The ESMP combines the whole of the recommended management procedures as well as the specific plans prepared in order to avoid, enhance or mitigate the various anticipated risks and impacts, at the stakeholders' satisfaction.

The ESMP clearly attributes all roles, responsibilities and intervention areas to adequately identify and manage negative impacts on workers, on communities and on the environment within the project area and in its surroundings. The ESMP includes a summary of environmental and social impacts, a description of management measures, specific management plans as well as a monitoring system for the environmental and social performance, in an objective of continuous adaptation and improvement.

The environmental clauses to be included in the bidding or work performance documents for the high-tension 330-kV Nigeria-Niger-Burkina Faso-Benin/Togo interconnection line are presented in Appendix 1. They will ensure the optimization of environmental and socio-economic protection. They also deal with safety measures for hazard and risk prevention.

The environmental and social management methodology used in this ESMP is presented in Figure 1.

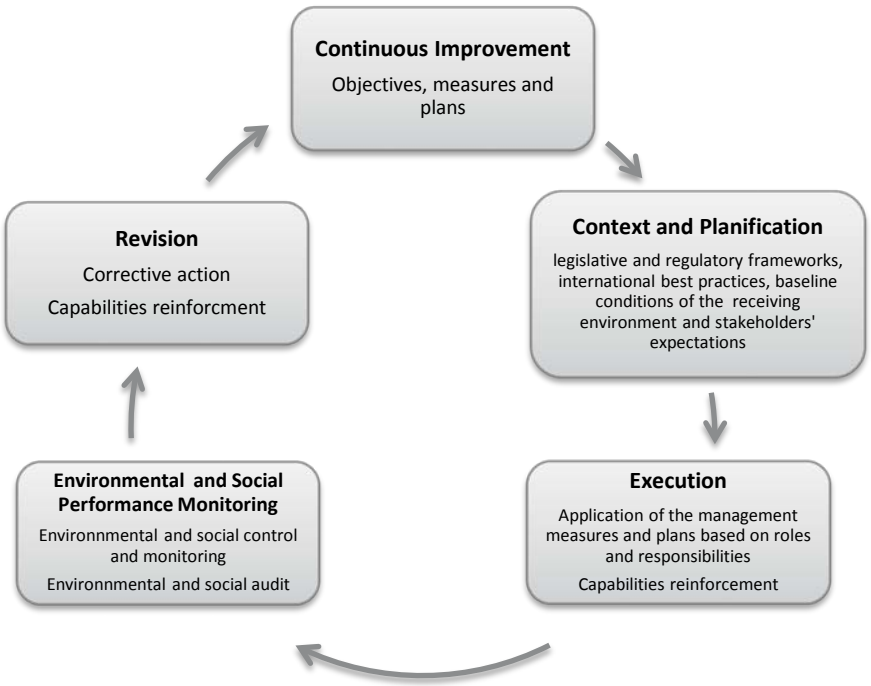

Figure 1-1 Environmental and Social Management Methodology Used in the ESMP

The following sections describe with further details the components of this ESMP.

2 PROJECT DESCRIPTION

This chapter describes the selected line route as a whole with emphasis on selected the line route in Nigeria, which has been the subject of Environmental and Social Impact Assessment. It presents also the promoter of the project including TCN in Nigeria. It Substations and technical components are then presented in order to understand the characteristics that may influence the identification and analysis of the impacts of the project.

2.1 CONTEXT

The WAPP is a specialized institution of the Economic Community of West African States (ECOWAS) which ensures regional power system integration and the realization of a regional electricity market. WAPP is made up of public and private generation, transmission and distribution companies involved in the operation of the electricity in West Africa. Some projects are currently in the planning phase or in execution.

The 330 kV North Core Power Line project- that will provide electrical interconnection between Nigeria, Niger, Burkina Faso and Benin is part of this large network and is a new step toward national networks integration. This project inserts into a sustainable development perspective. Environmental and social issues were considered when selecting the electric line route and electric power stations locations. This type of project must undergo an environmental and social impact assessment and because of its cross-border nature, it is covered by four different legislative schemes. An EIA for the North Core project is required in conformity to the Environmental Impact Assessment (EIA) Act No. 86 of 1992 which states that no industrial plan, development or activity falling under the mandatory list can be executed without prior consideration of the environmental consequences of such proposed actions, in the form of an environmental impact assessment. The EIA Act made it compulsory for EIA to be conducted for projects which are likely to have significant effects on the environment. Such projects are listed in category 1, which includes infrastructure projects like the North Core project. The EIA process consists in the various stages a project undergoes from proposal to approval for implementation, resulting in the issuing of an Environmental Impact Statement (EIS) and certificate. The EIA approach for the project follows the specific EIA National Procedural Guidelines as well as the Sectoral Guideline on Electricity Transmission Lines. This EIA must also comply with international best practices, in particular the World Bank Safeguard Policies, African Development Banks Safeguard Systems, International Finance Corporation Performance Standards and European Union Policies.

WSP has been mandated to perform the impact assessment study. WSP conducted the line route study allowing the integration of environmental and social concerns into the project concept. This integrative method implies an analysis of social and environmental stakes at the planning phase, hence enabling source reduction of potential impacts, while respecting economic considerations. This study analyzes environmental and social impacts expected to occur from the chosen route.

MAURITANIE
MALI
NIGER
SENEGAL
THE GAMBIA
GUINÉ-BISSAU
GUINÉE
SIERRA LEONE
LIBERIA
IVORY COAST
COTE D'IVOIRE
BURKINA FASO
GHANA
TOGO
BENIN
NIGERIA
CAMEROUN
ATLANTIC OCEAN
OCÉAN ATLANTIQUE
BAMAKO
OUAGADOUGOU
NIAMEY
ABUJA
CONAKRY
FREETOWN
Monrovia
ABIDJAN
ACCRA
LOME
PORTO-NOVO
Lagos
MALABO
YAOUNDE
LEGEND / LÉGENDE
Interconnection 330 kV existing / existante
Interconnexion 330 kV project / en projet
Interconnection 330 kV under study / à l'étude
Interconnection 225 kV existing / existante
Interconnection 225 kV project / en projet
Interconnection 225 kV under study / à l'étude
Super Grid 760 kV
Hydropowerplant existing / Centrale hydroélectrique existante
Hydropowerplant project / Projet de centrale hydroélectrique
Thermal power plant existing / Unité thermique existante
Thermal power plant project / Unité thermique en projet
Existing sub-station / Sous-station existante
Sub-station project / Projet de sous-station
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West African Power Pool
330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)
Environmental and Social Management Plan
Final Report
Current and Projected Electricity
Interconnections of the WAPP
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UTM, WGS 84, Zone 31N
Sources :
Tractebel Engineering GDF Suez,
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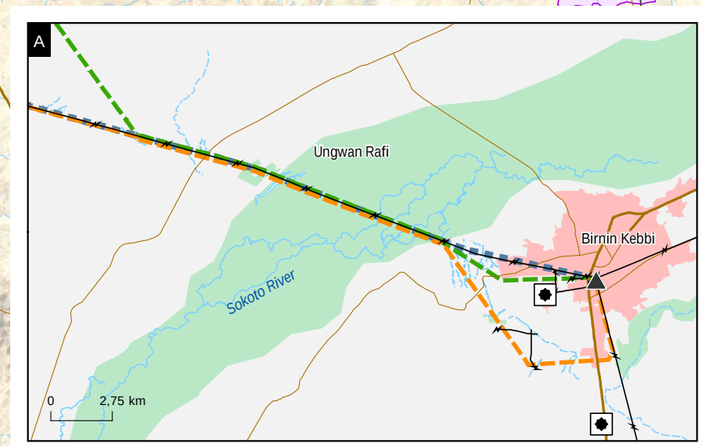


Biological Environment

- Niger Giraffe Distribution Area

Nationally Designated Area

- National Park
- Classified Forest
- Total or Partial Wildlife Reserve
- Hunting Area
- Cynegetic Area

Internationally Designated Area

- Ramsar Site
- Important Bird and Biodiversity Area
- Key Biodiversity Area

Human Environment

- City
- Built Environment
- Planned Built Environment
- Pastoral Area (approximate delineation)
- Agropastoral Area (approximate delineation)
- Area Occupied by Migrants
- Volta Valley Zones

Infrastructure

- Airport-Aerodrome
- National and Interstate Road
- Departmental Road
- Railroad
- Military Base

Substations and Transmission Lines

- Existing Line
- Existing Substation

Physical Environment

- Intermittent Watercourse
- Permanent Watercourse
- Reservoir
- Floodplain

Project Components

- Proposed Substation
- Option 1
- Option 2

Line

- Reference Line Route Proposed by Fichtner

Boundary / Limite

- International Border

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)

Environmental and Social Management Plan
Final Report

Line Route Options

0 16,5 33 49,5 km

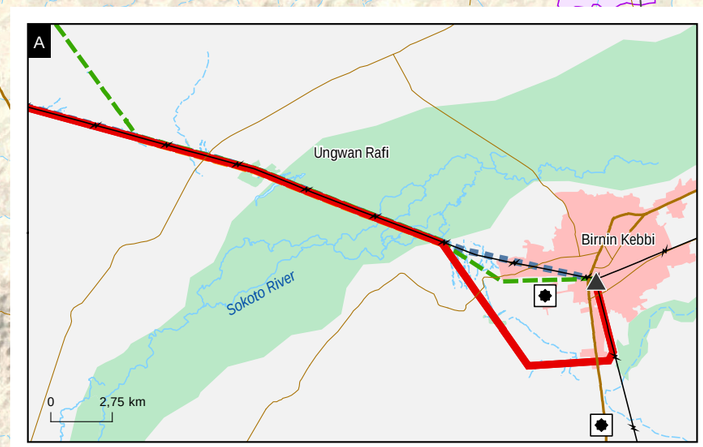
UTM, Zone 31N, WGS 84

Sources :
see Appendix A
Mapping: WSP, 2015
File: 141_24307_PGES_NG_c2_2_Global_160607.mxd

Map 2-2

June 2016

WSP



Biological Environment

- Niger Giraffe Distribution Area

Nationally Designated Area

- National Park
- Classified Forest
- Total or Partial Wildlife Reserve
- Hunting Area
- Cynegetic Area

Internationally Designated Area

- Ramsar Site
- Important Bird and Biodiversity Area
- Key Biodiversity Area

Human Environment

- City
- Built Environment
- Planned Built Environment
- Pastoral Area (approximate delineation)
- Agropastoral Area (approximate delineation)
- Area Occupied by Migrants
- Volta Valley Zones

Infrastructure

- Airport-Aerodrome
- National and Interstate Road
- Departmental Road
- Railroad
- Military Base

Substations and Transmission Lines

- Existing Line
- Existing Substation

Physical Environment

- Intermittent Watercourse
- Permanent Watercourse
- Reservoir
- Floodplain

Project Components

- Proposed Substation
- Draft Final Line Route
- Option 1
- Option 2

Line

- Reference Line Route Proposed by Fichtner

Boundary

- International Border

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)

Environmental and Social Management Plan
Final Report

Draft Final Line Route

0 16,5 33 49,5 km

UTM, Zone 31N, WGS 84

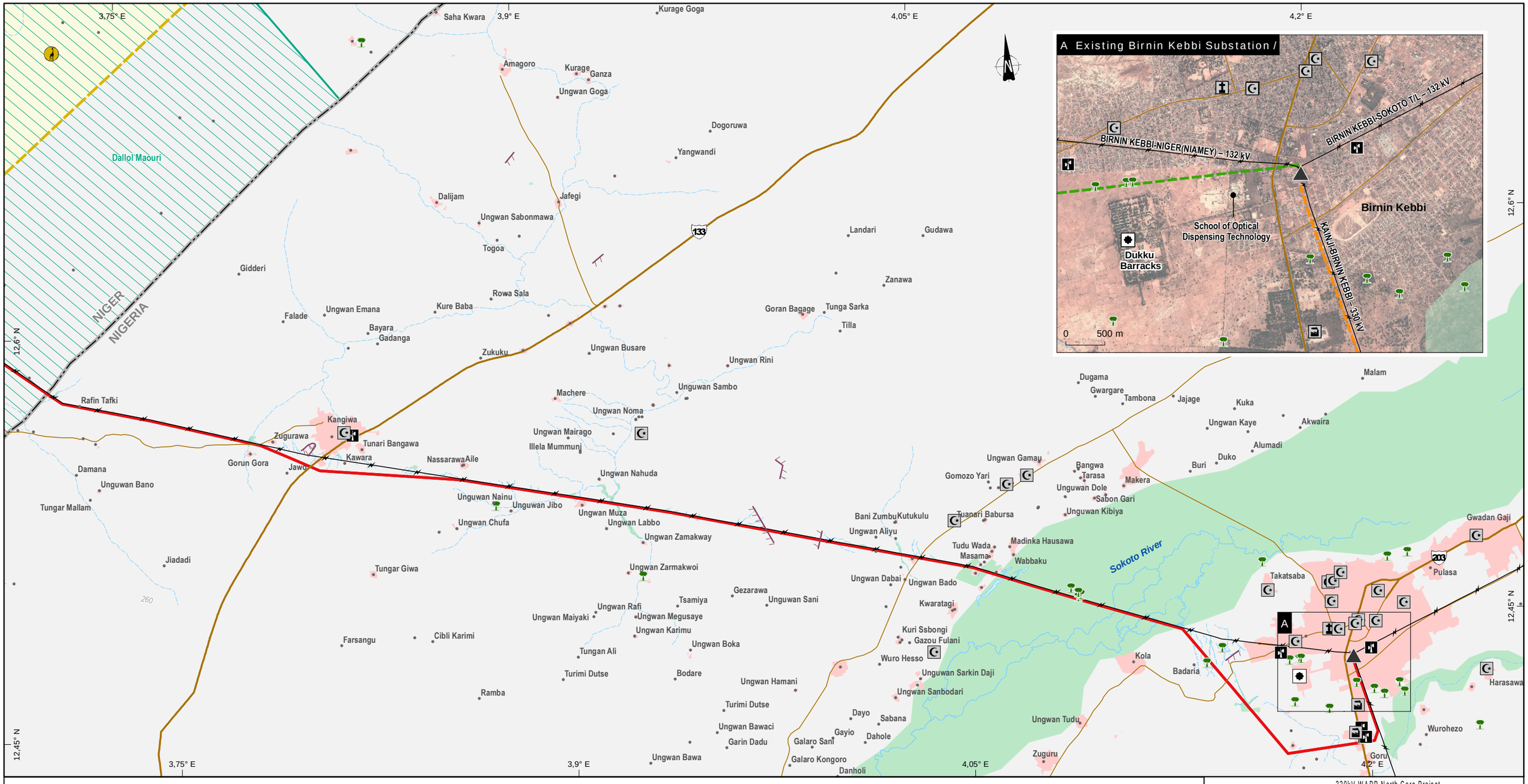
Sources :
see Appendix A
Mapping: WSP, 2015

File: 141_24307_PGES_NG_c2_3_Trace_160607.mxd

Map 2-3

June 2016

WSP



Biological Environment

- Niger Giraffe Distribution Area
- Internationally Designated Area
- Ramsar Site

Human Environment

- City
- Built Environment
- Plantation
- Mosque
- Church

Physical Environment

- Intermittent Watercourse
- Permanent Watercourse
- Floodplain
- Erosion

Infrastructure

- National Road
- Secondary Road
- Telecommunication Tower
- Military Base
- Factory

Substations and Transmission Lines

- Existing Line
- Existing Substation

Project Component

- Draft Final Line

Boundary

- International Border

West African Power Pool

330kV WAPP North Core Project
Nigeria-Niger-Burkina Faso-Togo/Benin
Update of Line Route Study and
Environmental and Social Impact Assessment (ESIA)
Environmental and Social Management Plan
Final Report

Draft Final Line Route in Nigeria

0 1,65 3,3 4,95 km
UTM, Zone 31N, WGS 84

Sources :
see Appendix A
Mapping: WSP, 2015
File: 141_24307_PGES_NG_c2_4_Nigeria_160607.mxd

Map 2-4

June 2016

WSP

2.2 PROMOTER PRESENTATION

The project is under the auspices of the WAPP. This institution is supported by each of the companies responsible for electricity production and / or distribution of electrical energy, whether the TCN in Nigeria, the NIGELEC in Niger, the SONABEL in Burkina Faso or the CEB in Benin.

2.2.1 WAPP

The WAPP is the institution of the ECOWAS in charge of the integration of the regional energy system and the creation of a regional electricity market through various public and private companies involved in the production, transmission and distribution of electricity in West Africa.

The WAPP has a structure enabling it to fulfill the responsibilities entrusted to it, including a General Secretariat, which is the administrative body responsible for the daily management of the WAPP activities. The General Secretariat has three branches, the Planning Department, Investment Programming and Safeguarding the Environment (PIPES) that is composed of a team of professionals responsible for performing daily tasks necessary for the fulfillment of environmental and social aspects of the mission of the WAPP.

2.2.2 TCN (TRANSMISSION COMPANY OF NIGERIA)

The Transmission Company of Nigeria (TCN) is responsible for activities related to the transportation of electric power across Nigeria. According to Fichtner (2016) the total production capacity in Nigeria is 12,318.9 MW while the available capacity is 9,990.3 MW and consists of the following primary sources:

Table 2-1 Types and Electricity Production Capacity in Nigeria

Type of Power Station	Total Capacity (MW)	% of Country's Total Capacity	Available Capacity (MW)	% of Country's Available Capacity
Hydroelectric	1,900	15	1,340	13
Thermal	10,418.9	85	8,650.3	87

In terms of the network, it consists mainly of:

- → 6,000 km of 330 kV power lines and 38 substations (330 kV)
- → 8,000 km of 132 kV power lines and 133 substations (132 kV)

In addition, Nigeria has interconnected transmission lines with the neighboring countries:

- → a 260 km 132 kV power line between Birnin Kebbi and Niamey (Niger)
- → a 103 km 132 kV power line between Katsina and Gazaoua (Niger)
- → a 70 km 330 kV power line between Lagos and Sakete (Benin)

Nigeria has a National control center located in the city of Osogbo, in addition to three regional control centers.

2.2.3 NIGELEC

The Nigerian Electricity Society (NIGELEC) was established in September 1968 as a public corporation to take over from the African Electricity Company (AEC). The company is overseen by the Ministry of Energy.

It is responsible for the generation, transmission and distribution of electricity, under a renewable 50-year concession signed with the State of Niger on March 3, 1993 and follows the first concession ratified on May 22, 1956.

According to the concession, the state transferred the monopoly to the NIGELEC while allowing the use of public facilities directly related to the generation, transmission and distribution of electric energy. The

NIGELEC has the responsibility to maintain and improve facilities to ensure the best quality service at the best price.

The NIGELEC is governed by a legal and regulatory framework by the electrical energy sub-sector. In 2003, a new electrical code was adopted (No. 2003-004), enabling production by independent companies, ending the monopoly of the NIGELEC.

The energy requirements of the NIGELEC are met through domestic production, imports, and independent producers. Total production and importation in 2015 reached a 1026.63 GWh of which 212.51 GWh was produced by NIGELEC, 52.70 GWh by SONICHAR and 781.99 GWh was imported from Power Holding Company of Nigeria (PHCN) (BOAD, 2016). National production is provided via:

- → The facilities of the NIGELEC, composed of 53 thermal centrals including more than a hundred power units generating between 50 and 16,000 kVA (BOAD, 2016), offers an approximate total capacity of 113.2 MW and available capacity of 73.2 MW (Fichtner, 2016).
- → The energy production of the Nigerian Society of Anou Araren Coal (SONICHAR), a state company that produces just over 36 MW thanks to a coal power plant. The transmission of electricity for the mining companies COMINAK and SOMAIR is provided through a 132 kV line. The transmission line and associated substations are leased to the SONICHAR but nevertheless belong to the NIGELEC. Part of this production is sold to the NIGELEC needed for the towns of Agadez, Arlit and Tchirozerine.

Imports from Nigeria are ensured by the PHCN and represented approximately 87% of electricity transiting on the NIGELEC distribution network in 2011. The PHCN has been selling electricity to the NIGELEC since 1976 when the first 132 kV interconnection line became operational between Birnin Kebbi (Nigeria) and Niamey, via Dosso. In 1994, a second interconnection line, of 330 kV, was built between Katsina in Nigeria and Gazaoua, Maradi and Zinder in Niger.

The network in Niger is established in six zones:

- → The River Zone, via the 264 km 132 kV interconnection line linking Birnin Kebbi (Nigeria) to Niamey (Niger) with a capacity of 120 MV and a diesel plant of 57,6 MW.
- → The Central East Zone, which includes the provinces of Zinder, Maradi and Tahoua, via a 302 km 132 kV line linking Katsina (Nigeria) to Gazaoua (Niger) with a capacity of 40 MW and a diesel plant of 13,8 MW.
- → The North Zone, which includes the communities of Agadez, Arlit and Tchirozerine, in addition to the mining companies, via a 155 km 132 kV line supplied by SONICHAR, the coal plant, with a power of 37,6 MW.
- → The East Zone, which includes the province of Diffa, connected to the network of Nigeria by 33 kV interconnection linking Damask, with a power of 5 MW.
- → The Gaya – Malanville Zone, supplied by the interconnection of Kamba in Niger, with a power of 7 MW.
- → The Thermal Zone, comprising isolated load centers, provided by thermal power plants of a 6 MW capacity.

This network is linked through the following type of substations:

- → 6 substations at 132 kV
- → 15 substations at 66 kV
- → 4 substations at 33 kV
- → 19 substations at 20 kV

The Government of Niger is currently undertaking an extensive program of energy production by developing their national resources.

Several projects have been initiated, including the construction of Kandadji dam with a power of 130 MW, coal power plants Salkadamna with 200 MW and Anou Araren with 50 MW and the 100 MW

Gourou-Banda diesel power plant, for which financing has been obtained for the first 80 MW, is currently under construction. 330 kV transmission line construction projects are also planned, including the North Core Project of the WAPP.

2.2.4 SONABEL

The national electricity company of Burkina Faso, The *Société Nationale d'Électricité du Burkina Faso* (SONABEL), is a company managed by the State under Decree (No. 97-599 / PRES / PM / MEM / CEC) approved on 31 December, 1997. Several changes have occurred since the creation of the company which was then a private company (AOF Energy) founded in 1954, and was responsible for the production and distribution of electricity in Ouagadougou. The SONABEL is currently responsible for the production, importation, transmission and distribution of electricity to the localities in the sectors it serves.

National production is essentially from thermal power plants and from a small amount of hydropower through 24 thermal power plants and 4 hydropower plants. According to Fichtner (2016), the total firm capacity of these facilities is 271,5 MW while the total available capacity is 147,5 MW distributed as follows.

Table 2-2 Types and Electricity Production Capacity in Burkina Faso

Type of Power Station	Total Capacity (MW)	% of Country's Total Capacity	Available Capacity (MW)	% of Country's Available Capacity
Hydroelectric	36	13	16	11
Thermal	235,5	87	131,5	89

The SONABEL also meets some of the needs by the importation of electricity from the Ivory Coast, Ghana and Togo. Imports accounted for 48% of production in late 2011.

The main transmission lines are 132 kV lines connecting the hydroelectric facilities of Bagre and Kompienga to Ouagadougou and a 225 kV line, connecting Ferkessedougou (Ivory Coast) to Bobo Dioulasso and Ouagadougou. The total length of transmission lines is about 1370 km, including the interconnection transmission line of 225 kV linking Bobo Dioulasso and Ouagadougou completed in 2008 at a length of 350 km. The 225 kV interconnection line project between Bolgatanga (Ghana) and Ouagadougou is under construction and is expected to be completed in 2015.

With regards to the electrical substations, the following installations are present:

- → 4 substations at 225 kV
- → 4 substations at 132 kV
- → 7 substations at 90 kV
- → 25 substations at 33 kV

In 2011, 172 localities were served. The electrification rate of the country was 20% in 2003, with a 60% objective to be reached by 2015.

2.2.5 CEB

The Electric Community of Benin (CEB) is a public organization established by an international agreement ratified on July 27, 1968. Under this agreement, the CEB has the monopoly on the production and transportation of energy and also possesses a monopoly for the development of structures connected to Benin and Togo.

The revision of the Beninese–Togolese Electrical Code assigned the CEB exclusive rights to transport, import and sell to the unique buyers of these two countries. This revision also opens the market to independent power producers.

The CEB is the only energy supplier to distribution companies located in Benin, via the Beninese Electric Power Corporation (SBEE), and in Togo, via the Electric Power Company of Togo (CEET).

The CEB's activities began in 1973, following the construction of a 161 kV transmission line interconnected between the two countries and Ghana. In 2007, a 330 kV network was built to interconnect the CEB network to the network of Nigeria. In 2010, the importation of electricity totaled 88,6% of consumption in Benin and Togo. These imports came from Ghana (30,2%) via The Volta River Authority, The Ivory Coast (4,0%) via the *la Compagnie Ivoirienne d'Électricité de Côte d'Ivoire*and Nigeria (51,5%) via the Transmission Company of Nigeria.

According to Fichtner (2016), this network is linked through the following substations:

- → 1 substation at 330 kV
- → 17 substations at 161 kV
- → 6 substations at 63 kV
- → 2 substations at 34.5 kV
- → 2 substations at 33 kV
- → 4 substations at 20 kV

The CEB currently operates the hydroelectric plant of Nangbeto located 210 km northeast of Lome. Its installed capacity is about 65 MW for an average annual production of about 172 GWh. This resource is however characterized by a high sensitivity to climatic events. The CEB also occasionally operates two thermal power plants of 20 MW, one in the city of Lome in Togo and the other in Cotonou, Benin. They function as equally well with natural gas as with A1 jet fuel and each have a generation capacity of 150 GWh per year. *Contour Global*, an independent producer located in Togo, currently operates a 100 MW thermal power plant.

According to Fichtner (2016), the total firm capacity of the CEB power generation plants is 285,6 MW, while its total available capacity is 90 MW, and consists of the following primary sources:

Table 2-3 Types and Electricity Production Capacity in Benin

Type of Power Station	Total Capacity (MW)	% of Country's Total Capacity	Available Capacity (MW)	% of Country's Available Capacity
Hydroelectric	65.6	23	20	22
Thermal	220	77	70	78

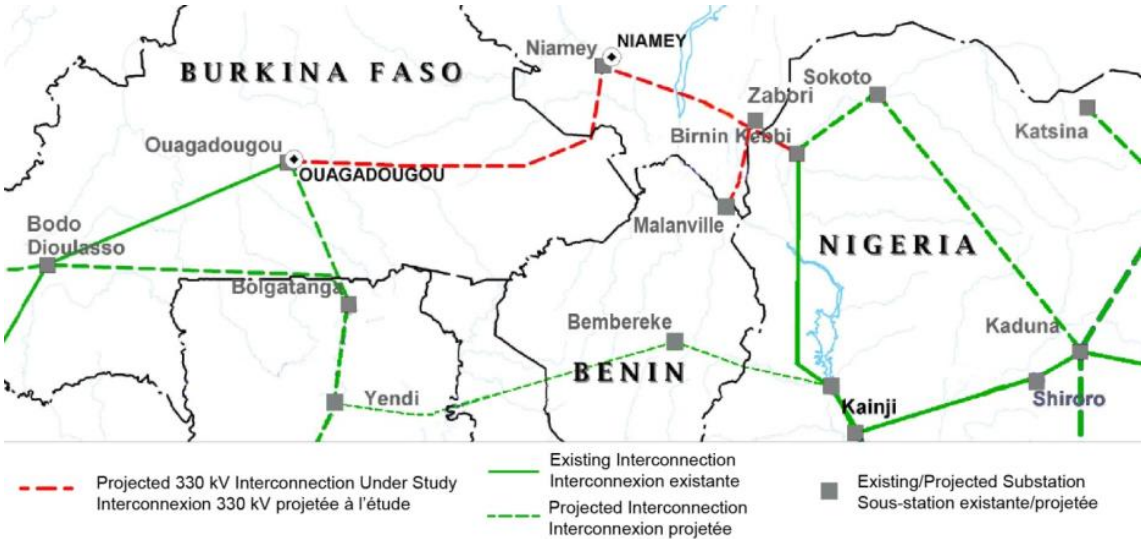
The interconnected network of the CEB mainly covers the coastal area, where the population density is high, and where the majority of economic and industrial activities are concentrated. Faced with a growing demand resulting from the development and expansion of new cities in both countries, the CEB has undertaken a series of studies aimed at:

- → The potential of hydroelectricity development in the two countries.
- → The possible diversification of energy sources, via transmission lines interconnected with Nigeria, which is part of the WAPP. The extension of the electricity transport systems in the two countries via the interconnection of the northern regions to the southern coastal network.

On January 22nd, 2011, the Government of Benin received funding from the West African Development Bank (WADB) to finance the preparation and construction of a 161 kV line linking Malanville, Kandi and Bembereke in Benin.

2.3 TYPE OF PROJECT

The project consists in the construction of a 330 kV transmission line on steel pylons with a total length of 880 km linking Nigeria to Burkina Faso through Niger, with a derivation toward Benin, as shown on the figure below.



Reference: WAPP, 2011

Figure 2-1 Projected Interconnection between Burkina Faso, Niger, Nigeria and Benin

Five new substations will be constructed: two in Niger (not that the Gorou Banda substation is in its final stages of construction), two in Burkina Faso, and one in Benin. The existing Birnin Kebbi substation in Nigeria will be modified to accept a new bay for the 330 kV line.

This interconnection between Nigeria, Niger, Burkina Faso and Benin will enable efficient transfer of electrical energy within the sub region and will help satisfy energy demand from appropriate production points.

It is planned that the 330 kV North Core project, from the overhead ground wire or other appropriate technologies, will supply electricity to all communities / villages / towns within a radius of 10 km from the center line, including a total of in between 500 to 2,500 inhabitants. In this context, WSP presented this list in the line route study (WSP 2015) to enable the consultant in charge of updating the feasibility study to make an appropriate proposal for rural electrification (Fichtner 2016). This component of the project is not comprised in this ESIA.

2.4 LOCATION AND CHARACTERISTICS OF THE LINE ROUTE

The final provisional line route (WSP 2015) takes into account the comments made during the meeting to review and adopt the provisional preliminary line route. This line route is presented below, from Nigeria to Burkina Faso through Niger and Benin. The following guidelines were followed to design an optimal line route:

- → follow existing roads as much as possible to ease maintenance
- → avoid the proximity of rivers and, as much as possible, paddy fields, to decrease pylon foundation costs
- → select normal river crossing spans to avoid using high towers
- → minimize the number of angle points
- → avoid restricted areas, like villages, airfields and nature reserves
- → consider technical and economic criteria for final optimization

2.4.1 NIGERIA

The 330 kV line runs from the Birnin Kebbi substation to the border with Niger, with the following characteristics:

- → extends over a total length of 62 km with a 50 m right-of-way
- → exits the Birnin Kebbi Station from the north following the corridor of the existing Kanji-Birnin Kebbi 330 kV line, by-passes the city and links with the existing 132 kV line

- → crosses the floodplain of the Sokoto River on a distance of 8 km following the existing 132 kV line
- → mainly follows the existing 132 kV transmission line to the border with Niger over a distance of 48 km

2.4.2 NIGER

There are three 330 kV line sections in Niger that are between the Niger/Nigeria border and the future Gorou Banda substation in Niamey, between the Gorou Banda substation and the Niger/Burkina Faso border and between the projected Zabori substation and the Niger/Benin border.

The first section, from the border with Nigeria to the projected Gorou Banda substation in Niamey presents the following characteristics:

- → extends over a length of 208 km with a 50 m right-of-way
- → from the border with Nigeria to the future site of the projected Zabori substation, crosses the Dallol Maouri Ramsar site for 24 km
- → east of Dosso, crosses the Dallol Bosso Ramsar site for 37 km parallel to the National 1 road and the existing 132 kV line
- → crosses the floodplain of the Niger River near Tahirou Koira
- → reaches the projected Gorou Banda substation site located to the south of Niamey

The second section, from Gorou Banda to Niger/Burkina Faso border, is characterized by the following:

- → extends over a length of 104 km with a 50 m right-of-way
- → exits the Gorou Banda substation towards the south-west
- → meets with the Niger NR6 and follows it to the Burkina Faso border
- → crosses the bird and biodiversity area of Makalondi for approximately 50 km

The third section, future site of the Zabori substation to Niger/Benin border, shows the following characteristics:

- → extends for a length of 108 km with a 50 m right-of-way
- → exits the future Zabori substation towards the south-west
- → touches a small section of the north-west limit of the Dallol Maouri Ramsar site
- → curves slightly towards the south to meet with Niger NR7 at the level of Gonga Innza, and follows this road on its western side for approximately 10 km
- → leaves the NR7 and pursues south through an area of classified forests
- → passes less than 2 km west of the Gourou Bassounga National Park and reaches the Niger River floodplain and the border with Benin

2.4.3 BENIN

The line runs from the border with Niger to the Malanville substation, with the following characteristics:

- → extends over a distance of 12 km with a 50 m right-of-way
- → enters in Benin at the frontier with Niger at the west of Malanville and crosses the Niger river and its floodplain
- → bypasses the suburban area of Malanville on the west side
- → bypasses the hilly area southwest of Malanville
- → crosses the NR2 to reach the Malanville substation by the north-west

2.4.4 BURKINA FASO

The original project, in Burkina Faso, consisted in one 330 kV line running from the border with Niger to the Ouaga-east substation in Burkina Faso, with the following characteristics:

- → extends over a distance of 381 km with a 50 m right-of-way
- → follows the south-west side of the NR4 at a distance of approximately 5 km and crosses the NR19 at the level of Kantchari
- → curves towards the west and continues following the NR4 on its southern side
- → crosses the NR4 at the level of Nalougou and continues to follow this road on its other side thus avoiding the agropastoral and pastoral area of Tapoa-Boopo
- → reaching the periphery of Fada N'Gouma, the line leaves the NR4's side to bypass the city on its northern side and then crosses the National road on the western side of the city
- → it pursues on the south side of the NR4 towards the west up to the level of the city of Koupéla which it bypasses on its southern side crossing, in the doing, the RN16
- → the line curves slightly towards the north-west following the southern side of the NR4 and passing north of Silmiougou pastoral area, a military base and the Boromé gold mine
- → approximately 13 km after passing the town of Rapadama, the line follows the RN4 with which crosses the Volta Valleys zone for approximately 22 km and crosses twice the NR4 that is once at the level of Kougri and then again as it exits the Volta Valley zone
- → when crossing the NR4 at the level of Kougri, the line is near the southern limit of the Wayen National Park
- → after leaving the Volta Valley zone, the line, still following the RN4, gradually curves towards the south-west, slightly touching the limits of the Gonsé National Park and finally reaching the Ouaga-east substation from the north

However, the WAPP introduced two other line sections to be constructed at the periphery of Ouagadougou, which are:

- → a 225 kV line originating from the Ouaga-east substation, connecting to the future Ouaga-south-east substation and pursuing up to an anchor pylon to the south-west of the future substation.
- → a 90 kV line originating from the Ouaga-east substation and reaching the Kossodo (KOS) substation to the north-west.

The new 225 kV line originating from the Ouaga-east substation shows the following characteristics:

- → extends towards the south for a length of 24 km and a 75 m right-of-way, bypassing on its eastern side the urban area of Ouagadougou
- → reaches the future location of the Ouaga-south-east substation some 2 km to the north-east of the NR6 after bypassing the western limits of the Ouassoudi community
- → leaving the Ouaga-south-east substation, the line crosses the NR6 and extends towards the south-west and reaches the PA5 pylon approximately 800 m after crossing a water course

The new 90 kV transmission line originating from the Ouaga-east substation presents the following characteristics:

- → extends for approximately 17 km with a 50 m right-of-way
- → the line stretches towards the north-west for 12 km crossing the NR4, the Ouaga 3 dam outlet and the NR3
- → almost 4 km after crossing the NR3, the line changes direction towards the south-west to finally reach the Kossodo substation.

2.5 LOCATION AND CHARACTERISTICS OF THE SUBSTATIONS

2.5.1 NIGERIA

The existing Birnin Kebbi substation is located in the heart of the city (12.437° N, 4.197° E). When completed with the new 330 kV bay for the present interconnection, the substation will occupy a surface of 110,000 m². According to Fichtner (2016), two development variants are considered for the extension of the substation, which would include the following components:

- → extension of air insulated double busbar
- → extension of the substation with 1 or 2 line feeders
- → extension of auxiliary power supply (AC/DC Panels)
- → connection of two existing transformers to the double busbar
- → construction of the incoming gantry for the existing Kainji line
- → removal of T-OFF of existing Kainji line

No information is currently available with regards to oil spill confinement measures or fire protection. It will be important to specifically require, in the tender documents, the preparation and implementation of a system that will alert, detect and fight eventual fires as well as an intervention process in case of an oil spill (or any other contaminant).

2.5.2 NIGER

The new Gourou Banda substation (13.426° N 2.116° E) is located 10 km south of Niamey and 2 km from highway 27. The substation is located 300 m from the Gourou Banda diesel power plant, on a hill at an elevation above sea level of 20 m. The substation occupies an area of 90,000 m². According to Fichtner 2016, this new substation is in fact an expansion of an existing 132 kV substation with two transformer feeders 161/330 kV in hybrid technology. Although initial recommendations were for an air insulated system (AIS) with double busbar for the extension, it seems that potential space limitation could prohibit this type of system and favor a gas insulated system (GIS). Two development variants have been considered which would include the following components:

- → **2 or 4** line feeders
- → **2 or 4** shunt reactor feeders
- → bus coupler
- → two 330/132, 80 MVA power transformer feeders
- → an auxiliary power supply (battery, UPS, auxiliary transformers and diesel generator)

The new Zabori switchyard (12.769°N 3.473°E) is located 3 km southeast of Baba Dey and 3.3 km northwest of Zabori. It occupies an area of 90,000 m² and according to Fichtner (2016), it will be an air insulated double busbar arrangement with or without power transformer. Two development variants have been considered which would include the following components:

- → **3 or 5** line feeders
- → one 330/132/33 kV, 20 MVA power transformer feeder
- → 1 or 2 shunt reactor feeders
- → bus coupler
- → an auxiliary power supply (battery, UPS, auxiliary transformers and diesel generator)

No information is currently available with regards to oil spill confinement measures or fire protection. It will be important to specifically require, in the tender documents, the preparation and implementation of a system that will alert, detect and fight eventual fires as well as an intervention process in case of an oil spill (or any other contaminant).

2.5.3 BENIN

The new Malanville substation (11.782° N 3.374° E) is located 3 km south of Badjekali and is accessible by a tertiary road linking the National Route E2. The substation occupies an area of approximately 70,000 m². According to Fichtner (2016), this substation will be built in two stages. First a 161 kV substation using air insulated double busbar will be built and later, the 330 kV section will be added. The required area to build both stages has already been reserved. The final station will include the following components:

- → 1 line feeder
- → bus coupler
- → 1 shunt reactor feeder
- → two 330/161 kV, 50 MVA power transformer feeders
- → an auxiliary power supply (battery, UPS, auxiliary transformers and diesel generator)

No information is currently available with regards to oil spill confinement measures or fire protection. It will be important to specifically require, in the tender documents, the preparation and implementation of a system that will alert, detect and fight eventual fires as well as an intervention process in case of an oil spill (or any other contaminant).

2.5.4 BURKINA FASO

Two new substations will be constructed at the periphery of Ouagadougou that is Ouaga-east and Ouaga-south-east.

The new 330/225/90 kV Ouaga-east substation near Ouagadougou (12.401° N 1.381° E) is located 1 km from an existing secondary road and accessible by NR4. The substation will occupy an area of 100,000 m². This substation is at a distance of 16.5 km from the city center of Ouagadougou. According to Fichtner (2016), two development variants are considered for this substation and will include the following component:

- → new air insulated double busbar substation with transfer busbar
- → **1 or 2** 330 kV Line feeders
- → **1 or 2** shunt reactor feeders
- → three 330/225 kV power transformer feeders
- → 330 kV bus coupler
- → 225 kV bus coupler
- → two 225 kV Line feeders
- → two 225/90 kV power transformer feeders
- → 90 kV bus coupler
- → two 90 kV Line feeders
- → auxiliary power supply (transformer, Battery, UPS, auxiliary transformers, diesel generator)

The new 225/132/33 kV Ouaga-south-east substation (12.287° N, 1.400° E) is located 2 km to the north-east of the NR6 and the Kouba community. The substation will occupy approximately 20,000 m² and it is located at a distance of 14.8 km from Ouagadougou's city center. According to Fichtner (2016), the station will include the following components:

- → new air insulated double busbar substation
- → three 225 kV line feeders
- → two 225/132 kV power transformer feeders
- → 225 kV bus coupler
- → two 132 kV line feeders

- one 132/33 kV power transformer feeder
- 132 kV bus coupler
- four 33 kV outgoing feeders
- auxiliary power supply (transformer, Battery, UPS, auxiliary transformers, diesel generator)

No information is currently available with regards to oil spill confinement measures or fire protection. It will be important to specifically require, in the tender documents, the preparation and implementation of a system that will alert, detect and fight eventual fires as well as an intervention process in case of an oil spill (or any other contaminant).

2.6 PROJECT COMPONENTS

2.6.1 VOLTAGE LEVEL

A 330 kV voltage level was selected for this interconnection, which is part of a wide network foreseen by the WAPP in ECOWAS member states.

As for the two existing lines, the Ouaga-east substation toward the south-west and north-west will respectively have a voltage of 225 kV and 90 kV.

2.6.2 NUMBER OF CIRCUITS

Fichtner (2016) defined the configuration of the 330 kV line as well as its number of circuits. The number of circuits considered is defined as follow:

- SCL: Single Circuit Overhead Line
- DCL: Double Circuit Overhead Line
- DSL: Double Circuit Overhead Line which is erected with one circuit only

Four distinct sections were considered for this analysis:

- Birnin Kebbi – Zabori: 90 km
- Zabori – Gorou Banda (Niamey): 180 km
- Zabori – Malanville: 120 km
- Gorou Banda – Ouagadougou: 490 km

Three variants were studied by the FS consultant for the configuration and number of circuits:

Variant 1:

- Birnin Kebbi – Zabori: SCL
- Zabori – Gorou Banda: SCL
- Zabori – Malanville: SCL
- Gorou Banda – Ouagadougou: SCL

Variant 2:

- Birnin Kebbi – Zabori: DCL
- Zabori – Gorou Banda: DCL
- Zabori – Malanville: DSL
- Gorou Banda – Ouagadougou: DCL

Variant 3:

- → Birnin Kebbi – Zabori: DSL
- → Zabori – Gorou Banda: DSL
- → Zabori – Malanville: DSL
- → Gorou Banda – Ouagadougou: DSL

Fichtner (2016) proposes to retain both variants 2 and 3 for network analysis and economic calculations. Variant 1, although it is the lowest investment cost option (see section 1.7), is not recommended as it does not allow the network to meet the n-1 criterion which is the ability to withstand the loss of any single component.

As for the 225 kV line to be implemented between the Ouaga-east substation and the PA5 pylon, it is recommended by Fichtner (2016) that the first 9 km to the Ouaga-south-east substation be DCL while the last 15 km to the PA5 pylon be SCL.

Finally, with regards to the 90 kV line which will link the Ouaga-east and Kossodo substations, it is recommended that the line be SCL.

2.6.3 PHASE CONDUCTORS AND SHIELD WIRES

According to the Fichtner (2016), the diameter, area and number of sub-conductors per phase should ensure:

- → provision of satisfactory radio interference (RI), audible noise (AN) and corona loss performances
- → transfer of a maximum design power at 330 kV nominal voltage
- → transfer of a maximum design power at 330 kV nominal voltage, in cases of emergency on one circuit where there is a double circuit system
- → provision of satisfactory safety to the line (considering the loads from wind pressure)

The existing 330 kV lines are equipped with two Aluminum Conductor Steel Reinforced (ACSR) Bison per phase, one classical ground wire (shield wire) and one Optical Ground Wire (OPGW). This type of conductor is suitable for power transfer at 330 kV nominal voltage and thus, no further investigations were made for the conductor size. The recommendation for the OPGW cables is the 48 fibers type G.652d.

Investigations focused on conductor materials in respect of the latest technological developments to determine the possibilities of:

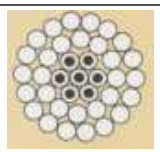
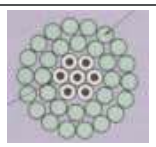
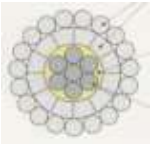
- → selecting an alternative conductor
- → solutions to upgrade the line in the future, if necessary

In order to ensure that the same types of towers and insulator strings could be maintained for an alternative conductor, the following restrictions were observed:

- → The alternative conductor shall have a diameter less than or equal to and breaking loads higher than or equal to the ACSR Bison.
- → The ground clearance and clearances to the other lines and structures shall be the same.

The following table summarizes the main characteristics of the existing conductor and of the alternative conductors considered.

Table 2-4 Key Features of the Existing Conductor and Alternative Conductors Considered

Conductor Type	Stranding	View	Characteristics	
			Temperature	Power Transfer at Max. Current
			ºC	% of ACSR
ACSR	Al + Steel		80ºC	100%
ACSR/ACS	Al + ACS		80ºC	107%
SLAC/ACS	Al + SBAl + ACS		80ºC	113%
TCASR/AS	TAl + ACS		150ºC	150%
60% ZTACIR/ACS	ZTAl + IR(ACS)		230ºC	200%
58% ZTACIR/ACS				
XTACIR/ACS	XTAl + IR(AS)			
60% ZTACEIR/ACS	SB ZTAl/IR(AS)		230ºC	200%
58% ZTACEIR/ACS				
XTACEIR/ACS	SB XTAl / IR(AS)			
GTACSR	TAl + TZ + EST		150ºC	150%
GZTACSR	ZTAl + TZ + EST		210ºC	180%

The conclusion of Fichtner's (2016) completed investigation was that for both single circuit and double circuit lines, the conductor should be two-bundle ACSR Bison with one steel conductor as classical ground wire (shield wire) and one OPGW. They also recommend that all inner layers of conductors and the ground wire's steel core, be greased for protection against corrosion.

As an alternative, Fichtner (2016) proposes a conductor with aluminum clad steel wires of ACSR/ACS Bison type that have the same size and strength as the ACSR, based on the following technical performance:

- → an electrical resistance approximately 7% lower than that of the ACSR (consequently power losses should be less)
- → favorable corrosion behavior, as all wire-to-wire contacts are aluminum-to-aluminum
- → reasonable extra costs, comparable to the savings resulting from low losses
- → favorable corona phenomenon performance (the grease on the ACSR conductor collects dust, so corona losses increase over time)
- → low weight compared to ACSR, since no grease is needed, sagging is then less than for the ACSR

The FS consultant will also select the number of optical fibres in the OPGW.

For the 225 kV line linking the Ouaga-east and Ouaga-south-east substations, the conductor type will be an almelec, model ASTER 570. These conductors are an alloy of aluminum with some magnesium and silicon. This type of cable is composed of 61 strands of 3.45 mm in diameters for a total exterior diameter of 31.05 mm.

Finally, the 90 kV line linking the Ouaga-east and Kossodo substations, the conductor type will also be an almelec, model ASTER 228. This type of cable is composed of 37 strands of 2,9 mm for a total exterior diameter of 19,6 mm.

2.6.4 TOWER TYPES

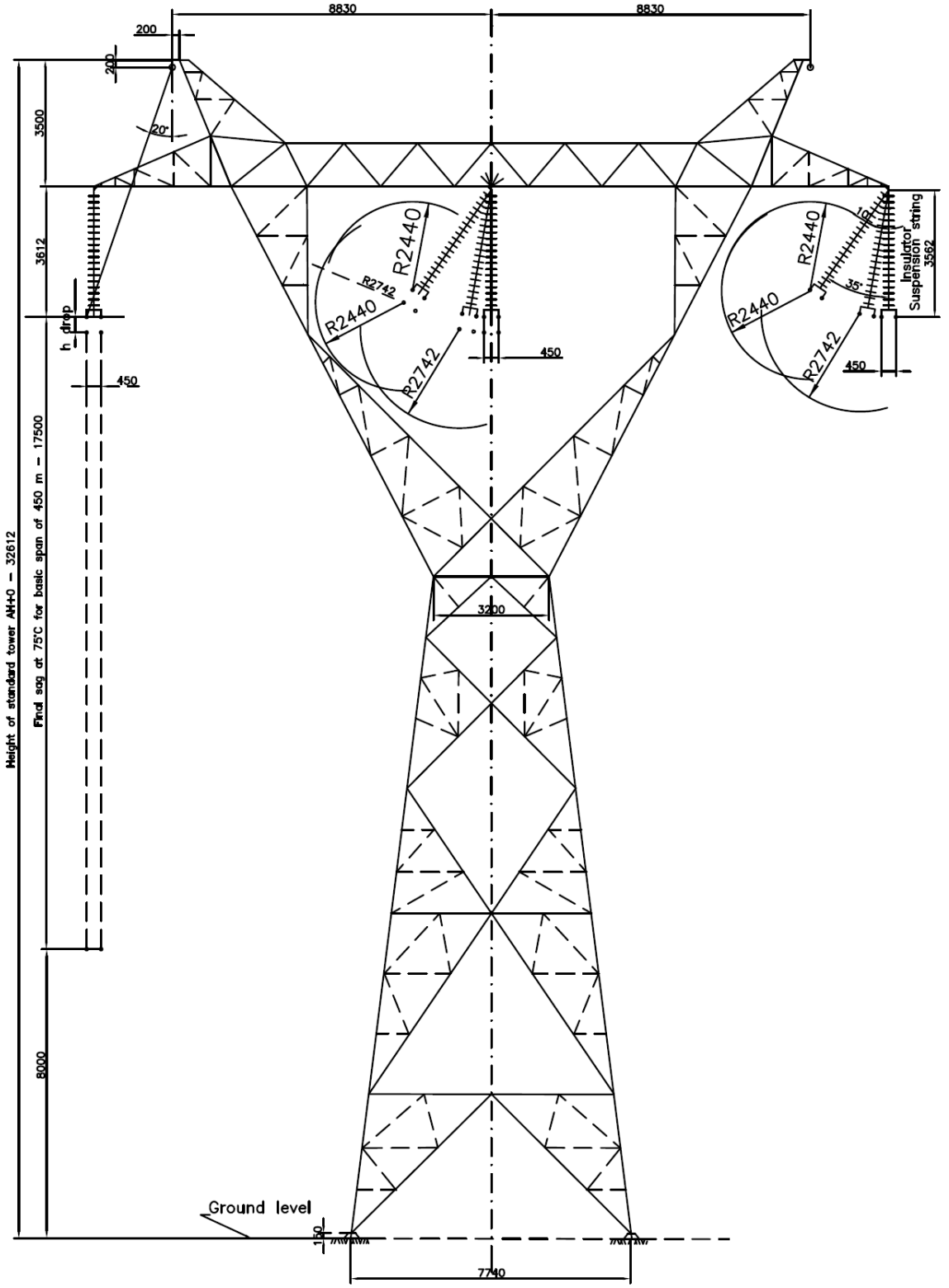
Typically, self-supporting lattice towers, as illustrated in figures 2-2 and 2-3, are used in western Africa and are foreseen for this interconnection. In its 2016 feasibility study, Fichtner proposes the following specifications for the towers:

- → Tower types will be made under conventional basis but it should be made clear to the tenderers that, if found economical, it would be acceptable to combine one or more designs into a single type.
- → Suspension towers should be designed for the maximum height and maximum characteristic spans and provide with adequate body extensions.
- → Tension towers will include 30°, 60°, 90° and terminal angle towers.
- → Tower span considered is 450 m for both single-circuit and double-circuit tower configurations.
- → Average height of the single-circuit structure will be 33 m and 47 m for the double-circuit structure.

The information related to minimum clearance to ground is currently not available for the 330 kV line. However, it will be necessary to consider the presence of giraffes in Niger during the feasibility study to ensure sufficient clearance, if required.

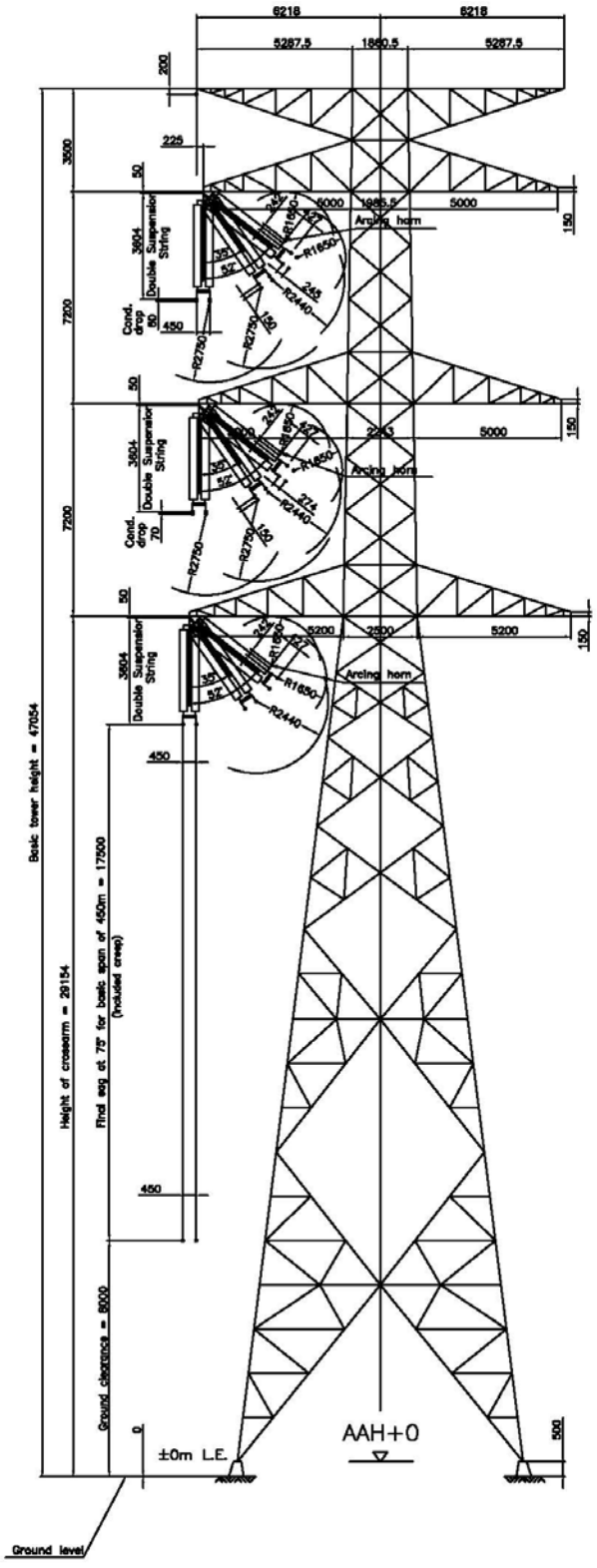
The specification for the selection of the 225 kV towers will be described in the call for tender file and thus, are not available at this time. Nonetheless, figures 2-4 and 2-5 respectively present the typical aspect of the DCL and SCL tower types to be used for this line. Typical span between two DCL towers will be 350 m and 300 m between two SCL towers.

The 90 kV line, also located in Burkina Faso, should be composed of tetrapod metal lattice towers equipped with composite isolators. The height of the structures will be calculated to ensure a minimal ground clearance of 6.5 m at conductor's maximum temperature. Figure 2-5 shows the typical aspect of the SCL towers to be used for this line. Typical span between two towers will be 300 m.



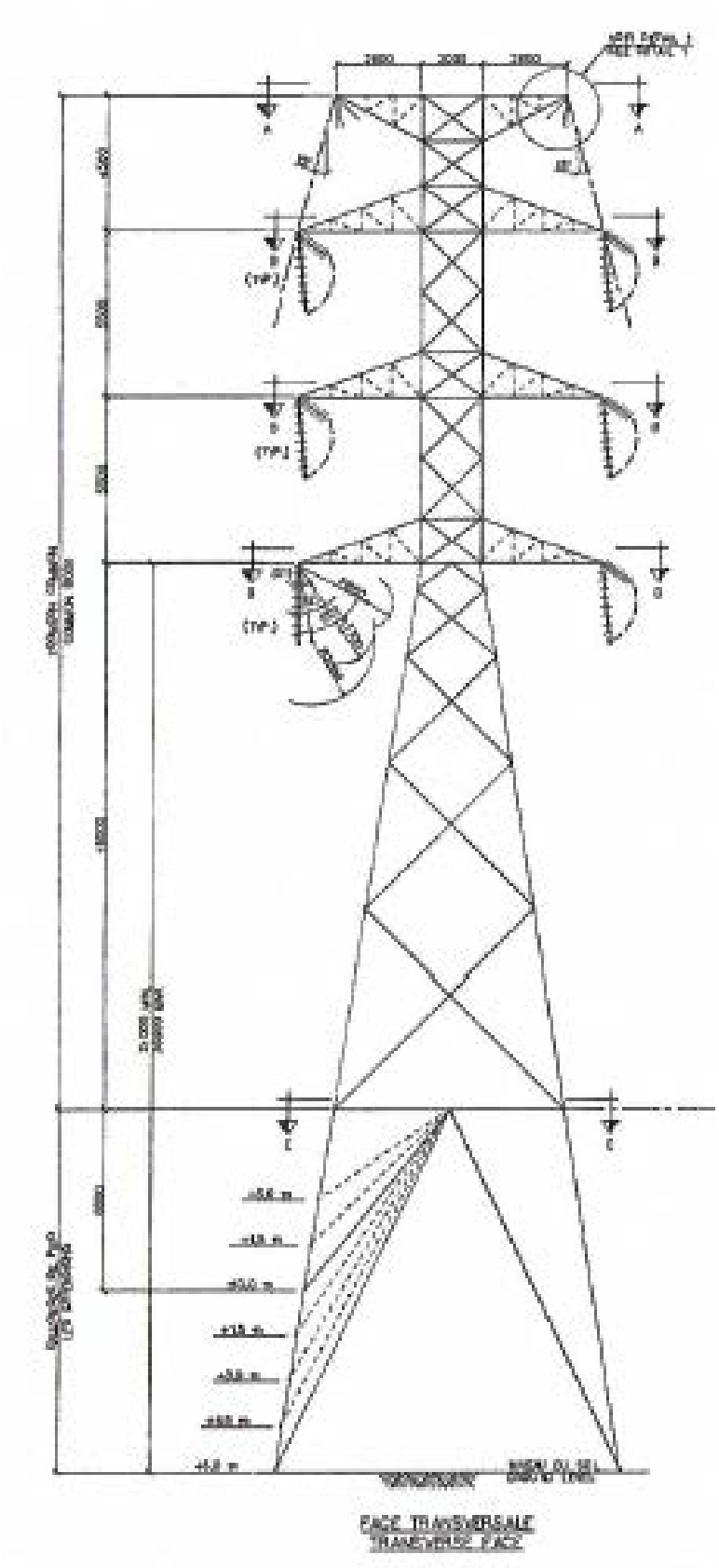
Reference: Fichtner, January, 2016

Figure 2-2 330 kV Single Circuit Suspension Tower Type



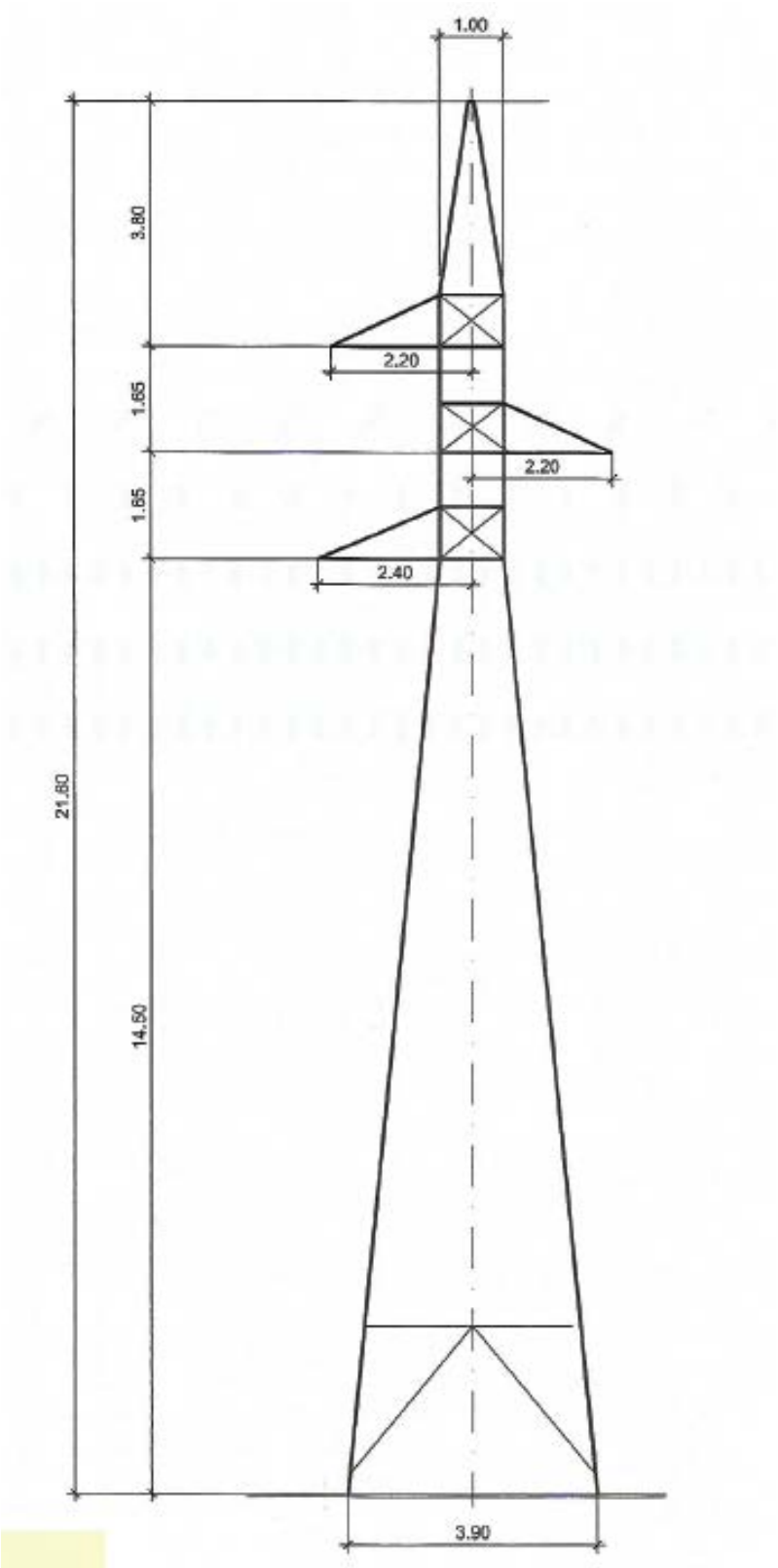
Reference: Fichtner, January, 2016

Figure 2-3 330 kV Double Circuit Suspension Tower Type



Reference: SONABEL, 2016

Figure 2-4 Typical Representation of a DCL Tower for the 225 kV Line



Reference: SONABEL, 2016

Figure 2-5 Typical Representation of a SCL Tower for the 225 and the 90 kV Lines

2.6.5 TOWER FOUNDATIONS

The 2016 feasibility study (Fichtner, 2016) specifies the following characteristics for the towers' foundations:

- → rock foundations for sound rock with a bearing capacity of at least 1,000 kN/m^2
- → rock foundations for weathered rock with a bearing capacity of 600-1,000 kN/m^2
- → pad and chimney foundations for heavily weathered / fractured rocks with a bearing capacity of 300-600 kN/m^2
- → pad and chimney foundations for normal / good soil conditions with a bearing capacity of 150-300 kN/m^2
- → pile foundations for poor / very poor soil conditions

The FS contractor has indicated that the footprint for a single-circuit tower, with an average height of 33 m, is about 60 m^2. With a 15 m base extension, the footprint would increase to 163 m^2 and 200 m^2 with a supplementary leg extension of 15 m.

For a double-circuit tower with an average height of 47 m, the footprint is about 52 m^2. With a 12 m base extension, the footprint would increase to 100 m^2 and 118 m^2 with a supplementary leg extension of 4 m.

The typical area occupied by the proposed 225 kV line DCL towers will be 8.5 X 8.5 m (mean value) and 10 X 10 (maximum value). The typical area occupied by the proposed 225 and 90 kV line SCL towers will be 5 X 5 m (mean value) and 7 X 7 m (maximum value).

The 90 kV line tower foundation will be in concrete/armed concrete and composed of 4 distinct bases located at each corner of the towers.

2.6.6 NUMBER OF TOWERS

Nigeria

The line route study (WSP 2015) indicates that there will be 17 angle structures. Considering that the FS consultant, Fichtner, has indicated that the average ruling span will be around 450 m (single and double-circuit lines), it can be estimated that there will be about 140 to 150 structures in Nigeria considering dead-end and angle structures.

Niger

The line route study (WSP 2015) indicates that there will be 84 angle structures. Considering that the FS consultant has indicated that the average ruling span will be around 450 m (single and double-circuit lines), it can be estimated that there will be about 935 to 950 structures in Niger considering dead-end and angle structures.

Benin

The line route study (WSP 2015) indicates that there will be 9 angle structures. Considering that the FS consultant, Fichtner, has indicated that the average ruling span will be around 450 m (single and double-circuit lines), it can be estimated that there will be about 30 to 35 structures in Benin considering dead-end and angle structures.

Burkina Faso

The line route study (WSP 2015) indicates that there will be 63 angle structures. Considering that the FS consultant, Fichtner, has indicated that the average ruling span will be around 450 m (single and double-circuit lines), it can be estimated that there will be about 850 to 865 structures in Burkina Faso considering dead-end and angle structures.

For the 225 kV line linking the Ouaga-east and Ouaga-south-east substations in Burkina Faso and considering that the first 9 km will be composed of DCL towers while the last 15 km will be composed

of SCL towers, the respective number of towers required has been estimated at 26 and 50, for a total of 76.

For the 90 kV line linking the Ouaga-east and Kossodo substations in Burkina Faso, the estimated number of towers required for its length of 17 km was estimated at 57.

2.6.7 RIGHT-OF-WAY

A width of right-of-way (RoW) of 50 m has been preselected in the four countries for the line route study and final selection. It is expected that this 50 m RoW is enough to satisfy the following technical requirements to which the 330 kV transmission lines must comply:

- → audible and radio noises
- → electric and magnetic fields
- → conductor swing clearance under high wind conditions
- → security clearance for tower collapsing scenario

For the 225 kV line, the basic RoW between the Ouaga-east substation and the PA5 pylon is 50 m. However, an additional width of 25 m has been reserved for the section between the Ouaga-east and the future Ouaga-south-east substations for a total RoW of 75 m.

The RoW for the 90 kV line between the Ouaga-east and the Kossodo substations is 50 m. This RoW will be adapted to the existing roads in the Kossodo industrial area as the line approaches the Kossodo substation.

2.7 PROJECT SCHEDULE AND COST

2.7.1 PROJECT SCHEDULE

According to Fichtner (2016), implementation schedule for the construction of the transmission lines and substations would imply the following duration which are presented per project phase.

Table 2-5 Project Implementation Schedule

TRANSMISSION LINES			SUBSTATIONS			
Phase 1: Pre-Construction	Phase 2: Supply and Construction	Phase 3: Commissioning, Project Closure	Phase 1: Design and Approval	Phase 2: Procurement and Manufacturing	Phase 3: Construction	Phase 4: Commissioning, Project Closure
6 months	18 months	3 months	5 months	9 months	14 months (with 6 months in parallel of Phase 2)	5 months

Based on the above, and allowing 10% for contingencies, the overall transmission line construction duration for each of the transmission line sections will be around 2.5 years. However, it would be possible to implement certain sections in parallel in the same period.

As for the substations, the total duration will be 27 months. Allowing a contingency of 10% for implementation, the total construction duration is 2.5 years. It is assumed that work may be undertaken in parallel at the various substation locations so the implementation period for all substation work will likewise be 2.5 years.

With regards to the 90 kV line linking the Ouaga-east and Kossodo substations, its construction will be realized in parallel with the other components of the project and thus, should not exceed the total duration of 2.5 years.

2.7.2 PROJECT COST

The total cost estimated by Fichtner (2016) included all work for the 330 kV and 225 kV lines as well as for the associated new substations or expansions of existing substations. The estimate was calculated comparing the three line variants presented in section 1.5.2. The following table summarizes the total cost estimates.

Table 2-6 Estimates of Project Costs

Country	Variant 1		Variant 2		Variant 3	
	Lines*	**Substations***	**Lines***	**Substations***	**Lines***	**Substations***
Nigeria	13,190,289	4,383,425	20,460,659	5,673,175	16,240,807	4,383,425
Total*	**17,573,714**		**26,133,834**		**20,624,232**	
Niger	89,353,572	39,594,200	131,253,757	51,705,200	110,018,370	39,594,200
Total*	**128,947,772**		**182,958,957**		**149,612,570**	
Burkina Faso	85,254,177	58,924,450	129,931,775	63,903,950	104,000,101	58,924,450
Total*	**144,178,627**		**193,835,725**		**162,924,551**	
Benin	2,552,959	13,794,150	3,143,382	13,794,150	3,143,382	13,794,150
Total*	**16,347,109**		**16,937,532**		**16,937,532**	
Total Lines and Substations	**307,047,222**		**419,866,048**		**350,098,885**	

* US $

Fichtner (2016), specifies that variant 2 is the most expensive but more profitable in the viewing time, by 2035, while variant 1, is the cheapest option, but not stable for the future.

With regards to the 90 kV line linking the Ouaga-east and Kossodo substations in Burkina Faso, its construction costs should amount to US $ 83,323 /km (€ 74,000/km) for a total of US $ 1,416,491 (€ 1,258,000) for 17 km of line.

The total cost of the project is thus US $ 421,282,539.

In Nigeria, the total cost of the project is US $ 26,133,834.

3 SUMMARY OF ENVIRONMENTAL AND SOCIAL IMPACTS

This section summarizes impact analysis as described in the environmental and social impact assessment report. The impact analysis takes into account the various phases of the project:

- → pre-construction and construction phases
- → operation phase
- → decommissionning phase

This analysis is based on a cause/effect matrix between project-related impact sources and valued environmental and social components. This matrix is displayed in Figure 3-1.

Impacts are defined by their intensity (low, medium, major), their extent (regional, local, limited) and their duration (long, medium, short). The method used to identify, analyze and mitigate environmental and social impacts, or to improve positive impacts, places the project in a sustainable development perspective. The mitigation of anticipated negative impacts and the enhancement of positive impacts allow its environmental and social acceptability by stakeholders. Impact intensity as well as impact probability of occurrence, based on the environmental and social impact assessment report of the North Core project, are shown in tables 3-1 and 3-2.

Impacts Sources		Physical Environment VESC				Biological Environment VESC				Human Environment VESC						
		Air quality	Noise levels	Soils and agriculture	Water resources	Terrestrial habitats, fauna and flora	Avifauna	Aquatic and semi-aquatic habitats and fauna	Land planning and use	Existing infrastructures	Economy, employment and livelihoods	Quality of life, health and safety	Social cohesion and gender	Vulnerable groups	Cultural and archaeological heritage	Landscape
Pre-construction phase	Land acquisition												X	X		
	Population resettlement								X	X	X	X	X	X		
Construction phase	Site preparation	X	X	X	X	X	X	X	X	X					X	X
	Exploitation of borrow pits					X	X								X	X
	Implementation of construction sites	X	X		X	X	X	X								
	Construction activities	X	X	X	X	X	X	X	X	X	X	X			X	X
	Work in aquatic environment					X	X	X								
	Management of hazardous products and residual materials			X	X	X		X				X				
	Transport and traffic	X	X	X	X	X		X		X	X	X				
	Purchase of materials, goods and services															
	Labor					X	X	X				X	X			
Operation phase	Presence and operation of line and substation		X	X	X	X	X	X		X	X	X				X
	Facilities maintenance		X	X	X	X	X	X								
	Right-of-way maintenance		X	X	X	X	X	X			X	X				
	Management of residual/hazardous material			X		X	X	X								
	Transport / circulation		X	X	X			X								
	Purchase of material, goods and services															
	Presence of workers					X	X	X								X

Figure 3-1 Interactions Between Impact Sources and Valuable Environmental and Social Components (VESC)

Table 3-1 Summary of Potential and Residual Impacts During Pre-Construction/Construction Phase

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Physical environment VESC				
Air quality and climate change	– site preparation – implementation of construction sites – construction activities – transport and traffic	– Temporary deterioration of air quality related to exhaust gas and dust generated by vehicle traffic. Construction activities could generate low emissions of GHG	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Noise levels	– site preparation – implementation of construction sites – construction activities – transport and traffic	– Local increase of noise levels anticipated during works. – Emissions of noise from construction works with associated machinery (roller, grader, concrete mixer, generators, trucks, etc.) could reach maximum noise emissions of approximately 100 dB	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Soils and agricultural potential	– site preparation – construction activities – management of hazardous products and residual materials – transport and traffic	– Foundation works for pylons, as well as the construction of access roads and camps will lead to soil erosion and compaction in erosion-prone areas such as strong slopes and wetlands. – Changes in soil chemical properties and risk of soil contamination are foreseen in case of an accidental spill of petrol or fuel oil.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Water resources	– site preparation – implementation of construction sites – construction activities – management of hazardous products and residual materials – transport and traffic	– In-water works and poor management of hazardous material could result in local changes in hydrology and in modifications to surface water and groundwater quality resulting in contamination. – Areas most at risk are the Sokoto River and its floodplain, as well as the intermittent watercourses crossed by the line route	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Biological environment VESC				
Terrestrial habitats, flora and fauna	– site preparation – exploitation of borrow pits – implementation of construction sites – construction activities – work in aquatic environment – management of hazardous products and residual materials – transport and traffic – labor	– Most of the power line ROW consists of agricultural areas including Agricultural-Shrubby Vegetation Mosaic, Cultivated Land and Intensive Cultivation which cover together 66,9 % of the right of way. – A total of 29.1 ha of tiger bush will need to be cut and constitutes permanent loss of natural habitat. – Habitat fragmentation and degradation will result in modification of species composition in flora and fauna communities and the introduction and risk of spread if invasive species.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High
Avifauna	– site preparation – exploitation of borrow pits – implementation of construction sites – construction activities – work in aquatic environment – labor	– Construction activities will lead to habitat losses, modification and fragmentation for some terrestrial and water birds, notably of conservation interest and water birds. – Habitats of higher ecological importance for birds in the study area are the Sokoto floodplain and areas close to the Niger border (not far from the dallol Maouri Ramsar site).	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High
Aquatic and semi-aquatic habitats and fauna	– site preparation – implementation of construction sites – construction activities – work in aquatic environment – management of hazardous products and residual materials – transport and traffic – labor	– During the construction phase, access road construction, vegetation clearing, and pylon construction will cause wetland and riparian habitat loss and could lead to local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances. Sokoto river, its associated floodplain and intermittent watercourses may be affected.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Medium

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Human Environment VESC				
Land planning and use	– site preparation – population resettlement – construction activities	– Loss of land, crops, trees and pastoral zones outside the ROW – 498 households will lose a piece of land entirely or partially. – 537 trees belonging to project affected people (PAPs) will need to be cut down	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Existing infrastructures	– population resettlement – site preparation – construction activities – transport and traffic	– A total of 25 houses, 11 secondary structures, six commercial structures and three community structures will need to be demolished or displaced before construction begin. – On main roads, the presence of vehicles and building materials can lead to an increase in traffic and damage risks. To the extent possible, existing roads will be used as access roads. New access roads (permanent or temporary) could be built only if clearly needed.	Nature: Negative Importance: **Major** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Economy, employment and livelihoods	– Purchase of materials, goods and services – Labor	– Construction activities will lead to the creation of short-term jobs. – Stimulation of local economy by the purchase of local goods and services.	Nature: Positive Importance: **Minor** Probability of impact occurrence: Medium	Nature: Positive Importance: **Minor** Probability of impact occurrence: High
Economy, employment and livelihoods	– presence and operation of the line and substations – wayleave maintenance – population resettlement – construction activities – transport and traffic	– Construction works will lead to the creation of short term jobs and will stimulate local economy by the purchase of local goods and services. This demand can however lead to risks of inflation. – Project implementation will also lead to permanent loss of crops. – Tourism and leisure activities could temporarily be disturbed by noise, dust, traffic and construction works.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Quality of life, health and security	– population resettlement – construction activities – management of hazardous products and residual materials – transport and traffic – labor	– The influx of foreign workers can lead to increased pressure on community health services in the region. Their presence can also increase STD transmission risks, including HIV/AIDS. – The increase in heavy vehicle traffic can increase risk of accidents and physical injuries involving local workers and residents. Construction sites can generate curiosity, especially among children. – Noise, dust, air pollution and risk of accidents can generate stress and disturbances in generally calm rural areas – Environment disruption caused by workers' camps	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Social cohesion and gender	– land acquisition – population resettlement – labor	– Compensation assessment and transfer could lead to conflicts and revive old quarrels. – Tensions with outside workers could also arise because of different value systems. – Also, there is a risk of marginalization of women from the compensation process if they are not implicated in all project steps. – Works can also disturb women subsistence activities.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Vulnerable groups	– land acquisition – population resettlement	– Increased marginalization of vulnerable groups (e.g.: women heads of households, disabled or elderly, etc.)	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Cultural and archeological heritage	– site preparation – exploitation of borrow pits – construction activities	– Potential disturbance or destruction of archaeological sites and / or objects, and of burial and / or sacred sites. No grave or cemetery were identified in the ROW.	Nature: Negative Importance: **Major** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Landscape	– site preparation – construction activities – exploitation of borrow pits	– Aesthetic impacts during the construction phase will be limited to work zones. Deforestation of the ROW will change the landscape	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High

Table 3-2 Summary of Potential and Residual Impacts During Operation and Maintenance Phase

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Physical Environment VESC				
Air quality and climate change	– presence and operation of line and substations – facilities maintenance – ROW management	– Slight degradation or air quality felt locally due to maintenance activities, particularly ROM maintenance and vegetation clearing activities. – Transport and traffic associated with maintenance activities are also likely to generate dust, especially during dry periods – Emissions of greenhouse gases from machinery in very small quantities.	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Noise levels	– presence and operation of line and substations – facilities maintenance – ROW management – transport and circulation	– Maintenance activities conducted near pylons, substations, transmission line or ROW could lead to an increase in noise levels – Operating transmission lines and substations emit a permanent background sound which is audible and which may also disturb communities in the vicinity to the line or substation . Noise propagation is generally higher during rainfall and be especially noticeable during nighttime.	Nature: Negative Importance: **Minor** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High
Soils and agriculture	– presence and operation of line and substations – facilities maintenance – ROW maintenance – transport and circulation – management of residual/hazardous material	– Maintenance activities will be limited during the operation phase, but are more regular at substation facilities. Oil leaks resulting from equipment breakdown and/or accidental spills of hazardous substances could lead to soil contamination	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Water resources	– presence and operation of line and substations – facilities of maintenance – ROW management – transport and circulation – management of residual/hazardous material	– Maintenance activities of the powerline will be limited during the operation phase, but could be more regular at substation facilities. Oil leaks resulting from equipment breakdown and/or accidental spills of hazardous substances could lead to ground water and surface contamination	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Biological Environment VESC				
Terrestrial habitats, flora and fauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – presence of workers	– Maintenance of the ROW requires regular clearing of vegetation in order to reduce short-circuit risks caused by electric arcing. This means no vegetation will be allowed to grow above 4 m within the ROW. This continuous alteration of natural habitats will maintain ROW habitats in earlier vegetation development stages, leading to habitat loss for some terrestrial fauna species and causing a barrier effect for small fauna, limiting their movements or making them more vulnerable to predation. – There are risks of collisions and electrocution with bats – Presence of the access road in previously inaccessible areas could lead to an increase in natural resources exploitation and a reduction of species communities with a higher use value.	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: High

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Avifauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – presence of workers	– Collision risks of birds with the ground wires are high and can cause injuries or death. Risk are greater for waterbirds near wetland or rivers, and for large birds. No species susceptible to collision surveyed inside the study area are threatened. – The Sokoto floodplain is certainly an area prone to bird collisions, as it is a wetland in proximity to the Niger river where birds are known to concentrate.Modification and disturbance of bird habitats, with associated changes in bird communities	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: High	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Medium
Aquatic and semi-aquatic habitats and fauna	– presence and operation of line and substation – facilities maintenance – ROW maintenance – management of residual/hazardous material – transport and circulation – presence of workers	– Hydrological conditions modifications that could potentially be caused by the presence of pylons in the floodplain and of access roads could cause modifications in aquatic habitats and its associated fauna – Potential introduction of invasive alien species	Nature: Negative Magnitude: **Moderate** Probability of impact occurrence: Low	Nature: Negative Magnitude: **Minor** Probability of impact occurrence: Low
Human Environment VESC				
Land planning and use		– No negative impact on land use, and planning is expected during the Operation Phase since the PAPs will have been displaced before construction	n/a	n/a
Existing infrastructures	– presence and operation of line and substation	– Transmission lines do not usually interfere with television and radio signals. In some cases, interference can occur very close to the ROW due to low broadcast signals or poor reception of the equipment.	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Economy, employment and livelihoods	– presence and operation of line and substations – facilities maintenance – ROW management	– Potential for economic development associated with electricity access originating from the project – Jobs will be created	Nature: Positive Importance: **Major** Probability of impact occurrence: Medium	Nature: Positive Importance: **Major** Probability of impact occurrence: High

VESC	SOURCES OF IMPACT	IMPACTS	POTENTIAL IMPACTS	RESIDUAL IMPACTS
Quality of life, health and security	– presence and operation of the line and substations	– The project can lead to electrocution risks caused by equipment failure, illegal connections, steel theft and any other forms of dangerous contacts. – Based on a recent comprehensive review of scientific literature, there is no evidence to date concluding that an exposure to electromagnetic fields (EMF) of low intensity is harmful to human health. However, – perceptions of risk remain.	Nature: Negative Importance: **Moderate** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium
Social cohesion and gender	– presence of workers – ROW maintenance	– The loss of crops (annual and perennial) due to maintenance activities can affect women more than men. In fact, women are usually in charge of subsistence activities and struggle to provide their household when crops are limited.	Nature: Negative Importance: **Minor** Probability of impact occurrence: Medium	Nature: Negative Importance: **Minor** Probability of impact occurrence: Low
Vulnerable groups		– No negative impact on vulnerable groups is expected in the Operation Phase	n/a	n/a
Cultural and archeological heritage		– No negative impact on the cultural and archaeological heritage is expected during the Operation Phase	n/a	n/a
Landscape	– presence and operation of line and substation	– The overall aesthetic effect of a transmission line is likely to be negative for some people, especially where the proposed lines cross natural landscapes. The tall steel structures may seem out of proportion and not compatible with agricultural landscapes. The consultations conducted with the local populations have not raised the visual aspect as a negative impact	Nature: Negative Importance: **Moderate** Probability of impact occurrence: High	Nature: Negative Importance: **Minor** Probability of impact occurrence: High

4 APPLICABLE MANAGEMENT MEASURES

Mitigation impact hierarchy has been applied as part of the project. The following tables present management measures that will allow to avoid, mitigate, compensate or enhance impacts that were identified in the previous chapter. Table 4-1 presents management measures planned during pre-construction/ construction phases whereas Table 4-2 presents measures to be implemented during the operational phase.

Table 4-1 Management Measures to be Implemented During Pre-Construction/Construction Phase

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Site preparation; Implementation of construction sites Construction activities; Transport and traffic	Air quality and climate change	Temporary air quality deterioration	x	x	Stockpiles of fine materials will be covered during period of high winds	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration	x	x	Non-stabilized stockpiles and exposed soils will be sprayed with water regularly if dust generation is visible.	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Air quality and climate change	Temporary air quality deterioration Low emissions of GHG Soils and agriculture potential	x	x	Develop and apply a proper waste management strategy. Burning of solid wastes will not be permitted.	Prior to and throughout the construction phase	Contractor
Construction activities	Air quality and climate change; Noise levels	Temporary air quality deterioration Low emissions of GHG Increase in noise levels	x	x	Generators, vehicles and machinery will be shut down when not in use.	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration Lowe emissions of GHG	x	x	Maintain equipment and machinery in good running condition, including brakes, mufflers, silencers and catalyzers.	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration	x	x	Cover excavated materials with erosion control blankets	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration	x	x	Use water for dust suppression on dust generating areas.	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration	x	x	Restrict speed on loose surface roads to 25 km/h during dry or dusty conditions	Throughout the construction phase	Contractor
Construction activities	Air quality and climate change	Temporary air quality deterioration Low emissions of GHG	x	x	Prohibit idling of vehicles on-site to reduce emissions	Throughout the construction phase	
Construction activities	Air quality and climate change	Temporary air quality deterioration	x	x	Cover loads of brittle material during transport	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities; Transport and traffic	Noise Levels	Increase in noise levels	x	x	Restrict noise generating activities near residential or institutional sensitive receptors to the period considered as daytime by national noise standards	Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Site preparation; Implementation of construction sites; Construction activities; Transport and traffic	Noise Levels	Increase in noise levels	x	x	Follow national noise standards. Apply for a licence to emit noise in excess of the permissible levels.	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites; Construction activities Transport and traffic	Noise Levels	Increase in noise levels	x	x	Provide all internal combustion equipment with properly functioning silencers or mufflers	Throughout the construction phase	Contractor
Transport and traffic	Soils and agricultural potential	Soil erosion in erosion-prone areas Soil compaction in work areas	x	x	Strictly restrict transport to identified access. Clearly mark out the limit of the ROW and access roads	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential; Water resources Vulnerable groups	Changes in soil chemical properties and risk of soil contamination; Surface water contamination; Groundwater contamination	x	x	All ignitable, reactive, flammable, corrosive and toxic materials will be stored in clearly labelled containers	Throughout the construction phase	Contractor
Construction activities; Transport and traffic	Soils and agricultural potential	Soil erosion in erosion-prone areas	x	x	Operate machinery on land in a way that minimizes disturbance to the banks of watercourses	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities; Transport and traffic	Soils and agricultural potential	Soil erosion in erosion-prone areas	x	x	Prepare and implement erosion and sediment control plans, particularly in areas identified as having high erosion potential	Throughout the construction phase	Contractor
Transport and traffic	Soils and agricultural potential	Soil erosion in erosion-prone areas Soil compaction in work areas	x	x	Restrict materials and manpower movements to existing roads/tracks to the extent possible.	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Soil erosion in erosion-prone areas	x	x	Identify and rehabilitate exposed soils immediately following construction activities	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Soil compaction in work areas	x	x	Avoid construction activities in areas where soils are highly saturated	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	x	x	Construct a designated, signposted, concrete wash down bay that is fully contained and bunded for all excess concrete and concrete wash down (e.g. plastic lined)	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	x	x	Regularly maintain the concrete washout bay, treating any water prior to release to natural systems.	Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Management of hazardous products and residual materials	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	x	x	Hazardous materials (mainly used oil and gas) must be stored in a manner that prevents interaction with each other or with the environment or from being tampered accidentally	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	x	x	International Chemical Safety Cards or Material Safety Data Sheets or equivalent data/information will be readily available in an easily understood language to exposed workers and first aid personnel	Throughout the construction phase	Contractor
Transport and traffic	Soils and agricultural potential	Soil compaction in work areas	x	x	De-compact soils following construction with appropriate equipment	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities Management of hazardous products and residual materials Transport and traffic	Soils and agricultural potential Water resources	Changes in soil chemical properties and risk of soil contamination Risk of surface water contamination Risk of groundwater contamination	x	x	Prepare and implement an Emergency Response Plan	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	x	x	Control and reduce at source the production of wastes and hazardous waste (mainly used oil and gas)	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities; Management of hazardous products and residual materials Transport and traffic	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination Risk of surface water contamination Risk of groundwater contamination	x	x	Keep a Spill Containment Kit readily accessible onsite in the event of an accidental spill and ensure on-site staff is trained in spill response	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities Management of hazardous products and residual materials Transport and traffic	Soils and agricultural potential Water resources	Changes in soil chemical properties and risk of soil contamination Risk of surface water contamination Risk of groundwater contamination	x	x	Contain any spills onsite and clean up spills as soon as possible	Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Site preparation; Implementation of construction sites Construction activities Management of hazardous products and residual materials Transport and traffic	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination Risk of surface water contamination; Risk of groundwater contamination	x	x	Document and report all spills to the FMEnv	Throughout the construction phase	Contractor PMU
Construction activities	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	x	x	Characterize, remove and dispose of contaminated soils at sites authorized by relevant authorities	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Soils and agricultural potential; Water resources	Changes in soil chemical properties and risk of soil contamination; Risk of surface water contamination; Risk of groundwater contamination	x	x	Ensure that equipment and machinery are in good operating condition, clean (power washed), free of leaks, excess oil, and grease	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	x	x	Segregate and temporarily store excavated soils in order to used them as backfill when needed	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination		x	Ensure that all stationary equipment and machinery are installed above permanent spill containment facilities of sufficient capacity.	Design stage	Contractor
Construction activities	Soils and agricultural potential	Changes in soil chemical properties and risk of soil contamination	x	x	Remove any construction debris generated at the sites immediately after completion of construction activities.	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Soil erosion in erosion-prone areas;	x	x	Revegetate areas of bare and disturbed soils as soon as possible with native species.	Throughout the construction phase	Contractor
Construction activities	Soils and agricultural potential	Soil erosion in erosion-prone areas	x	x	Operate machinery on land in a way that minimizes disturbance to the banks of watercourses	Throughout the construction phase	Contractor
Construction activities	Water resources	Risk of groundwater contamination	x	x	Pump out and dispose of any groundwater encountered during excavation in order to protect groundwater resources from contamination in case of spills	Throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Water resources	Changes in hydrology	x		Ensure towers to be located outside the floodplain of all watercourses and permanent wetlands	Throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Water resources	Changes in hydrology	x	x	Select access tracks so as to avoid crossing streams and other water bodies	Throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Water resources	Changes in hydrology	x	x	Where stream crossings are unavoidable, construct suitable culvert. Under no circumstances will water bodies be blocked to provide access.		Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Construction activities Work in aquatic environment	Water resources	Changes in hydrology	x	x	Avoid equipment and vehicle movements in rivers, floodplains and wetland areas. If unavoidable, reduce access to a minimum length in wetlands and floodplains.	Throughout the construction phase	Contractor
Management of hazardous products and residual materials	Water resources	Modification to water quality; Risk of surface water contamination	x		Store hazardous material and vehicles minimally 100m away from wetlands and watercourses floodplains	Throughout the construction phase	Contractor
Site preparation; Implementation of construction sites Construction activities Transport and traffic	Water resources	Changes in hydrology	x		Properly delineate wetlands and floodplain areas	Prior to construction work within or near aquatic habitats	Contractor
Work in aquatic environment	Water resources	Changes in hydrology; Modification to water quality; Surface water contamination	x	x	Set and implement strict procedures for in-water works.	Within or near aquatic habitats prior to and throughout the construction phase	Contractor
Construction activities; Work in aquatic environment	Water resources	Changes in hydrology; Modification to water quality; Risk of surface water contamination	x	x	Conduct activities during the dry season to minimize disturbance of sensitive shoreline and wetland areas.	Throughout the construction phase	Contractor
Construction activities	Water resources	Changes in hydrology; Modification to water quality; Risk of surface water contamination	x	x	Avoid material piling inside wetland areas and floodplains	Throughout the construction phase	Contractor
Construction activities	Water resources	Modification to water quality; Risk of surface water contamination	x	x	Operate machinery on land in a way that minimizes disturbance to the banks of watercourses	Throughout the construction phase	Contractor
Construction activities	Water resources	Risk of surface water contamination	x	x	Do not refuel or service equipment within 100 m of any watercourse or surface water drainage installations	Throughout the construction phase	Contractor
Construction activities	Water resources	Modification to water quality; Risk of surface water contamination	x	x	While working within wetlands, restrict all equipment movements to access roads	Throughout the construction phase	Contractor
Construction activities	Water resources	Modification to water quality; Risk of surface water contamination	x	x	Install silt barriers (e.g., fencing) when working in steep riparian areas and along wetlands to minimize potential sediment transport to aquatic habitats.	Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Site preparation; Implementation of construction sites Construction activities	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora; Terrestrial habitat fragmentation and degradation over small areas at the project site; Modification of species composition in flora and fauna communities present in the project area.	x		Establish a Compensation and Revegetation Plan for lost natural habitats during construction phase. The loss of ligneous species should be compensated at least by planting equivalent areas with native species. Validate with a botanical expert: species chosen for restoration; best time for revegetation depending on species to plant and habitat to restore; preferential habitats for endangered species.	Beginning of and throughout the construction phase	Contractor
Construction activities Transport and traffic	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora; Terrestrial habitat fragmentation and degradation over small areas at the project site; Modification of species composition in flora and fauna communities present in the project area.	x	x	Restrict construction activities, including vehicle movements and material storage, inside the ROW	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	x	x	Minimize the construction of new access roads. Promote the use of existing access roads for machinery and vehicle movements, increasing their width as necessary.	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site	x		Promote the use of existing roads for transporting material and tower parts to the construction sites in order to reduce the project's footprint and minimize the need for new access roads	Throughout the construction phase	Contractor
Site preparation	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora.	x	x	Clearly mark the extent of vegetation cutting in the ROW with stakes at intervals of 50 m or less. Identify and mark the vegetation to be preserved along sections of the ROW.	Throughout the construction phase	Contractor
Construction activities	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site.	x	x	Shift tower positions and adjust tower intervals as practicable to minimize encroachment in ecologically sensitive areas	Design stage	Contractor
Site preparation	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site. .	x	x	Undertake ROW vegetation cutting with the supervision of a botanist in order to identify and relocate if possible species of conservation concern as well as protect vegetation that does not represent a risk for the powerline. Any species of conservation concern that need to be cut will be located and its	During vegetation removal within the ROW	PMU

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
					habitat will be fully described. This information will be integrated in the planning of reforestation program. If possible, collect seeds from species of conservation concern		
Site preparation	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site.	x	x	Undertake a selective cutting of the vegetation in order to keep low scrubby and herbaceous species that do not represent a risk for the powerline.	During vegetation removal within the ROW	Contractor
Site preparation Construction activities	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site.	x		Conserve all the vegetation (trees, shrubs, herbaceous plants, crops) present at the edge of watercourses and on steep slopes.	Throughout the construction phase	Contractor
Site preparation; Construction activities	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site.	x	x	Use existing roads and trails as much as possible to minimize road construction and associated habitat fragmentation.	Project Design Phase	Contractor
Construction activities Transport and traffic	Terrestrial habitats, flora and fauna	Invasive species introduction and risk of spread.	x	x	Inspect and clean construction equipment properly after working in areas known to be infested with invasive species.	Throughout the construction phase	Contractor
Construction activities	Terrestrial habitats, flora and fauna	Invasive species introduction and risk of spread.	x	x	Survey sensitive areas such as wetlands and shorelines for invasive species following construction and site re-vegetation.	Throughout the construction phase	Contractor
Site preparation; Construction activities	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site.	x	x	Develop and implement a construction waste management plan that strictly respects sound waste management practices.	Throughout the construction phase	Contractor
Site preparation Construction activities	Land planning and use	Loss of land, crops, tree and pastoral zones in the ROW;	x	x	Make chopped woody resources and residues available to local population in order to reduce additional pressures on natural resources.	During vegetation removal within the ROW	Contractor
Site preparation Construction activities	Land planning and use	Disturbance of the International Transhumance Stalk Route around Birnin Kebbi and Kangiwa;	x		Provide a plantation of woody plants and ensure that the construction of the line near the transhumance route is not done during the migration period.	Throughout the construction phase	Contractor
Site preparation; Construction activities	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora.	x		Rehabilitate and revegetate temporary access road and work areas as soon as possible	Throughout the construction phase	Contractor
Site preparation	Terrestrial habitats, flora and fauna	Terrestrial habitat fragmentation and degradation over small areas at the project site Modification of species composition in flora and fauna communities present in the project area.	x	x	Promote the selection of areas with less of a need for tree cutting for temporary work and storage areas	Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Construction activities	Terrestrial habitats, flora and fauna	Modification of species composition in flora and fauna communities present in the project area	x		Undertake a pre-construction survey, covering migration season and seasonal specificities in order to validate areas of higher risk for bat communities. Develop adapted mitigation measures.	Design stage	Contractor
Construction activities	Terrestrial habitats, flora and fauna	Modification of species composition in flora and fauna communities present in the project area	x		Locate towers outside of bat breeding and bat migration area.	Design stage	Contractor
Labor	Terrestrial habitats, flora and fauna	Permanent loss of natural habitat area and of its associated flora. Terrestrial habitat fragmentation and degradation over small areas at the project site. Modification of species composition in flora and fauna communities present in the project area.	x	x	Implement a biodiversity protection awareness program with workers. Prohibit workers from owning firearms and other hunting gear, and raise awareness about the prohibition to engage in any kind of poaching.	Throughout the construction phase	Contractor
Construction activities	Terrestrial habitats, flora and fauna	Modification of species composition in flora and fauna communities present in the project area.	x	x	Inform the Contractor's E&S specialist when endangered fauna species are observed in or close to project sites.	Throughout the construction phase	Contractor
Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	x		Undertake a birds surveys to validate the presence of threatened species Undertake birds nest surveys within a period of 2 weeks before clearing to identify nest of protected or endangered species. Protect identified nests until chicks are mature. Where a threatened bird species is nesting, do not undertake trees clearing within a radius of 1 km. Wait until the nest is deserted. Come monthly to the nesting site to verify, not more often.	Two weeks prior to the vegetation clearing	PMU
Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	x	x	Compensate any loss of breeding/nesting sites by the creation of suitable habitats elsewhere, notably from enhancement of degraded habitats	Prior to construction and throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	x		Place “bird diverters” on the top (ground) wire to make the lines more visible to birds if the collision potential is high, in particular where the powerline crosses the Sokoto river floodplain). Typical installation of bird diverters requires: - Installation on both earth wires in a staggered pattern - Installation only on the middle lower 60% of the span - Installation at 10 m intervals on each earth wire	Throughout the construction phase	Contractor
Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	x		Installation of indicator lights at night.	Throughout the construction phase	Contractor
Site preparation Construction activities	Avifauna	Modification and degradation of bird habitat Disturbance and modification of local communities	x	x	Complete tree and/or brush cutting prior to or after the core nesting season	Throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Adjust pylon siting to span wetlands areas, or limit equipment access in wetlands, wherever possible.	Prior to construction and throughout the construction phase	Contractor
Construction activities Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Avoid the construction of a permanent access road inside a wetland or a watercourse	Throughout the construction phase	Contractor
Site preparation	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Perform all vegetation clearing work manually. Avoid vegetation clearing along stream shores and on steep slopes.	Project Design Phase and Throughout the construction phase	Contractor
Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Based on an appropriate project design, avoid erecting towers within wetlands. If unavoidable, select the most optimized site for each tower considering human uses and areas of higher ecological integrity.	Project Design Phase and Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x	x	Prohibit construction of permanent access roads along river banks, in wetlands or in areas where soils are saturated	Project Design Phase and Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x	x	Avoid construction of temporary access roads along river banks, in wetlands or in areas where soils are saturated, to the extent possible	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Maintain fish access when road crossings of watercourse are unavoidable by utilizing clear span bridges or open-bottom culverts	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Avoid removing stream bank vegetation	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x	x	Maintain vegetated buffer zones within and around wetlands and along both sides of watercourse crossings. Restore as soon as possible any disturbed areas in the riparian buffer zone.	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x	x	Dismantle temporary access roads built for construction phase in temporary wetland areas. Perform this dismantlement during the dry season and dispose of materials outside wetland areas;	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Avoid equipment and vehicle movements in rivers, floodplains and wetland areas. If unavoidable, reduce access to a minimum length in wetlands and floodplains and select the most optimized site for the access considering human uses and areas of higher ecological integrity	Throughout the construction phase	Contractor
Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x	x	Set and implement strict procedures for in-water works.	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x	x	Conduct activities during the dry season to minimize disturbance of sensitive shoreline and wetland areas.	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Do not operate heavy machinery in wetland areas with standing water	Throughout the construction phase	Contractor
Site preparation Construction activities	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x	x	Avoid material piling inside wetland areas	Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Site preparation Construction activities Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x	x	Do not throw debris in aquatic habitats and remove any debris introduced accidentally into the aquatic environment as soon as possible.	Throughout the construction phase	Contractor
Work in aquatic environment	Water resources	Changes in hydrology	x		Always maintain hydrologic connectivity between upstream and downstream in the work areas.	Throughout the construction phase	Contractor
Work in aquatic environment	Water resources	Changes in hydrology	x		Always ensure free flow of water and sufficient water supply in order to maintain a viable fish habitat downstream from the work areas	Throughout the construction phase	Contractor
Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Install diversion structures (canals, dikes, coffers) that neither obstruct fish movements nor diminish habitat width to less than 2/3 of the current water bodies, including rivers, wetlands, etc.	Throughout the construction phase	Contractor
Work in aquatic environment	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		After termination of construction work, restore natural river bed conditions (minor bed, natural obstacles, etc.);	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Aquatic and semi-aquatic habitats and fauna.	Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances.	x		Use wetland mat or bridge for vehicle and machinery movement inside permanent wetland to avoid the need for building a road	Throughout the construction phase	Contractor
Site preparation Population resettlement Construction activities	Land planning and use Economy, employment and livelihood Existing infrastuctures Vulnerable groups	Loss of land, crops, tree and pastoral zones in the ROW Resettlement Houses and other buildings located in the ROW will have to be relocated Need of existing infrastructures relocation Permanent loss of crops Temporary disruption of activities related to tourism and leisure Compensation and resettlement measures distribution Increased marginalization of vulnerable groups.	x	x	Implement Resettlement Action Plan	Prior to the construction phase	PMU
Population resettlement	Social cohesion and gender	Land use and conflicts related to compensation (could revive old quarrels);	x	x	Involve traditional leaders in the resettlement process	Prior to the construction phase	PMU
Population resettlement	Land planning and use	Loss of land, crops, tree and pastoral zones in the ROW	x	x	Validate with local leaders temporary areas to be used during construction activities	Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Transport and traffic	Existing infrastructures	Increase in traffic and circulation perturbation	x	x	Travel to and from the construction sites should be done during low traffic periods	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Existing infrastructures	Damage to existing infrastructure	x	x	Plan construction activities in collaboration with local authorities to minimize damage to existing infrastructures	Prior to and throughout the construction phase	Contractor
Construction activities Transport and traffic	Existing infrastructures	Damage to existing infrastructure	x	x	Rehabilitate damaged infrastructures after the construction	After the construction phase	Contractor
Site preparation Population resettlement	Economy, employment and livelihoods	Temporary disruption of activities related to tourism and leisure	x	x	Provide compensation measures to affected tourism and recreation activities, if any	Prior and throughout the construction phase	Contractor
Purchase of materials, goods and services	Economy, employment and livelihoods	Inflation risk	x	x	Adopt procurement policies promoting local products and services, when available	Prior to the construction phase	Contractor
Construction activities Transport and traffic	Economy, employment and livelihoods	Temporary disruption of activities related to tourism and leisure	x		Promote portage of material and tower parts to the construction sites using existing roads in order to reduce project footprint and minimize need for new access roads	Throughout the construction phase	Contractor
Construction activities Transport and traffic	Economy, employment and livelihoods	Temporary disruption of activities related to tourism and leisure	x		Mark out the access roads in order to reduce the multiplication of informal access	Throughout the construction phase	Contractor
Site preparation Construction activities	Economy, employment and livelihoods	Permanent loss of crops	x	x	Provide compensations to affected households and landowners	Throughout the construction phase	PMU
Site preparation Construction activities	Economy, employment and livelihoods	Permanent loss of crops	x		Clearing will only be done when consent of each owner has been obtained to clear plantations or cut trees in the ROW.	Throughout the construction phase	Contractor
Site preparation Construction activities	Economy, employment and livelihoods	Permanent loss of crops Loss of ecosystem services	x		Undertake revegetation planting agro-forestry trees that increase availability of fodder or fruit trees, in order to maximize livelihood benefits for local population.	Throughout the construction phase	Contractor
Site preparation Construction activities	Economy, employment and livelihoods	Loss of ecosystem services	x		Include species of use-value in the Compensation and revegetation plan	Throughout the construction phase	Contractor
Site preparation Construction activities	Economy, employment and livelihoods	Permanent loss of crops	x		Carefully select the landing area of falling trees to minimize damages to crops.	Prior to and throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Site preparation Construction activities Transport and trafffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution);	x	x	Locate access roads and lay down areas away from residences to the possible extent	Throughout the construction phase	Contractor
Site preparation Construction activities Transport and trafffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution);	x	x	Notify landowners along the line route about the construction schedule and activities	Throughout the construction phase	Contractor
Site preparation Construction activities Transport and trafffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution);	x	x	An accessible grievance mechanism for PAPs to address complaints at the local level needs to be implemented	Throughout the construction phase	PMU
Site preparationConstruction activitiesTransport and trafffic	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	x	x	Secure equipment and demarcate any excavation works areas	Throughout the construction phase	Contractor
Site preparation Construction activities Transport and trafffic	Quality of life, health and safety	Accidents and physical injuries involving local residents	x	x	Sign and fence construction areas where necessary	Throughout the construction phase	Contractor
Construction activities	Quality of life, health and safety	Exposure to EMFs from the transmission line	x		Design and build the transmission line as to ensure that EMF levels are well below accepted guidelines for occupational and human health exposure limits.	Design stage	TCN
Construction activities	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution);	x	x	Locate temporary access roads and lay down areas away from residences to the extent possible.	Throughout the construction phase	Contractor
Transport and traffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution);	x	x	Restrict transport and circulation activities on public roads to the period between 6 a.m. and 6 p.m.	Throughout the construction phase	Contractor
Construction activities	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution);	x	x	Notify landowners along the main public transportation routes about the construction schedule and activities	Throughout the construction phase	Contractor
Transport and traffic	Quality of life, health and safety	Increased stress-related disturbances (noise, dust, air pollution);	x	x	Control speed of transport vehicles. Limit speed to 20 km/h inside villages and install signposts where relevant	Throughout the construction phase	Contractor
Construction activities	Quality of life, health and safety	Adherence to labor standards and well-being of construction workers	x	x	Require the Contractor to adopt policies and procedures that comply with national legislation and address all aspects of labor standards relevant to the project as specified by BM policies. Sub-contractors will be contractually required to comply with labor and health and safety legislation	Throughout the construction phase	PMU Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Construction activities	Quality of life, health and safety	Adherence to labor standards and well-being of construction workers	x	x	Comply with TCN Corporate Policy on Occupational Health and Safety	Throughout the construction phase	PMU Contractor
Construction activities	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	x	x	Require all contractors and sub-contractors to comply with relevant World Bank health and safety requirements, including specific provisions for: - Introduction, and use of, poisonous or other chemicals injurious to health; - Handling dangerous goods and specialized waste; - Training; - Provision of potable water; - Working environment committee; - Use of helmets and other safety equipment; - Personal injuries and accidents; - Damage to material, equipment and buildings; - Poison treatment, chemical and fire injuries; - Safety audit; - Work done by hired personnel or firms; - Operating cranes; - Working with heat in confined places; - Corrective action; - Protective action; - Use of fall arrestors and anti-climbing devices to prevent public injury.	Throughout the construction phase	PMU Contractor
Construction activities Labor	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	x		Supply drinking water and maintain its quality and ensure sanitation at the construction sites	Throughout the construction phase	Contractor
Construction activities Labor	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	x	x	Develop and Implement an Hygiene, Health and Safety Management Plan according to OHSAS 18001: 2007 international standards	Prior to and throughout the construction phase	Contractor
Labor	Quality of life, health and safety	Risk of increased incidences of STIs and HIV / AIDS	x	x	Prepare and implement a STIsHIV/AIDS prevention program for both communities and workers	Prior to and throughout the construction phase	Contractor
Labor	Quality of life, health and safety	Risk of increased incidences of STIs and HIV / AIDS	x	x	Establish a voluntary and confidential STI screening program, including HIV / AIDS, for workers (to be included in subcontractor contracts)	Prior to and throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Labor	Quality of life, health and safety	Risk of accidents and physical injuries involving local workers and residents	x	x	Maintain construction camps in a clean and healthy condition as prescribed by international worker health standards.	Throughout the construction phase	Contractor
Labor	Social cohesion and gender	Tensions with outside workers;	x	x	Communicate with communities effectively and involve their representatives	Prior to and throughout the construction phase	Contractor PMU
Labor	Social cohesion and gender	Disturbance of women subsistence activities	x	x	Encourage the recruitment of female workers	Throughout the construction phase	Contractor
Labor	Social cohesion and gender	Marginalization of women from the compensation process;	x	x	Implement Resettlement Action Plan	Prior to and throughout the construction phase	PMU
Labor	Vulnerable groups	Increased marginalization of vulnerable groups.		x	Encourage the recruitment of female workers	Prior to and throughout the construction phase	Contractor
Construction Activities	Archaeological and cultural heritage	Potential disturbance or destruction of archaeological sites and / or objects Destruction or potential disturbance of burials and / or sacred sites.	x		Apply the Physical Cultural Resources Management Plan	Prior to and throughout the construction phase	Contractor
Construction Activities	Archaeological and cultural heritage	Potential disturbance or destruction of archaeological sites and / or objects Destruction or potential disturbance of burials and / or sacred sites.	x	x	Provide financial and logistical assistance for the relocation of known burial grounds, sacred sites, or any other cultural sites of importance to communities if needed	Prior to and throughout the construction phase	Contractor
Construction Activities	Archaeological and cultural heritage	Potential disturbance or destruction of archaeological sites and / or objects Destruction or potential disturbance of burials and / or sacred sites.	x	x	Prepare and implement chance find procedures, including supervision of excavation works by an archeologist	Throughout the construction phase	Contractor
Construction Activities	Landscape	Temporary degradation of the landscape on the site.	x		Use tubular pylon with modern design to reduce impact on the visual landscape of the Sokoto crossing area	Design stage	TCN
Construction Activities	Landscape	Temporary degradation of the landscape on the site.	x	x	Minimize vegetation clearing around work areas	Throughout the construction phase	Contractor
Construction Activities	Landscape	Temporary degradation of the landscape on the site.	x	x	Restore all temporary work areas, such as borrow pits and camp sites, as soon as possible	Throughout the construction phase	Contractor

SOURCE OF IMPACT	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Construction Activities	Landscape	Temporary degradation of the landscape on the site.	x	x	Planting of trees or hedges in order to block the view in the ROW and camouflage particularly exposed and/or visible towers.	Throughout the construction phase	Contractor

Table 4-2 Management Measures to be Implemented During Operational Phase

SOURCES OF IMPACTS	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Facilities maintenance ROW management Transport and Circulation	Noise levels	Increase in noise levels	x	x	Provide all internal combustion equipment with properly functioning silencers or mufflers	Project lifetime	TCN
Facilities maintenance ROW management Transport and Circulation	Soils and agricultural potential Water resources	Risk of soil contamination Risk of water contamination	x	x	Prepare and implement an Emergency Response Plan	Project lifetime	TCN
Facilities maintenance ROW management Transport and Circulation	Soils and agricultural potential Water resources	Risk of soil contamination Risk of water contamination	x	x	Keep Spill Containment Kits readily accessible in the event of an accidental spill and ensure on-site staff is trained in spill response	Project lifetime	TCN
Facilities maintenance ROW management Transport and Circulation	Soils and agricultural potential Water resources	Risk of soil contamination Risk of water contamination	x	x	Contain any spills and clean up spills as soon as possible	Project lifetime	TCN
Facilities maintenance ROW management Transport and Circulation	Soils and agricultural potential Water resources	Risk of soil contamination Risk of water contamination	x	x	Document and report all spills to the FMEnv	Project lifetime	TCN
Facilities maintenance	Water resources		x	x	Grade ground surface at each tower site to provide drainage away from tower base.	Project lifetime	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Maintain all work inside the footprint of access road and ROW to reduce encroachment on natural habitats.	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Clearly mark the extent of vegetation control in the ROW. Identify and mark the vegetation to be preserved along sections of the ROW.	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Undertake selective control of the vegetation in order to keep low scrubby and herbaceous species that do not represent a risk for the powerline (species that cannot grow more than 4m in height)	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Dispose of organic material removed from the ROW properly and in collaboration with local communities	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Use mechanical method for vegetation control inside the ROW. Forbid use of chemical pesticides to control vegetation in the ROW	Throughout the operation phase	TCN

SOURCES OF IMPACTS	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
ROW maintenance	Terrestrial habitats and associated flora	Impairments of natural habitats and associated flora communities	x		Undertake ROW vegetation cutting with the supervision of a botanist in order to identify and relocate if possible species of conservation concern as well as protect vegetation that does not represent a risk for the powerline. Any species of conservation concern that need to be cut will be located and its habitat will be fully described. This information will be integrated in the planning of reforestation program.	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Potential introduction of IAS	x		Implement an IAS monitoring program following project construction and site re-vegetation in sensitive areas, forests reserves, and forest stands. Consider conduction along with ROW maintenance.	Throughout the operation phase	TCN
ROW maintenance	Terrestrial habitats and associated flora	Potential introduction of IAS	x		Implement the vegetation management plan, including specific measures for IAS control	Throughout the operation phase	TCN
Presence and operation of line and substation	Terrestrial fauna	Bat collision and electrocution	x		Implement a bat mortality monitoring program in partnership with local communities	1 time/year in first 5 years of operation.	TCN
Presence and operation of line and substation	Avifauna	Bird collisions with grounding cables causing injuries and death.	x		Implement a bird mortality monitoring program in partnership with local communities. Review mitigation measures according to their efficiency	2 times/year in first 5 years of operation. After that, once every 5 years	TCN
Presence and operation of line and substation	Avifauna	Bird electrocutions and collisions	x		Develop specific mitigation measures for species that are involved in bird mortality.	Throughout the operation phase	TCN
ROW maintenance	Avifauna	Modification and disturbance of bird habitat, with associated changes in bird communities	x		Schedule ROW maintenance activities to avoid breeding and nesting seasons of bird species with special status	Throughout the operation phase	TCN
ROW maintenance	Aquatic and semi-aquatic habitats and fauna	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna. Potential introduction of invasive alien species	x		Undertake selective cutting of the vegetation in order to maintain low scrubby and herbaceous species that do not represent a risk for the power line (species that cannot grow more than 4m in height)	Throughout the operation phase	TCN

SOURCES OF IMPACTS	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
ROW maintenance	Aquatic and semi-aquatic habitats and fauna	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna Potential introduction of IAS	x		Forbid use of chemical pesticides to control vegetation in the ROW	Throughout the operation phase	TCN
ROW maintenance	Aquatic and semi-aquatic habitats and fauna	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna.	x		Undertake monitoring of natural resources exploitation and implement a sensitization program in order to educate and increase local communities' awareness on natural resources protection.	Throughout the operation phase	TCN
ROW maintenance	Aquatic habitats and associated flora	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna	x		Avoid destabilization of shores and sediments or other pollutants rejection in watercourses during road and wayleave maintenance;	Throughout the operation phase	TCN
ROW maintenance	Aquatic habitats and associated flora	Disturbances of the water dynamics causing modifications in aquatic habitat and its associated fauna	x		Only excavate the lower third of ditches during drainage ditch maintenance in order to maintain ditch slope stability;	Throughout the operation phase	TCN
ROW maintenance	Aquatic habitats and associated flora	Potential introduction of IAS	x		Implement the vegetation management plan, including specific measures for IAS control	Throughout the operation phase	TCN
ROW maintenance	Land Planning and Use	Land use restriction in the ROW	x	x	Allow grazing cultivation in the ROW and wayleave, provided that plantations do not exceed 4 m in height. If possible, the ROW in urban areas can be used for a number of purposes that will increase quality of life in neighborhoods crossed by the wayleave, e.g. gardening, playgrounds, walking paths.	Throughout the operation phase	TCN
ROW maintenance	Land Planning and Use	Occasional infringement of crops by machinery for maintenance purposes	x		Plan for maintenance activities to be conducted outside of the growing and grazing seasons.	Throughout the operation phase	TCN
ROW maintenance Facilities maintenance	Economy, Employment and livelihoods	Creation of temporary jobs	x	x	Apply human resources policies favouring local labor	Prior to the operation phase	TCN

SOURCES OF IMPACTS	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
ROW maintenance Facilities maintenance	Economy, Employment and livelihoods	Creation of temporary jobs		x	Implement training programs to build local capacity	Prior to and throughout the operation phase	TCN
ROW maintenance Facilities maintenance	Economy, Employment and livelihoods	Occasional infringement of crops by machinery for maintenance purposes	x		Compensate PAPs for any damaged crops during maintenance works		
ROW maintenance Facilities maintenance	Economy, Employment and livelihoods	Creation of temporary jobs	x	x	Disclose information on newly created business opportunities	Prior to the operation phase	TCN
ROW maintenance Facilities maintenance	Economy, Employment and livelihood	Occasional infringement of crops by machinery for maintenance purposes	x		Carefully select the landing area of falling trees to minimize damages to crops.	Throughout the operation phase	TCN
ROW maintenance Facilities maintenance	Vulnerable groups	n/a		x	Encourage the recruitment of female workers	Throughout the operation phase	TCN
ROW maintenance Facilities maintenance	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	x		Maintain a minimum working distance of 2.13 m to the energized components during maintenance work	Throughout the operation phase	TCN
Presence and operation of the line and substations.	Quality of life, health and safety	Health problems associated with exposure to electromagnetic fields	x		Keep residences and other permanent structures such as schools, shops or offices out of the wayleave to minimize exposure to EMFs.	Project lifetime	TCN
Presence and operation of the line and substations ROW maintenance Facilities maintenance	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	x	x	Educate local populations to safe behavior in the presence of a high voltage power line	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	x	x	Undertake awareness campaign to reduce bushfire and slash and burn practices under and close to the powerline	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	x	x	Install warning signs and anti-climbing devices on pylons	Throughout the operation phase	TCN

SOURCES OF IMPACTS	VESC	POTENTIAL IMPACTS	PROJECT COMPONENT		MITIGATION MEASURES	IMPLEMENTATION TIMING	RESPONSIBILITIES
			LINE	SUBSTATIONS			
Presence and operation of the line and substations	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	x	x	Ensure the development of local and regional emergency plans in case of infrastructure breakdowns, especially near roads or residential areas	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Quality of life, health and safety	Electrocution risk caused by equipment failures, illegal connections, steel theft and any other forms of dangerous contacts	x	x	Monitor and control illegal connections	Throughout the operation phase	TCN
Presence and operation of the line and substations	Quality of life, health and safety	Health problems associated with exposure to electromagnetic fields.	x	x	Educate the local population on electromagnetic field risk	Prior to and throughout the operation phase	TCN
Presence of workers	Social cohesion and gender	Tensions between local populations and outside workers	x	x	Communicate with communities effectively and involve their leaders	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Landscape	Permanent alteration to the landscape	x	x	Minimize the number of permanent access roads to and in the ROW. When possible, proceed to early closing and rehabilitation of temporary access roads nearby sensitive scenic areas	Prior to and throughout the operation phase	TCN
Presence and operation of the line and substations	Landscape	Permanent alteration to the landscape	x	x	Allow tree and shrub species whose height is limited to 4m to grow within the ROW	Throughout the operation phase	TCN
Presence and operation of the line and substations	Landscape	Permanent alteration to the landscape	x	x	Create visual barriers to reduce line visibility in sensitive areas when possible	Prior to and throughout the operation phase	TCN

5 RESETTLEMENT ACTION PLAN

The Resettlement Action Plan (RAP) presents the stakeholder's eligibility to compensation aspect and resettlement program details for the local community and PAP. Given the approval of the RAP by the competent authorities and the Transmission Company of Nigeria (TCN), a comprehensive framework of measures were presented to the PAPs during local community consultations. The information provided during the consultations reduced any concern that may be raised by the PAPs, favoring their approval and their collaboration through the census and socio-economic survey. Further consultation and information activities will be performed during implementation of the resettlement compensations.

The RAP's goals and objectives are the followings:

- → To minimize involuntary resettlement through the optimization of the line route in collaboration with the environmental, technical specialists and relevant stakeholders (see section 2);
- → To address social issues related to land acquisition and to address livelihood restoration due to construction activities and other project related infrastructure construction;
- → To optimize compensation measures and support to all stakeholders through the identification and consultation of stakeholder and PAPs concerns (see section 4);
- → To prepare cost estimates for resettlement/compensation through measuring the affected assets and socio-economic status of the PAPs, identifying vulnerable PAPs and households, and assessing compensation and mitigation measures (see section 5-6-7-8);
- → To assess opportunities for affected communities and PAPs to have them benefit from the project's positive impacts (see section 8);
- → To provide baseline information to be able to, through post-project comparison, assess whether the PAP's socio-economic situation, as a result of the project, has positively changed or has maintained a status quo;
- → To comply with applicable laws in Nigeria in order to obtain the environmental authority's approval;
- → To integrate the best practices during project implementation in order to comply with guidelines of funding agencies, namely the World Bank (WB), the African Development Bank (AFDB), and the European Union (EU) and therefore facilitate international funding.

The evaluation of the social impacts of resettlement, carried out through field surveys, documents and stakeholder consultations and socioeconomic census of Project affected persons (PAPs) and assets, revealed that the North Core project had impacts on 448 PAP and the following assets:

- → 25 houses and related secondary structures;
- → 6 commercial structures;
- → 3 community structures (1 Islamic school and 2 Mosque);
- → 1 cooperatively cultivated marshland;
- → 121.9 acres of land (531 parcels affected) will be expropriate for the ROW;
- → 443 trees need to be destroyed and compensate.

Compensation for all these assets are prescribed in the RAP.

Various measures to restore income and livelihoods and provide post-displacement support are foreseen by RAP or will be developed during implementation.

These measures are:

- → reinforcement of agricultural practices and trees plantation;
- → assistance to PAP in all administrative steps for parcel transaction;
- → income support during household move;
- → assistance to vulnerable groups (administrative support, special economic allocation, etc.);

- → priority for employment and other benefits;
- → a Community Compensation Fund will also be made available to affected communities to improve their infrastructures and services.

The total amount of the RAP is 1 385 637 783 Naira or 4 398 850 USD. The compensation strategy for project affected persons, the implementation responsibilities and the associated budget are described in details in the RAP[1].

[1] WSP (2017). *330kV WAPP North Core Project - Nigeria - Niger - Burkina Faso -Togo/Benin - Environmental Impact Assessment Scoping Report update – Resettlement Action Plan - Nigeria*, Final Report. Various pages and appendices. Ref. 141-24307-00

6 SPECIFIC MANAGEMENT PLANS

This chapter presents the Specific Management Plans including the Waste Management Plan, the Vegetation Management Plan, the Physical Cultural Resources Management Plan, the Stakeholder Management Plan, the Emergency Management Plan and the Remediation Plan.

6.1 WASTE MANAGEMENT PLAN

The objectives of the waste management plan are to:

- → identify which type of waste will need to be managed during project implementation.
- → give an outline of waste streams and quantities to be managed.
- → ensure the capacity and the nature of collection and treatment systems are in line with the waste to be managed.

Construction and operation of electric lines and substations are a significant source of waste, hazardous or not. The nature of those residual materials will vary according to the project phases. During the construction phase, residual materials principally consist in:

- → packaging material (wood, cardboard, plastic)
- → organic matters (food and vegetation remains)
- → used oil and gas used in the maintenance of machinery

During the operational phase, the maintenance of equipment and the replacement of some parts could generate a large amount of residual materials such as:

- → porcelain, glass and metal from old transformers or electric isolators
- → used oil

Some of the non-hazardous materials, such as vegetation and packaging waste, could be reused by local communities. Organic matter could be put in composting trenches. Unused material must not stay on the site and should be appropriately managed.

Waste management activities during the construction phase will be managed by the contractor specified in the environmental and social plans and specification clauses. The contractor in charge of construction must integrate in his specifications the waste management method, the location of storage and landfill sites, as well as the contractors who will handle the hazardous waste management. The waste management strategy should follow environmental best practices.

Hazardous waste, which are mainly used oil and gas, will be stored in barrels with the contents clearly marked. These barrels will be located in safe areas limiting risks for staff safety and risks of contamination in the environment. A registry will monitor material deposits and collections. The choice of the company responsible for the management of hazardous waste is important because it guarantees the protection of the environment and people. The choice of business should be primarily based on its ability to properly manage hazardous waste, and in accordance with best practices.

6.2 REVEGETATION AND EROSION CONTROL PLAN

The objectives of the Revegetation and Erosion Control Plan are to compensate any loss of habitat and rehabilitate affected areas to:

- → Protect local flora and fauna
- → Protect access to ecosystem services for communities
- → Avoid and control any erosion phenomenon associated with the project activities

According to the environmental impact assessment, power line construction will require vegetation clearing along a 50 km long and 50 m wide corridor, corresponding to an area of 310,04 ha. Vegetation clearing will lead to a permanent loss of woody species in terrestrial habitats found along the corridor. Table 6-1 presents the different habitats and their impacted areas.

Table 6-1 Land Use Area in the Power Line ROW

LAND-USE	AREA (HA)	%
Cultivated land	69,39	22,4
Degraded area	3,98	1,3
Tiger bush	29,06	9,4
Intensive cultivation	66,69	21,5
Lateritic iron capped hills	12,98	4,2
Agricultural-shrubby vegetation mozaic	71,40	23,0
Floodplain	56,54	18,2
Total :	310,04	100,0

These habitat losses mainly target human modified habitats. However, 29,06 ha of tiger bush as well as 56,54 ha of floodplain fall inside the ROW. Any impact on vegetation inside these habitats will need to be compensated in order to reduce associated biological impacts. Based on the species that have been surveyed inside the project footprint, a compensation program should be implemented. Local communities should also be involved in the selection of species to be planted as well as in the supply of plants and revegetation activities.

Since no vegetation over 4m is tolerated under the powerline, tree cutting will be the main activity during the site's preparation works. The tiger bush is the natural habitat that should experiment most of the degradation. However, based on the natural lined pattern of this habitat, the vegetation loss will be less than 29,06 ha while considering the bare soil area. Consequently, typical tree species should be planted in degraded tiger bush areas in order to rehabilitate them. Two tree species have been surveyed in tiger bush during baseline surveys; *Acacia Nilotica* and *Balanites Aegyptiaca*.

According to the biological baseline characterization, wetland areas essentially support herbs and two species of low shrubs. Habitat alterations will mainly be related to the implementation of towers inside the wetlands. Rehabilitation of wetland areas, showing species compositions similar to the impacted areas, should be undertaken.

This plan is to be prepared in collaboration with a botanical expert and the following elements are to be considered in its preparation:

- → Best native plant species to be chosen for restoration.
- → Best time for revegetation depending on species to plant, and habitats to restore.
- → Preferential habitats for endangered species.

Reclaimed areas will then be revegetated according to the plan.

If erosion phenomena are expected to happen, erosion control measures, including revegetation and soil control structures, will be proposed.

6.3 VEGETATION MANAGEMENT PLAN

The objectives of the vegetation management plan are to:

- → prevent line breakage, incidents involving electric lines and power shortages
- → allow the presence of ligneous vegetation that does not represent a risk for the powerline
- → properly manage vegetation inside the RoW limiting negative impacts on the environment

One of the vegetation management plan goals is to prevent line breakage, incidents involving electric lines and power shortages. It is not solely a matter of direct contact between lines and vegetation. If vegetation gets close to electric wires, even without touching them, it can potentially create an electric arc. The higher the line voltage, the more important the clearance distance around the wires. Management implies interventions within and around the ROW to control line-threatening vegetation.

Adequate vegetation control in the right-of-way allows:

- → easier access to lines for emergency teams in case of breakage
- → creating fire obstacles, thus reducing the chances of fire induced line damages

Proper vegetation control should be performed periodically during the operational phase to ensure woody plant species do not threaten electric lines.

Several conditions will influence the type of vegetation control activities:

- → sensitive components near or on the line trajectory
- → on-site plant communities' characteristics; in particular their density, height at maturity and growing rat.
- → accessibility and cost of intervention

In the North Core project, the site's ground coverage is 50 m. The management of vegetation in the right-of-way can contribute to implement and maintain annual crops, herbaceous plants and shrubs up to 4 meters high.

Since vegetation plays important environmental roles, its conservation is essential, especially in some areas. Although line security is prioritized, some strategies are proposed for specific vegetation management:

- → In erosion prone sectors, plants, suitable to grow along electric lines and having proven soil retention properties, should be planted.
- → In riparian zones, vegetation must be kept to filter suspended matter, to reduce evaporation and cool water temperature as well as providing faunal habitats.
- → In zones of higher ecological value, fire-resistant shrubs should be planted to provide faunal habitats and to reduce border and fragmentation effects created by lines.

6.3.1 MANAGEMENT OF INVASIVE SPECIES

The right-of-way of an electric line is a disturbed zone, with the potential of being colonized by invasive species. Such species could use the line corridor as a spreading area and consequently reach adjacent habitats. A monitoring program of invasive species propagation within the right-of-way should be instituted and, if present, must be removed. The proper elimination method will be provided depending on targeted species. According to Global Invasive Species Database (Invasive Species Specialist, 2015), there are fourteen invasive and introduced species in Nigeria.

6.4 PHYSICAL CULTURAL RESOURCES MANAGEMENT PLAN

The purpose of the Physical Cultural Resources Management Plan (PCRMP) is to provide concise and achievable management measures to preserve and protect physical cultural heritage associated with the burial and archaeological sites from adverse impacts associated directly with construction and operations of any of the components of the project.

Specifically, the PCRMP is intended to result in the following:

- → A significant reduction in social grievances concerning the loss of physical cultural resources.
- → Collaboration with government officials charged with managing national physical cultural resources through engagement with archaeologists trained in modern mapping, survey, and preservation techniques.

→ Reduction of the potential for project delay through compliance and engagement with national laws and institutions as well as international best practices.

The overall purpose of this management plan is to clearly state the general characteristics and importance of the burial and archaeological sites located in the project wayleave, and to identify the specific steps that will be taken to protect these resources, along with the rationale of these steps. This management plan aims to make sure the project complies with World Bank Policy Operational Policy 4.11 of July, 2006. The policy addresses the protection of Physical Cultural Resources, which it defines as:

> «*Movable or immovable objects, sites, structures, groups of structures, and natural features that have archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance, found in urban or rural settings, above or below the ground surface, or under water; and their cultural interest may be at the local, provincial, national or international level.*»

The policy also states that:

> «*Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic or social development, and as integral parts of a people's cultural identity and practices».*

The policy requires that the assessment of project impacts on physical cultural resources be part of the environmental assessment process; that includes:

→ consideration of likely impacts

→ appropriate measures for avoiding or mitigating impacts

→ development of a physical cultural management plan

→ provisions for managing chance finds

→ measures for strengthening institutional capacity

→ a monitoring system to track progress

6.4.1 IMPACTS AND MITIGATION

Ground disturbing activities, especially during construction activities, within the Project ROW have the potential to impact and irreversibly damage physical cultural resources. As ground disturbing activities are only expected during pre-construction and construction phases, associated impacts should only arise at that time. The table below identifies mitigation measures to be implemented, to avoid and minimize these localized impacts.

Table 6-2 Mitigation Measures Associated with Physical Cultural Resources

Impacts	Desired Outcome	Mitigating/Monitoring Activity
The removal of burial sites during the construction phase could disrupt local worship practices and could result in significant tension with the communities.	Minimize the disruption as a result of the relocation and removal of sacred sites.	Stakeholder engagement with members of the community and families to determine each site's level of importance. Integrate locational data from mapping survey and burial site importance information from stakeholder engagement data into the project's cultural heritage GIS database. Avoidance of burial sites determined to be important to the local community. Discussions with stakeholders about ways of dealing with this cultural aspect and how to adequately compensate (rituals, sacrifices, ceremonies, etc.).
Construction work could damage surface artefacts (archaeological sites).	Mitigate impacts to potentially significant archaeological deposits.	Map identified archaeological sites in the cultural heritage GIS database. Where possible, design or re-design project components to avoid or minimize impacts to known physical cultural heritage resources based on input from cultural heritage specialists. Develop and provide training and information on physical cultural heritage issues and the chance finds protocol to all personnel working for or on behalf of the project. Document deposits and artifact finds during construction phase by means of a chance find protocol including archaeological monitoring (watching brief) executed during ground-disturbing activities.

6.4.2 CHANCE FINDS PROCEDURE

The chance finds procedure objectives are to identify and protect previously unrecorded cultural heritage sites, objects, or features from project-related damages. The protocol applies to potential cultural heritage objects, features or sites identified as a result of vegetation and topsoil removal and other ground disturbing construction activities. The procedure complements the other mitigation measures described above addressing finds that may not be identified in the planned preconstruction reconnaissance. As a key part of the chance finds procedure, an archaeologist with a watching brief will be assigned to on-site direct observation of ground disturbing activities.

Chance finds may be made by any member of the project, but must be evaluated by an archaeologist as being cultural heritage. Two types of chance finds are likely to be encountered during construction works:

1. Cultural heritage chance finds
2. Non-cultural heritage chance finds.

Non-cultural heritage chance finds may include modern objects and features as well as isolated artefacts. Individual artefacts, even out of their context, may be important indicators of the presence of nearby surface or subsurface cultural heritage sites.

The principal value of most cultural heritage artefacts is only realised, however, when the objects are part of an interpretable cultural heritage site. Distinguishing between the two types of chance finds requires the expertise of an archaeologist. This procedure concerns artefacts as potential indicators of sites themselves rather than artefacts of individual importance.

In the case of a chance find, project activities will cease temporarily in the vicinity and the area shall be marked for avoidance. Construction supervisors, field personnel, and staff will be notified, as well as the Environmental and Social Management Committee. Government cultural heritage representatives will be notified as well, in order that appropriate treatment strategies be developed and approved. Site treatment scenarios to be considered include in place preservation through redesigned or specialized construction techniques, and rescue excavations in advance of additional construction work, if avoidance is not possible. After treatment work is agreed on and required excavations are carried out, project excavation or construction activities will be cleared to resume in the area.

A more detailed, step-by-step description of the chance finds protocol is provided below:

1. Stop work in the immediate area.
2. Inform site supervisor/foreman.
3. Establish no-go area needed to protect the chance find.
4. Install temporary site protection measures (warning tape and stakes, avoidance signs).
5. Inform all personnel of the chance find if access to any part of the work area is restricted.
6. Inform Environmental and Social Management Committee.
7. Archaeologist will perform a preliminary evaluation to determine whether the chance find is cultural heritage, and if so, whether it is an isolate or part of a larger site or feature.
8. Artifacts will be left in place when possible; if materials are collected they will be placed in bags and labeled by the archaeologist and transported to the appropriate institute (archaeology/anthropology); no project personnel are permitted to take or keep artifacts as personal possessions.
9. Document finds through photography, notes, GPS coordinates, and maps (collected spatial data), as appropriate.
10. If the chance find is isolated or non-cultural heritage, the archaeologist will authorize the removal of site protection measures and activities can resume.
11. If the archaeologist confirms the chance find is a cultural heritage site he/she will inform the appropriate institute (archeology/anthropology) and initiate discussions with the latter about treatment.
12. Prepare and maintain an initial chance finds report (for all possible chance finds, cultural heritage or not); include spatial data for use in cultural heritage database and GIS system.
13. Implement treatment plan with qualified archaeologists or using cultural heritage contractors provided by the project owner.
14. If a chance find is a verified cultural heritage site, prepare a final chance finds report once treatment has been completed.
15. While treatment is ongoing, coordinate with on-site personnel, keeping them informed as to status and schedule of investigations, informing them when the construction may resume.

Artefacts collected in connection with chance finds will be minimized. Those retained because they are accidentally unearthed or broken free of their soil matrix should be retained with precise notation of their original location, and with photographs taken of their original context. Photos of the artefacts and site photos may be useful for consultation regarding chance finds and should be taken as soon as possible.

Artefacts and associated notes and photographs taken by any project personnel should be given to the Environmental and Social Management Committee. Ultimately the artefacts belong to the national government, and project staff will be responsible for transferring the material to the appropriate authorities.

6.5 STAKEHOLDER ENGAGEMENT PLAN

From the start of the project implementation, a detailed Stakeholder Engagement Plan (SEP) will be developed and adopted by TCN. The following section is intended to provide guidance for the implementation of such a plan. It outlines the general objectives of the SEP, the target groups and the suggested methods of communication. The resource requirements and institutional organization for the implementation of the SEP are also discussed.

6.5.1 OBJECTIVES

The Stakeholder Engagement Plan aims to identify the preferred mechanisms for facilitating sustained communication with local communities and other external stakeholders in the pre-construction / construction and operation phases. Its main objectives are to:

- → Maintain a social and institutional dialogue through which the population, authorities and other organizations concerned by the project will be informed about the activities of the project and will be able to express their opinion on the nuisances, risks or opportunities perceived in connection with the project, as well as on the measures and actions to be taken in response to the perceived or anticipated impacts.
- → Ensure compliance with good public engagement practices in the implementation of major infrastructure projects.
- → Ensure that the project implementation process contributes to strengthening TCN's efforts to build lasting relationships with affected communities, relevant authorities and other stakeholders.

6.5.2 TARGET GROUPS

The stakeholder groups targeted by the SEP include:

- → Relevant national ministries and agencies.
- → Local government authorities and technical services.
- → The communities crossed by the line route and the populations near the substations.
- → NGOs and civil society organizations in the fields of nature conservation, development and human rights.

A detailed list of the structures, organizations and communities identified as project stakeholders in NIGERIA is presented in Appendix 3.

6.5.3 STAKEHOLDER ENGAGEMENT PROGRAM

6.5.3.1 PRE-CONSTRUCTION PUBLIC EDUCATION CAMPAIGN

Prior to undertaking the implementation of the project, and once the sitting of the final line route has been completed, a public information and awareness campaign will be carried out to ensure a fair understanding by the affected communities of the project, the final line route and the main conclusions and recommendations formulated by the ESIA and RAP. This campaign will be developed and coordinated by the consultant responsible for the ESIA and RAP studies, in close collaboration with TNC. It will notably allow for the public disclosure of information in connection with:

- → The objectives and expected benefits of the project.
- → The timetable for the implementation of the project.
- → Anticipated environmental and social impacts and associated preventive and mitigation measures.
- → Compensation and resettlement assistance measures for affected households.
- → The public safety hazards associated with the presence of a power line and proposed mitigation measures.

The public information and awareness campaign will involve the following activities:

- → Field reconnaissance walks with representatives from each affected village or neighborhood to locate the line route.
- → Mobilization of concerned local government authorities (LGA) and technical services through an information meeting to be held in each one of the LGA affected.

To assist stakeholders in preparing for these meetings, non-technical summaries of the ESIA and RAP studies will be produced for public consultation and distributed at least two weeks prior to the meetings.

6.5.3.2 COMMUNICATION ACTIVITIES DURING PRE-CONSTRUCTION / CONSTRUCTION PHASE

Throughout the right-of-way clearing, land preparation and construction works, affected communities and other stakeholders will be notified in advance of the nature and timelines of the work planned. Information publicly disclosed will include the following:

- → Previous announcements of planned field activities (objectives, nature, organizations involved and timelines).
- → Any significant adjustments to the overall schedule, if any.
- → The anticipated local labor needs in the short and medium terms.
- → The results of the environmental and social monitoring program.
- → The evolution of the implementation of RAP and other specific management plans.
- → The dangers to public safety associated with the presence of a power line, the mitigation measures adopted and the dangerous behaviors to be avoided.

The preferred means of communication for this phase of project implementation include:

- → The mobilization of local government authorities and technical services during information and consultation meetings held every six (6) months during construction.
- → The production of a bi-weekly public information newsletter, for general and personalized distribution (targeted mailings), in English and in the local language of the project area.
- → Public adverts in the local media (newspapers and radio) to announce the start of work and any other steps of relevance to the public.
- → The distribution on TNC's website of bi-monthly bulletins and public notices.
- → The holding of individual meetings with the main ministries concerned by the anticipated impacts of the project, including Agriculture, Animal Resources, Environment and Forests, Land Use Planning and Road Infrastructure. These ministries will be met once before construction begins, and thereafter on an *ad hoc* basis when deemed useful.

6.5.3.3 COMMUNICATION ACTIVITIES DURING THE OPERATIONAL PHASE

During the project's operational phase, the following information will be made available to communities and other stakeholders in an accessible format and language:

- → Results of the project's environmental and social monitoring program.
- → Planning of maintenance works on the right-of-way and facilities.
- → Guidelines for land use restrictions within the right-of-way.
- → The dangers to public safety associated with the presence of a power line and the dangerous behaviors to be avoided.

The preferred means of communication for this phase of project implementation include:

- → The production of an annual report on the project's environmental and social performance, presenting a summary of the results of environmental and social monitoring, for disclosure to the general public in English and in the local language of the project area.
- → The mobilization of local government authorities and technical services through information meetings held annually during the first two years of operation and every two years thereafter. A copy of the annual report on the project's environmental and social performance will be provided to the individuals concerned prior to the meetings.
- → The filing of a copy of the annual report on the project's environmental and social performance in each town hall concerned, as well as on TNC's website, for public consultation.
- → Public adverts in the local media (newspapers and radio) to announce any major or irregular maintenance work.

6.5.4 RESOURCES AND RESPONSIBILITIES

The lead project manager within TNC will be responsible for the overall stakeholder engagement process, its diligent implementation and its success. The primary duties and responsibilities of the process will be assigned to the Health, Safety and Environment Manager.

TNC will ensure the availability of adequate human and financial resources on an ongoing basis for the development and effective implementation of the SEP. Under the supervision of the Health, Safety and Environment Manager, a Stakeholder Relations Manager will be appointed and responsible for implementation of the entire community engagement process. During the construction period, this Stakeholder Relations manager may be assisted by LGAs' community relations officers for the communication activities planned for the municipalities and villages concerned. All staff involved in stakeholder engagement activities will receive adequate training on the environmental, social and safety issues associated with the project and transmission lines in general, as well as on TNC's corporate policies so as to ensure that discussions with stakeholders are based on accurate information.

6.5.5 IMPLEMENTATION COSTS

A preliminary estimation of SEP implementation costs is given below, for indicative purposes only:

→ Communication activities during the pre-construction / construction phase: 40,000 USD / year.

→ Communication activities during the operational phase: 20,000 USD/ year.

6.6 GRIEVANCE MECHANISM

Grievance redress mechanisms are essential tools for allowing stakeholders affected by the Project to voice concerns about environmental and socioeconomic issues affecting them as they arise and, if necessary, for corrective action to be taken in a timely fashion. Such mechanisms are fundamental to achieving transparency in the ESMP implementation process. The grievance redress procedure includes the use of records (grievance log) to determine the validity of claims.

It is essential that all projects incorporate a Grievance Redress Mechanism and one that is accessible, free, easily understood, transparent, responsive and effective, that does not restrict access to official grievance channels (such as the courts including traditional courts), and causes no fear of negative consequences for its recourse amongst users. Affected individuals and households should be informed about the existence of a grievance redress mechanism. General information regarding the existence of such mechanisms should be made public through community consultations.

The objective of the proposed grievance redress mechanism is to respond to the complaints of aggrieved villagers in a fast and transparent manner, and to ensure that they have avenues for presenting and addressing their grievances related to any aspect of the ESMP.

Potential grievances and disputes that arise during the course of implementation of the ESMP are often related to the following issues:

→ Issues related to influx of labour including inflation, gender-based violence, sexual abuse and child abuse among others;

→ Dissatisfaction regarding economic benefits to local communities during construction/operation phases;

→ Issues related to nuisances caused by construction works such as dust and other air pollutant emissions, noise emissions, drinking water pollution, etc.;

→ Environmental impacts affecting ecosystem services used by community members (ex. water pollution or hydrological regime modifications affecting fisheries resources);

→ Issues related to effects of land-use changes caused by the project construction or operation;

→ Issues related to damages caused to village or district infrastructures (roads among others);

→ Disturbance of important cultural and archaeological heritage elements;

→ Increased marginalization of vulnerable groups.

→ And any other possibilities.

With respect to the implementation of the RAP, the complaints are mainly those related to the process and those related to ownership.

→ Process complaints and litigation are typically associated with the following causes:
- the omissions of assets in the surveys;
- Wrong registrations of personal or community data;
- errors in the identities of the people affected;
- undervaluation feelings;
- the basis for calculating compensation;
- resettlement conditions;
- disagreements on parcel boundaries, fields either between the affected people of the same locality or between two neighbors;
- disputes over the ownership of a property or land use (two or more affected persons claim to be the owner of a certain property);
- disputes over the sharing of compensation.

→ Complaints and disputes over the right of ownership usually relate to the following cases:
- the recent change in ownership of the asset;
- succession in inheritance;
- divorces;
- the appropriation of a common good or production capital put in place by several people;
- landholdings

The practice of grievance arbitration over resettlement issues in Nigeria is conducted within the framework of the Land Use Act (LUA) of 1978, reviewed under Cap 202, 1990. Two stages have been identified in the grievance procedure: customary mediation and judiciary hearings.

A grievance procedure based on community grievance committees, one per LGA, will be established for resolution of the disputes and complaints before the pre-construction phase for RAP implementation. This procedure created during RAP implementation should continue during the construction and operation phases and the same grievance process should apply.

6.6.1 CUSTOMARY MEDIATION

Procedures for grievances will be clearly explained during community meetings. At the village levels, a series of customary avenues exists to deal with dispute resolutions. Those avenues should be employed, when and where it is relevant as a “court of first appeal”.

Such customary avenues should provide a first culturally and amicable grievance procedure that will facilitate formal and/or informal grievance resolution for grievances such as:

→ Wrongly recorded personal or community details;

→ Wrongly recorded assets including land details and/or affected acreage;

→ Change of recipient due to recent death or disability;

→ Recent change of asset ownership;

→ Wrong computation of compensation;

→ Name missed out of register, etc.

A Customary Grievance Redress Committee (CGRC) shall be set up by the PIU in each LGA to address complaints from RAP and ESMP implementation. This committee will be assisted by the PIU who will act as TCN representative and its members will include:

→ Representative of State Ministry of Land and Housing (Chairperson);

→ Representative of Land Administration- (Secretary);

→ Representative of the local Government Area (s) (Member);

→ Respected local Elders (Members);

→ Representative of Village Head of affected village (s);

→ Representative of the Emirate Councils from all affected Emirates;

→ Representative of Witness NGO.

PAPs' or other stakeholders complaints should first be lodged verbally or in writing through this process via the Village Head.

It is expected that the committee will deal with the grievances they receive via the Village Head within three days of receipt of the complaint. The proposed solution will be presented to the PAP or other stakeholders in person if he attends the CGRC meeting, or by the PIU if the PAP is not present. If the complaint cannot be resolved at this level, or if the plaintiff is not satisfied with the settlement proposed, the plaintiff should then be referred to the official legal procedures.

6.6.2 COURTS OF LAW

The judicial process in accordance with applicable laws will be followed and the law courts will pass binding judgment on the matter.

6.7 EMERGENCY MANAGEMENT PLAN

6.7.1 OBJECTIVE

TCN's objective, in terms of risk management, consists of reducing risks to the lowest levels, as much as is reasonably possible. They strictly implement their Corporate Policy on Occupational Health and Safety that will need to be implemented during all project phases. However, an accident could affect people on-site as well as personal objects and the environment. Thus, risk identification is important in order to deploy appropriate staff and personnel to intervene with diligence and confidence in the case of a major accident.

6.7.2 ANALYSIS OF ENVIRONMENTAL RISKS

The use of a power line or an electrical station entails some environmental risks. These risks may be of a natural or a technological origin.

In general, natural risks are caused by natural phenomenon such as rain fall, floods, tornados, droughts, bush fires, etc. Natural risks could be the source of hazards or technological risks.

Technological risks rely on hazard identifications (hazardous products, system failures, sources which lead to breaking, generic project risks etc.).

Natural risks associated to the current project are mostly associated to lightning which could short circuit the system, erosion phenomena in particular in flooding zones or in areas which are prone to erosion and bush fires which could start in areas close to the lines or stations. However, these risks are managed at a technical level via the use of specific components during the conceptualization of the project (earthing cable, appropriate choice of tower location, foundation composition, adequate clearing zone, etc.).

The risk analysis relies mostly on the technological risks associated to the use of the power line and the stations on the North Ridge project. The sources of the two main risks are:

→ the storage and use of petroleum products

→ the use of electrical transformers

6.7.2.1 STORAGE AND USE OF PETROLEUM PRODUCTS AND HAZARDOUS SUSBTANCES

This section outlines the potential risks associated with the storage and use of petroleum products such as, diesel, light crude oils, fuel, lubrication oils and grease.

The hazards which can lead to identified major accidents are:

→ petroleum product spills

→ fires and/or explosions involving petroleum products

→ oil and grease spills

6.7.2.2 PETROLEUM PRODUCT SPILLS

The nature and the location of petroleum products and other solicited hazardous substances will be detailed in the feasibility study.

Equipment corrosion, breaking/leaks in equipment or human error can lead to spills of petroleum products or hazardous substances resulting in the contamination of surface water, underground water as well as soil contamination or fires.

The following prevention or mitigation measures will be in place in order to reduce the risks of accidents, as well as their consequences in an emergency situation:

→ the design of equipment and tanks in accordance with the requirements of the regulations, standards, applicable codes and appropriate industrial practices

→ the design of secondary retention devices which have a sufficient capacity to contain the worst probable spill scenario

→ double-walled tanks with a secondary retention basin which have a sufficient capacity to contain up to 110% of the stored volume

→ training of all employees who are assigned to the handling of bulk petroleum products

→ development and use of work procedures, if necessary

→ continuous operating staff training

→ continuous updating of the emergency response plan including the intervention procedures in case of an incident involving a petroleum product

→ the storage and use of intervention materials in case of a spill close to the handling areas of petroleum products

→ continuous service contract with a company which specializes in the cleanup of spills and in industrial cleaning

→ preventative maintenance of tanks and all related equipment in order to reduce potential breaking and premature wear on the equipment

→ completion of a risk analysis before every unusual task which has not been described by an appropriate work procedure

→ inspection and conformity assessment of the bulk petroleum product storage tanks

The spill, while potentially substantial, would be controlled at the area of the incident, due to the mitigation measures which are in place (double-walled tank, secondary retention devices, separator, etc.).

FIRE/EXPLOSION INVOLVING PETROLEUM PRODUCTS OR OTHER HAZARDOUS SUBSTANCES

A fire / explosion involving petroleum products or other hazardous substances could occur in exceptional circumstances, for example, a fire close to the petroleum tanks. Therefore, the probability of this occurrence is deemed to be very low. This type of incident could lead to serious injuries and potentially to the loss of the life of the person located within the impact radius, as well as damage to nearby buildings and infrastructures and will therefore necessitate an interruption of all operations and lead to economic losses.

The following preventative and mitigation measures are in place in order to reduce the risks of accidents, as well as their consequences in case of an emergency situation. Supplementary mitigation measures, to protect the petroleum product tanks, nearby infrastructures and the workers, will also be elaborated during the operational phase of the project.

- → the design of equipment and tanks in accordance with the requirements of the regulations, standards, applicable codes and appropriate industrial practices
- → training of all employees who are assigned to the handling of bulk petroleum products
- → development and use of work procedures, if necessary
- → continuous updating of the emergency response plan including the intervention procedures in case of an incident involving a petroleum product
- → preventative maintenance of tanks and all related equipment in order to reduce potential breaking and premature wear on all equipment
- → completion of a risk analysis before every unusual task which has not been described by an appropriate work procedure
- → inspection and conformity assessment of the bulk petroleum product storage tanks

SPILLS OF OILS AND GREASE

Spills of petroleum products such as lubrication oils and grease, following breaking/leaks in equipment, handling errors and machine spills, can lead to surface water and underground water contamination.

The following prevention or mitigation measures will be in place in order to reduce the risks of accidents, as well as their consequences in an emergency situation:

- → the design of equipment and tanks in accordance to the requirements of the regulations, standards, applicable codes and appropriate industrial practices
- → training and awareness of all workers to the protection of the environment
- → development and use of work procedures, if necessary
- → continuous updating of an emergency plan which includes intervention procedures in the case of an incident involving a petroleum product
- → preventative maintenance of equipment in order to reduce potential breaking and premature wear on the equipment
- → completion of a risk analysis before every unusual task which is not detailed by an appropriate work procedure

A spill of lubrication oils and grease could eventually occur during the operational phase of the project. The impact level of the environment is deemed to be low given that the quantities and the mitigation measures in place.

6.7.2.3 USE OF ELECTRIC TRANSFORMERS

This section outlines the risks associated to the presence of electric transformers.

The hazards which can lead to identified major accidents are:

→ spills of dielectric oils

→ fire/ explosion involving an electrical transformer

SPILLS OF DIELECTRIC OIL

The spill of insulating oil found in the transformers could lead to the contamination of surface and underground water and as well as soil contamination, following the corrosion of equipment, breaks/leaks of equipment or human errors.

The following preventative and mitigation measures are in place in order to reduce the risks of accidents as well as their consequences in case of an emergency situation:

→ preventative maintenance of transformers and related equipment in order to prevent breaking of equipment and premature wear on all equipment

→ protection against lightning

→ retention basin for all transformers that contain dielectric fluids

→ extra transformers for the production equipment in case a breakdown or failure occurs in order to avoid a stoppage in operations

→ completion of a risk analysis before every unusual task which is not detailed by an appropriate work procedure

FIRE/EXPLOSION INVOLVING AN ELECTRIC TRANSFORMER

A fire in a transformer is a potential risk. Potential causes for a fire are contaminated dielectric oils, short-circuits and overheating.

The following preventative and mitigation measures are in place in order to reduce the risks of accidents as well as their consequences in an emergency situation:

→ preventative maintenance of transformers and related equipment in order to prevent breaking of equipment and premature wear on all equipment

→ protection against lightning

→ retention basin for all transformers that contain dielectric fluids

→ extra transformers for the production equipment in case a breakdown or failure occurs in order to avoid a stoppage in operations

→ completion of a risk analysis before every unusual task which is not detailed by an appropriate work procedure

6.7.3 NATURE OF THE EMERGENCY RESPONSE PLAN

An appropriate emergency response plan will be elaborated in a more formal manner in function with the progress of each phase of the project, diligently, confidently and quickly, in case of an accident. The contractor, in charge of the construction phase, will be required to complete an emergency plan in order to mitigate every risk that he will have identified with the work which needs to be accomplished. Furthermore, the emergency plan will regularly be reviewed and adapted for the construction and operation phases of the project. The review must include all activities for each phase and the associated risks.

Any event that could threaten or affect the environmental components will trigger the emergency plan. The plan will allow for appropriate actions to be put in place to respond to the emergency situations arising from the identified risks.

The following section outlines the main elements that need to be retained and integrated in the emergency response plan which will be completed to quickly and efficiently intervene during the different phases of the project.

The emergency response plan includes three general objectives:

- → Clearly defining the role and responsibilities of all stakeholders, for all levels, from construction to operations.
- → Facilitating the communication of the plan to all concerned parties such as workers and the general population.
- → To serve as a reference document during warning, mobilization and intervention procedures.

In order to minimize risks for all employees, the population and the environment, the following specific plan objectives were defined:

- → Develop a mechanism to alert stakeholders and all concerned organizations.
- → Coordinate the operational and intervention crews.
- → Define the role and responsibilities of all stakeholders.
- → Specify the different levels of authority.
- → Reduce intervention time in order to minimize the effects on the environment.

6.7.4 ORGANIZATION AND RESPONSIBILITIES

6.7.4.1 EMERGENCY MEASURES PLANNING COMMITTEE

A planning committee in charge of the emergency measures will be active within the TCN and will maintain an up to date emergency plan in order to efficiently mobilize workers in the eventuality that an emergency occurs. A thorough review of every item in the plan will be regularly completed by the emergency plan, planning committee. The committee's role will consist of elaborating, preparing, updating and diffusing the emergency response plan as well as initiating and preparing large-scale simulations, reviewing the results and ensuring follow-ups. The committee must also train the workers and upper management, via simulation and evacuation exercises, to develop proper intervention relations with the civil authorities as well as initiate the annual emergency response plan review process and ensure that the operation plans are updated.

INTERNAL TEAM FOR EMERGENCY INTERVENTIONS

The internal emergency intervention team will consist of on-site staff and personnel representing the first line emergency team, in charge of the communication and deployment in an emergency situation. The role of this team will consist of receiving all emergency calls, giving them priority and giving them the required and needed attention. The team will convey all information to upper management without delay, as well as all appropriate emergency services and, if necessary, acquire external aid.

6.7.5 EMERGENCY INTERVENTIONS

6.7.5.1 PROCEDURE IN CASE OF A SPILL OF PETROLEUM PRODUCTS

TCN and its subcontractors will ensure that emergency procedures are rapidly put in place in the event of an accidental petroleum products spill.

Appropriate procedures will be established and communicated to all operating staff, as well as suppliers. These procedures will outline the proper way of recuperating and cleaning all accidental petroleum product spills and any related products, on site as well as off site.

The interventions will consist of:

- → Wearing appropriate clothes and personal protective equipment (i.e. security goggles or sealed goggles, resistant gloves, etc.).
- → Managing and controlling the leak (i.e. eliminating the ignition source, identifying the product which was used, and stopping , if possible, the source of the spill, by disabling or turning off the equipment that controls the flow of the product).
- → Confining the spilled product (i.e. stemming the spilled product in order to prevent the product from migrating to a river of water or to the sewer, and absorbing with items found in the emergency kit such as absorbents, dry sand or any other dry and non-combustible material).
- → Outlining a security perimeter (i.e. prohibiting traffic, vehicles, and any unauthorized staff near the accident).
- → Evacuating the area if there is a fire or risk of a fire.
- → Notifying the concerned staff that is in charge according to the warning procedures and following the instructions given by the team who is managing the emergencies.
- → Recovering all contaminants and restoring the contaminated area (in compliance to all regulations and appropriate practices in order to prevent the migration of any contamination).

The emergency response plan will include specific procedures for every emergency situation. All persons and organizations that must be notified for each situation will be identified in the final version of the emergency response plan. Also, the emergency response plan must include a risk communications program to the general population and a section on preventative measures. These items will be integrated afterwards to the final version of the emergency response plan.

After each event, a report on the emergency situation will be completed with the personnel staff that is in charge, in order to evaluate the measures which were taken, specify possible improvements and make the necessary changes to the procedures.

6.7.6 TRAINING

The operating staff benefits from continuous training in order to guarantee a certain level of knowledge and adequate competence. The operating staff must fully understand the emergency response plan's procedures. Each worker will be trained in order to know the warning and intervention procedures in the event of an emergency.

6.7.6.1 EMERGENCY INTERVENTION EXERCISES

The emergency response plan will be regularly tested in order to verify its efficiency level. A program consisting of a series of exercises will allow the users to verify the efficiency level of every aspect of an intervention, of the equipment and of the workers identified in the emergency response plan. The plan will outline the types of exercises which need to be done and the frequencies at which they must be done. Every exercise will be evaluated in order to validate and/or improve the operational processes of the emergency response plan. These exercises will be analyzed in a post-mortem report.

6.8 REMEDIATION PLAN

The project, like other transmission lines, involves construction of permanent electricity infrastructures and therefore it is not envisaged that the transmission line will be decommissioned in the near future. However, after the project's operational design lifespan, a reassessment of the current status of the transmission line shall be carried out. The decommissioning phase refers to all the activities which relate to the proposed transmission line when it is no longer in use.

The remediation plan is intended to achieve the following objectives:

- → Comply with legislative and regulatory requirements for a decommissioning and remediation strategy.

- → Ensure as much as possible that all necessary decommissioning activities are completed prior to final project closure.
- → Ensure that measures are in place to maximize, to the greatest reasonable extent, the recycling and re-use of decommissioned materials, equipment and infrastructures to the benefit of people residing in the project area.
- → Ensure that the receiving environment is free of all contaminants and is rehabilitated to a proper level.

6.8.1 TRANSMISSION LINE COMPONENTS REMOVAL

Assuming the transmission line has gone through its useful life and no longer serves a useful purpose for the area, it will be disassembled and removed. Initially the conductors will be de-energized, removed from the tower hangers, collected and transported, and disposed of in accordance with relevant national waste management regulations and World Bank waste management guidelines applicable at the time of decommissioning. The lattice/tubular steel tower components would then be disassembled and removed, including grounding rods. Using lifting cranes, tower sections would be loaded in trucks and managed in accordance with relevant national waste management regulations and World Bank waste management guidelines applicable at the time of decommissioning.

6.8.2 ELECTRICAL SYSTEMS REMOVAL

The disassembly and removal of substation equipment will essentially be the same as its installation, but in reverse order.

6.8.3 STRUCTURAL FOUNDATIONS AND ACCESS ROAD REMOVAL

The areas around the transmission line towers, along with any access roads that were necessary, will be reclaimed. When towers are removed from their foundations, the foundations need to be removed too so as to enable re-vegetation of the land. The concrete and steel in the foundations will be broken-up and removed to appropriate depths. All concrete and steel debris will be removed from the site and disposed of as per National and World Bank guidelines. The excavated lattice tower foundations are to be backfilled with soil material.

6.9 RESPONSABILITIES FOR SPECIFIC MANAGEMENT PLANS IMPLEMENTATION

The specific management plans presented above outline the various basic elements contained therein. However, they will have to be detailed prior to project implementation in order to ensure the full applicability of the measures they contain. It is important to mention that all the companies that will be in charge of the construction phase will have to develop a construction ESMP that clearly states how they will implement the various requirements identified in the ESMP. This construction ESMP will include a Hygiene, Health and Safety (HHS) Plan according to OHSAS 18001: 2007 international standards and strict procedures for in-water works, and a Transport Management Plan, a Labor Influx Management Plan and a Workers Camp Management Plan. A compensation and re-vegetation plan will be developed by the PMU to compensate for losses incurred in clearing the right-of-way and to ensure that the impact on biodiversity is offset.

These plans will also be reviewed periodically and adapted throughout the implementation of the project. The development and implementation of these plans will vary according to the plans and phases of the project. The following table identifies the responsibilities for developing and implementing plans during the pre-construction / construction and operational phases.

Table 6-3 Responsibilities for the development and implementation of proposed specific management plans

PLAN	PRECONSTRUCTION/ CONSTRUCTION PHASE		OPERATION PHASE	
	Development of detailed plan	Implementation	Development of detailed plan	Implementation
Vegetation Management lanp	Contractor	Contractor	PMU	PMU
Revegetation and Erosion Control Plan	PMU	PMU	--	--
Waste Management Plan	Contractor	Contractor	PMU	PMU
Physical Cultural Resources Management Plan	Contractor	Contractor	--	--
Stakeholder Engagement Plan	PMU	PMU	PMU	PMU
Grievance mechanism	PMU	PMU	PMU	PMU
Emergency Management Plan	Contractor	Contractor	PMU	PMU
Hygiene, Health and Safety Plan	Contractor	Contractor	PMU	PMU

7 ENVIRONMENTAL AND SOCIAL PERFORMANCE MONITORING

Performance monitoring, and if required, implementation of corrective actions, are carried out to ensure that the required ESMP activities are being implemented and that the desired targets and outcomes are being achieved.

Performance monitoring involves three components:

- → Monitoring of the implementation of identified management measures and plans, during pre-construction and construction phases.
- → Monitoring of selected environmental and social indicators associated with expected impact sources, and changes on environmental and social components associated with project implementation, during operation phase.
- → Audits assessing the strengths and weaknesses of the ESMP.

The environmental and social performance monitoring consolidates all needed monitoring activities planned to ensure a proper implementation. Monitoring, inspections and verifications will be carried out regularly to control compliance with the procedures and plans set up. The discrepancies will be corrected, incorporated into existing practices and documented. The nature and causes of issues will be analyzed.

The environmental and social performance monitoring provides an outline to ensure the project's environmental and social compliance during pre-construction-construction and operational phases, tracks environmental and social performance and provides an analysis framework to implement corrective actions, as needed. It should be implemented and kept up to date by the environmental and social management committee of the project management unit. A retroactive mechanism for each unconformity reported will help ensure the improvement of the ESMP overtime and its adaptation to field realities. The retroactive mechanism is presented in Figure 7-1.

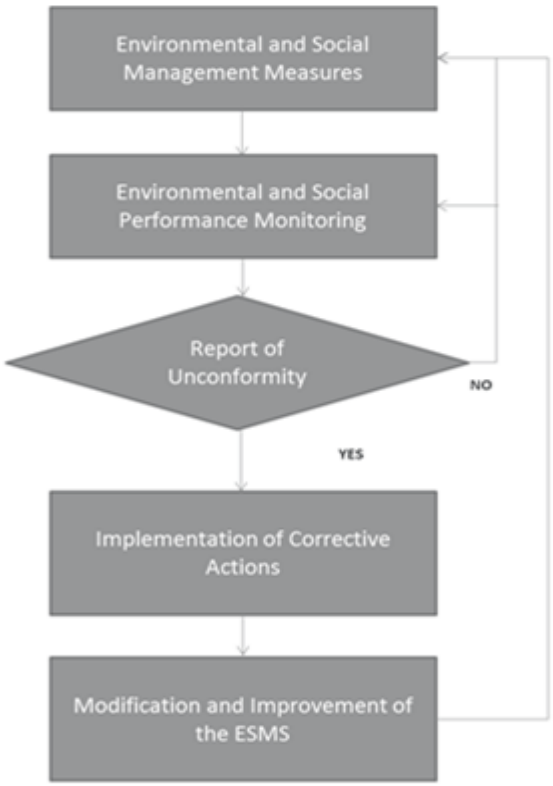


Figure 7-1 Retroactive Mechanism for the ESMP Implementation

Each component of the environmental and social performance monitoring is described in the following sections, the surveillance being implemented during the construction phase and the monitoring during the operational phase.

7.1 ENVIRONMENTAL AND SOCIAL SURVEILLANCE

Environmental and social surveillance aims at ensuring that commitments regarding environmental and social measures, included in the ESIA, and more particularly in the ESMP, are fully respected at the implementation phase. At first, this monitoring includes the validation and integration of management measures (avoidance, mitigation, compensation, improvement) and other environmental considerations from the plans and specifications, and then their implementation during construction. It also includes the global application of the management solutions proposed and the considerations raised by the contractor that oversees the construction phase. To facilitate surveillance operations, the contractor will have to hire an environmental specialist to verify the obedience to environmental and social measures. The non-obedience and unconformity could result in penalties. It will be possible that a contractor could not be paid because it contravenes to its environmental and social commitments. The environmentalist of the supervising engineer will also play a key role in the daily surveillance of the implementation of environmental and social measures during construction phase.

In addition, before starting construction work, WAPP and TCN will internally appoint a responsible person for environmental monitoring. The person responsible for environmental monitoring will be present on site on a regular basis, will be easily reachable at all times during construction and will be mandated to ensure the practical application of management measures on site. This person will collaborate with an environmental specialist hired by the contractor. The role and authority of this specialist will be clearly defined in the environmental specifications to be provided to the contractor, but he/she will have sufficient power to compel the contractor to change his working procedures and techniques.

In addition, to ensure the implementation of all management measures, those responsible for environmental surveillance will spot non-conformities, propose corrective measures and guide decision-making on-site in relation with environmental issues.

In summary, the activities related to environmental monitoring will allow:

- → Overseeing the application of management or enhancement measures contained in the ESIA and in plans and specifications.
- → Conducting on-site work inspections, reporting all non-conformities, new issues or impacts not previously identified to the contractor.
- → Supervising higher impact activities or activities occurring in sensitive zones (deforestation, work in aquatic environments such as floodplains or banks or near cultural or collective sites etc.) to constrain impacts.
- → Recording all complaints and concerns raised by affected communities.
- → Evaluating the efficiency and the quality of management procedures and identifying, in consultation with the environment committee of the project management unit, alternative measures to put in place to resolve any unforeseen problems that may occur during the work.
- → Ensure that the work is performed in accordance with national environmental requirements and international best practices adopted by the funders.
- → Address Health & Safety Supervision.

Corrective actions will then be added to the monitoring program to ensure there is a follow-up on their application and efficiency. The environmental and social surveillance program includes on-site inspections along with samplings, and specific observations or investigations, in neighbouring communities.

Surveillance will focus on the application of proposed management measures during construction phase. Detailed management plans to be produced will also propose surveillance methods and indicators to be included to the surveillance program. Different surveillance measures specific to the

implementation of the various components of the RAP are also specified in the RAP and are part of the project monitoring program. Table 7-1 shows additional measures, mainly at the level of the affected components, which should also be integrated into the monitoring program.

Biannual environmental surveillance reports will be provided to ministerial authorities during the work period.

Table 7-1 Specific Environmental and Social Compliance Measures

Monitored Component	Supervision Method	Indicators	Standards / Targets	Location	Frequency	Responsibility	Supervision
Soil integrity	Visual inspection of construction sites and access roads Site assessment after a spill or identification of soil contamination	Signs of erosion, area involved, level of erosion, type of soil involved, period Sign of compaction, areas involved Signs of contamination Time needed to apply emergency measures plan (EMP) and to ask for corrective actions, if needed	Avoid the installation of erosive processes or control them Reduce soil compaction Avoid soil profile structure destruction Avoid any soil contamination	Along the ROW, access roads and work areas	Continuously during preconstruction and construction activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Hydrology	Visual inspection of natural water flow	Sign of obstruction to natural water flow Respect of natural run-off Proper dimensioning of culvert in regard to natural water flow along the access road	Ensure there is no obstruction to water flow and that size of culverts is well designed and well installed	Sokoto river and its floodplain, Selected sites along intermittent watercourses Construction sites for natural run-off	Continuously during works on water and near aquatic environments Twice a month run-off	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Water quality	Visual inspection of construction sites Evaluation of the time needed to apply EMP and to ask for corrective actions, if needed	Intensity of suspended particles in water (turbidity) Signs and intensity of water contamination	Avoid significant degradation of baseline conditions Comply with national standards	Sokoto river and its floodplain, Selected sites along intermittent watercourses crossed by the ROW Workers' camps Communal water withdrawal points near work sites in case of contamination	Twice a month during construction work on water and near aquatic environments	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Air quality	Visual inspection of construction sites, access roads; verification of equipment and machinery	Intensity of particle material in the air Exhaust emissions from vehicles, equipment and machinery	Avoid significant degradation of air quality	Along ROW, access roads and work areas	Continuously during preconstruction and construction activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee

Monitored Component	Supervision Method	Indicators	Standards / Targets	Location	Frequency	Responsibility	Supervision
Noise Levels	Inspection of construction sites Sampling during noisy activities with a sound level meter in trouble zones	Number of noise complaints dB	Conformity to national noise standards	In communities and cluster of houses close to construction sites with noisy activities	During noisy activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Vegetation integrity	Visual inspection of construction sites and access roads Vegetation surveys	Vegetation integrity outside ROW (area of affected vegetation and species composition)	Avoid significant degradation outside the ROW Protection of flora species with conservation status	Along and inside ROW and substation site	During vegetation removal in the ROW	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Aquatic habitat integrity	Visual inspection of construction sites and access roads	Aquatic habitat integrity Number and area of degraded habitat Composition of degraded habitat	Avoid significant degradation of aquatic habitats	Sokoto river and its floodplain, Selected sites along intermittent watercourses crossed by the ROW	Continuously during works on water and near aquatic environments	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Birds conservation	Bird nests inventory within the ROW	Number of nests, species involved, threatened species, active or old nests	Avoid nest destruction, especially active ones or those of threatened species	ROW and substation site	During vegetation removal in the ROW	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Fauna protection	Visual inspection of construction sites and access roads	Observed species, mortality, species involved, age, number of individuals, threatened species	Avoid habitat loss and disturbances for local fauna	ROW and substation sites	During vegetation removal in the ROW	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Existing infrastructures	Visual inspection of access roads	Length of created access road	Reduce the length of created access road	Along the ROW	Monthly	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee

Monitored Component	Supervision Method	Indicators	Standards / Targets	Location	Frequency	Responsibility	Supervision
Nuisance felt by neighbouring communities	Grievance mechanism and surveys among communities	Type of nuisance, measures implemented to solve the problem, solved problem	Support the quality of life during the work period, in or around populated areas	Along ROW and substation sites, especially in populated areas	Continuously during preconstruction and construction activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Local and regional economy	Assessment of local communities' involvement in work or in the procurement of goods and services to the contractor	Number of locals involved in works Number of working days for locals Proportion of local workers and days of works for locals	Support local economy	Neighbour communities along ROW	During the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Local and regional economy	Grievance mechanism	Number of affected tourism and leisure activities	No affected communities	Along the ROW	Continuously during the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Workers health and safety	Complete register of the cause and type of injuries/accidents within communities	cause and type of injuries/accidents within communities	No injuries or accidents	At all construction sites	Continuously during the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Communities' health and safety	Complete register of the cause and type of injuries/accidents within communities	Cause and type of injuries/accidents within communities	No injuries or accidents	Communities in the ROW and near substation site	Continuously during the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee
Cultural and archaeological heritage	Register mechanism during construction work	Number of discovered heritage movable or immovable objects, sites, structures, groups of structures Conformity to the procedure of the Physical Cultural Resources Management Plan	No affected components of cultural or archaeological heritage	Along the ROW	Continuously during the construction	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee

Monitored Component	Supervision Method	Indicators	Standards / Targets	Location	Frequency	Responsibility	Supervision
Land use	Visual inspection of construction sites and access roads, as well as properties used for cultures, livestock and other activities Grievance mechanism	Affected areas outside the RoW Rehabilitation of affected areas	Avoid encroachment into areas used by neighbouring communities not identified on the plans and specifications	ROW and substation sites	Continuously during preconstruction and construction activities	Contractor's environmental specialists Environmentalist of the supervising engineer TCN	PMU's Environmental committee

7.2 ENVIRONMENTAL AND SOCIAL MONITORING

Environmental and social monitoring is an essential component of the ESMP; it allows evaluating the environmental performance during the project's operation phase. Essentially, this exercise should provide ongoing information on actual changes occurring in natural and socio-economic systems as a result of the project implementation. It also allows validating the implementation of the planned management strategies.

Throughout the project cycle, the monitoring of environmental and social performance allows a continuous assessment and improvement of the proposed management measures' efficiency, thus contributing significantly to the sustainable development of the project. Monitoring efforts are applied at different levels (local, along the ROW and in nearby communities or at national level) and therefore require the cooperation of several participants.

The elements included in the project follow-up are: location, frequency, and the designated officials. They are listed in Table 7-2. It should be noted that the description of the ROW's initial conditions will have to be undertaken at the end of the work. The baseline data collected, in particular during the surveillance, will be compared with data collected during the monitoring.

Table 7-2 Environmental and Social Monitoring Components

COMPONENT	METHOD	INDICATORS	STANDARDS / TARGETS	LOCATION	FREQUENCY	RESPONSIBILITY
Noise level	Noise measurement	dBA	National standards	Sampling in communities and dwellings closest to the substations Representative sampling along electric lines	Annually for the first five years during rainy season	TCN
Electromagnetic fields	Sampling with proper device	µT	WHO	Along the ROW with representative sample of zones with human activities (crop areas, urban and rural zones etc.)	Annually for the first five years	TCN
Soil integrity	Visual inspection of construction sites and access roads	Signs of erosion, area involved, level of erosion, type of soil involved, period Sign of compaction, areas involved Signs of contamination Time needed to apply emergency measures plan (EMP) and to ask for corrective actions, if needed	Avoid the installation of erosive processes or control them. Reduce soil compaction Avoid soil profile structure destruction	Work areas in use and around pylons	Annually during the whole operational phase	TCN
Surface water quality	Visual detection of pollution or contamination signs (presence of oil, waste, etc.) Evaluate the time needed to apply the EMP and to ask for corrective actions, if needed	Intensity of suspended particles in water Signs and intensity of water contamination	Avoid significant degradation in relation with baseline conditions.	Selected sites along rivers and streams crossed by the ROW Downstream of electric substations	Twice per year for the first five years, in rainy season and in dry season. Then once every two years	TCN
Plant communities	Evaluation of the plant communities' composition via flora surveys	Number of species and families per habitat type Number of threatened species Number of exotic invasive species	Follow the plant communities' evolution after eventual degradation from openings and border effects Identification of invasive species	In the different types of habitats found in the ROW, focussing on areas with higher ecological integrity	Annually for the first five years, then once every two years	TCN

COMPONENT	METHOD	INDICATORS	STANDARDS / TARGETS	LOCATION	FREQUENCY	RESPONSIBILITY
Integrity of aquatic habitats	Evaluation of the presence of aquatic habitats and of their integrity	Aquatic habitat description Signs of degradation	Ensure the conservation of wildlife habitats	Zones where streams and wetlands are crossed	Annually for the first five years, then twice a year	TCN
Wildlife poaching	Validate the presence of a wild meat market with wildlife officers	Trends in poaching and bush meat markets	Avoid traffic of bush meat hunted from the line's ROW and access roads	In areas within a five km distance from existing roads	Annually for the first ten years	TCN, in collaboration with wildlife authorities
Bird or bat mortality	Monitoring of the mortality rate caused by collisions and/or electrocution	Species involved, location of the carcasses, period, number of threatened species individuals involved	No bird or bat mortality	Along the ROW and specifically in targeted zones (highest risk of collisions)	Three times for the two first years (targeting migration period), then annually	TCN in collaboration with local communities
Social and Economic advantages for local communities	Monitoring of the rate of rural electrification and number of development projects	Number and rate of electrified communities number of development projects	Maximizing economic benefits for communities	Communities within ten km from the ROW and substation sites	Annually	TCN
Employees' health and safety	Complete register of the cause and type of workers' injuries/accidents	cause and type of workers' injuries/accidents	No injuries or accidents	Employees working in the line	Annually	TCN
Communities' health and safety	Register on HIV/AIDS prevalence in local population	Prevalence of HIV/AIDS	No propagation attributable to the project.	Communities in the ROW and near substation site	Annually	TCN, in collaboration with Health authorities
Communities' health and safety	Complete register of the cause and type of injuries/accidents within communities	Cause and type of injuries/accidents within communities	No injuries or accidents	Communities in the ROW and near substation site	Annually	TCN, in collaboration with local communities

7.3 ENVIRONMENTAL AND SOCIAL AUDITS

7.3.1 INTERNAL AUDITS

The purpose of these audits is to assess activities against procedures, measures and plans integrated in the ESMP established to ensure compliance with environmental and social commitments and objectives. TCN members will undertake yearly environmental and social inspections. Each component of the management system will then be audited at least once a year. The components demonstrating a sign of weakness will be audited more frequently. The internal audit can be conducted in one or multiple periods as per the audit programme to be determined. Protocols are established based on internal documentation supporting the assessed component. Internal audits will also include Health and Safety issues.

Non-compliance claims will be recorded in a database with preventive or corrective measures indicated along with the responsible party, timelines and resources needed to implement the measures identified. The number of claims should decrease each year until the ultimate goal of zero is reached. Non-compliances will be corrected; corrective actions will be documented and incorporated into existing practices. The nature and causes of non-compliances will be analyzed. This internal audit will notably aim at preparing all supporting information for the statutory audit by the Federal ministry of Environment.

7.3.2 LEGAL COMPLIANCE AUDITS

The purpose of these audits is to assess the compliance with national legislations and regulations, as well as, international agreements the project implementation needs to comply with. Unless conducted or reviewed by lawyers, conclusions of these audits do not have any legal value. The intent of the exercise is to diligently ensure that project activities meet the core legal requirements and that legal framework and associated management measures are updated, if needed.

7.3.3 EXTERNAL AUDITS

The purpose of the external audit is to assess the activities against the procedures, measures and plans, integrated in the ESMP, established to ensure compliance with environmental and social commitments and objectives. A successful external audit will provide an accredited auditor's perspective that ESMP and project related activities conform to specified requirements, reach environmental and social objectives, and that the entire environmental and social management approach is effectively carried out. An external auditor brings a fresh pair of eyes to the task, identifying issues that internal auditors may have overlooked because of familiarity. Best practices and current developments can be introduced if external consultants are made aware. Results of the external audits will be recorded in a database. When improvements need to be implemented, preventive or corrective measures will be followed and the responsible party, timelines and resources, needed to implement the measures, identified. ESMP content will be updated after external audits. External audit will also cover Health and Safety issues.

7.3.4 ENVIRONMENTAL AUDIT RESULTS

Environmental auditing is a key process in the implementation of the ESMP. The findings of each audit are registered in a database, where corrective and/or preventive actions are prescribed, responsibilities assigned, deadlines established and necessary resources mobilized.

In compliance with the procedure, audit reports shall categorize the findings as being either "major", "minor" or "observational". The number of findings should decrease every year until the ultimate goal of zero major findings is achieved.

The reviewing process evaluates the performance of the Environmental and Social Management System with regard to its suitability, adequacy and effectiveness. Reviews will assess the need for changes and the opportunity for management system improvements, including, objectives, activities, management measures and implementation resources.

The review will be based on the following:

- → The annual report with the results of environmental and social surveillance and monitoring.
- → The results of internal and external audits.
- → A presentation summarizing the ESMP's state of performance, main results and findings.
- → Foreseen changes in circumstances or legal requirements.
- → Recommendations for future objectives and orientations, intended improvements, suggested preventive and/or corrective actions and proposals for improvements.

The review will lead to decisions stated by the project management unit, regarding projects and activities to implement, management procedures to adapt and future orientations to promote, in terms of environmental and social management.

7.3.5 DOCUMENT CONTROL & RECORD MANAGEMENT

In order to ensure that the ESMP documents are kept up to date with regard to activities, that current versions of the documents are made available and that the outdated versions are withdrawn from circulation, management measures, management plans, environmental and social performance monitoring frames, drawings, photographs, forms and any other document required to support administrative activities, will be controlled. Document control and records management will be subjected to internal and external audits.

7.3.5.1 DOCUMENT CONTROL

Document control comprises:

- → Review and approval: Any new document or modification to an existing document is prepared by the person responsible for the activity and forwarded to the ESMC and PMU for comments and approval. A signature from the general manager is required before the new document or modification is approved and integrated into the system.
- → Distribution control: The electronic version is the official version. Documents will be available to users under a "read only" mode to prevent accidental changes to the document. Only authorized persons will have access to the modified documents. Only updated versions of the document will be available for use. Preceding versions will be archived on the system, but will only be available to authorized personnel.
- → Hardcopy documents will be used where access to the electronic information system is not possible or not convenient. In this case, ring binders, plastic lamination of loose sheets or other protection measures will be implemented to ensure that legibility and identification of the documents remain throughout its use. Circulating documents will be stamped with color ink to let the user know that he is using a controlled hardcopy.

7.3.5.2 RECORD KEEPING

Records are essential to keep track of implementation of all environmental and social commitments. Once completed, records are permanent documents that are no longer modified, as they demonstrate the results of an activity that has been performed.

The individuals responsible for the implementation will be responsible for record completion and transmittal to their supervisors. Archives will be kept as long as the line is operated. The ESMP approach promotes electronic record keeping. Hardcopies will be digitized as much as possible, those that cannot be digitized, for any reason, will be stored in boxes. Electronic back-ups and backup copies will be made frequently in case of computer information system failures. Electronic files are kept for the entire lifetime of the project.

8 INSTITUTIONAL FRAMEWORK FOR IMPLEMENTATION

Responsibilities, in the ESMP implementation and monitoring, are shared between multiple stakeholders, including concerned ministries, competent authorities, the WAPP, the TCN and the contractors.

In this context, and to encourage the coordination of decisions as well as the appropriate application of the various management measures, of the specific management plans and of the ESMP, the WAPP and the TCN will set up a Project Management Unit (PMU), who will be responsible for the project execution. Figure 8-1 illustrates the structure of such institutional organizations.

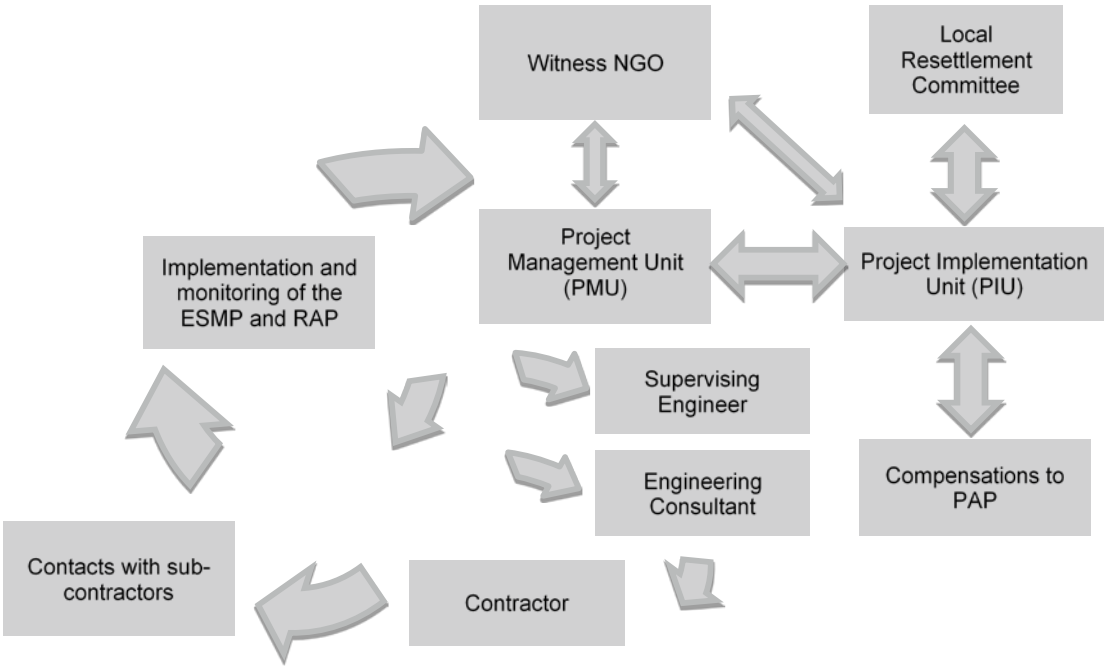


Figure 8-1 Institutional Arrangements for ESMP Implementation

8.1 PROJECT MANAGEMENT UNIT (PMU)

The PMU, consisting in a Technical Committee and in an Environmental and Social Management Committee, will be set up for the project implementation. The PMU will create a Technical Committee and an Environmental and Social Management Committee.

The Technical Committee should be composed of engineers and technical experts able to ensure compliance with the construction standards provided in the plans and specifications, bidding documents and contracts. The Technical Committee will oversee the Supervising Engineer who will supervise the Contractor responsible for the project construction. The Supervising Engineer will ensure that the Contractor (and its subcontractors) successfully implement the environmental and social clauses included in the contracts. The Supervising Engineer will have to recruit a Health and Safety expert (HSS) with an OHSAS Certificate 18001: 2007 as well as a senior environmental specialist and a senior social specialist, which must have experience at the international level. The Supervising Engineer will be also responsible for day-to-day supervision of the Contractor as to ensure ESMP implementation as well as Health and Safety aspects during construction. The Supervising Engineer will also make sure that the Contractor recruits an Environmental expert and a Health and Safety expert with an OHSAS Certificate 18001: 2007 with experience at the international level as well as a liaison officers which will provide support for communications with local communities.

The environmental and social management committee should be composed of an environmental expert, a resettlement expert as well as a Health and Safety expert (HSS) with an OHSAS Certificate 18001: 2007. They will be in charge to:

- → Oversee the proper application of reduction, mitigation, enhancement and compensation measures presented in the ESMP (including those relating to the RAP) that are the responsibility of the contractor and its subcontractors.
- → Implement management measures of the ESMP (including those related to the SEP and RAP) under their responsibilities.
- → Monitor the environmental and social performance of the project in accordance with the programs presented in the ESMP.
- → Do internal coordination with the PMU Project Engineer responsible for supervising the contractor in charge of the project construction.
- → Establish a mechanism for handling complaints and disputes with the communities and employees of enterprises. The PMU will have to set up a hotline for complaints.

The different specialists will be located in the project area, especially during the pre-construction / construction phase. These specialists will be supported by one or more liaison officers with the local communities and will have to master the local language(s).

The environmental and social management committee will also comprise experts from the professional TCN staff and from departmental and local authorities that need to supervise the ESMP and RAP implementation.

Mostly, these experts are:

- → Lands or Works department of Local Government Authorities
- → Kebbi state and Federal state Ministry of Environment specialists
- → Land Use Advisory and Allocation Committee of the Kebbi State Ministry of Lands and Housing
- → Representatives (4) of local chiefs from affected communities

Acting under the authority of the coordinator, the committee will meet on a bi-monthly basis in the first weeks of the project, then on a monthly basis, unless, more is necessary.

It is recommended that the committee hire and appoint an environmental manager and technical assistants who will be responsible for field monitoring and day-to-day implementation of the measures contained in the ESMP. These representatives will also be in charge of relations with local chiefs and persons affected by project (PAP), receiving and documenting complaints and grievances related to environmental measures, nuisances, workers-population relations, etc. These complaints and related correctives measures will be discussed on a daily basis between the contractor and the environmental manager and reported to the committee at their regular meetings.

In the case of an incident that could potentially cause serious damage to the environment or equipment, the environment committee, through its environmental manager, will be authorized to stop work or to give instructions to the head contractor to ensure that impacts are minimized or eliminated. All cases need to be reported and discussed at the committee meetings.

In addition, the Environmental and Social Management Committee, as mandated by the TCN, will work closely with the Project Implementation Unit (PIU) created for the RAP implementation. The PIU will be in charge of the followings activities: estimation and delivery of compensation packages; livelihood restoration and vulnerable group assistance measures to affected households; reconstruction of community affected structures; implementation of the Community Compensation Fund's (CCF) funded measures.

The PMU should also have a Liaison Officer, to avoid and solve problems with the communities and to receive grievances. The liaison officer will work closely with the PIU.

8.2 PROJECT IMPLEMENTATION UNIT (PIU)

Responsibility for the good implementation of the RAP lies on TCN. It is his responsibility to insure the creation of the Project Implementation Unit (PIU) and to hire a witness non-governmental organization (NGO), with the help of the environmental committee of the PMU, at least one year before the start of construction activities to insure implementation of the RAP.

This structure will take care of the implementation of the RAP, including the monitoring activities and implementation of the CCF.

It is recommended that TCN hire, through a public proposal and selection process, a local consultant or NGO with good credentials to act as the PIU. An open bidding process must be put in place to recruit this organization.

This PIU should be in place to monitor the construction activities and impacts on environmental and social components, and also implement the projects funded through the CCF. It is estimated that the PIU will need to operate in full activity during 36 to 48 months (1 year before start of construction and all along construction operations) after which a limited team will monitor the long term impacts.

The PIU will be directed by a coordinator who will supervise all its associated activities.

The responsibilities of the PIU coordinator, approved by the various parties, will include:

- → Provision of information on activities and consultations with the PAPs.
- → Maintain an inventory of the goods to be resettled and a detailed valuation of the compensations.
- → Ensure proper information and participation of PAPs and affected communities.
- → Management of compensation payments.
- → Monitoring the resettlement work.
- → Implementation of community-approved projects financed through the CCF.
- → Identification of the witness NGOs to be hired and facilitation of their involvement in the consultation activities, compensation and resettlement related activities.
- → Production of monitoring reports (see below) for the RAP implementation to appropriate government authorities, TCN and the contractor in charge of the line construction.

The PIU coordinator must rely on a team of professionals and support staff able to conduct all the following tasks. It is recommended that the PIU have:

- → **Support staff**: secretarial services, drivers, security and legal personnel, general accountants.
- → **Survey, Identification & Appraisal Team**: surveyors, appraisers, “option disclosure and agreement” officers in charge of relations with each PAP household (negotiation, compensation payment, PAP feed-back, etc.).
- → **Resettlement (house and community structures)**: ad-hoc urban planner and architect (consultants), engineers / construction supervisors.
- → **Cash compensation**: compensation officers, accountant, security officer.
- → **Database management**: database officers.
- → **Livelihood restoration and community forest**: agronomist / agro-foresters.
- → **Assistance to vulnerable people and displaced households**: social workers with at least one woman.
- → **Communication specialist**: Community engagement specialist (or a Liaison Officer)in charge of the information and participation program.
- → **CCF community project**: technicians or engineers on ad-hoc basis providing technical advices for community projects.

It is also proposed that the PIU have offices located in easily accessible communities to facilitate transport, contact with population and local authorities. The PIU coordinator will assess the situation and propose proper localization to that effect.

The envisaged compensation amounts and resettlement modalities for each PAP will have to be approved and endorsed by the PAPs, the competent governmental authorities and by TCN.

Communities' and households' fears regarding the non-payment of the claims are important and widespread. In order to reduce those fears, it is strongly recommended that the approval of the start of the construction of the power line be conditional to the transmission of a satisfactory progress report from the PIU. This report must clearly establish, with the support of evidence, that compensations were paid, and that resettlement projects were successfully carried out prior to the initiation of the construction phase. The confirmation of the witness NGO, of this report, is essential.

Also, as a mitigation measure, the PIU should clearly identify the cut-off date (when will the verification survey come to an end and new compensation claims be refused) and disclose it well in advance to the PAPs and their representatives, and provide them with the necessary contact information and procedures to fill in their compensation claims prior to the cut-off date.

8.3 WITNESS NGO

To enhance transparency and trust from PAPs it is suggested that a witness NGO, recognized and credible in the project area, be retained, through a public proposal and selection process, by the PMU to provide independent advice and report on RAP implementation and management focusing on consultation activities, compensation and resettlement related activities and grievances management. This NGO could be a recognized and credible Human Right advocacy group or a NGO active in rural development.

This outside look will ensure that proper procedures and stated compensation processes are followed, that PAP grievances are well taken care of, and that PAPs are treated with fairness. This mode of supervision was experienced in other projects and gave good results in terms of reduction of grievances in particular[1].

This NGO will revise PIU reports, meet with PAPs, check implementation of the measures, reconstruction, etc. in the field, and provide comments and recommendations. All PAPs will be informed of the NGO role and function and need to have access to its representatives, in a confidential manner if need be, to explain and discuss their difficulties of grievances.

8.4 CONTRACTORS

Each contractor shall appoint a qualified environmental manager who, after approval by the PMU's environmental and social management committee, will be responsible for daily management on-site and for the respect of management measures from the ESMP and RAP. This manager will report regularly to the environment manager appointed by the environmental and social management committee and the PMU during the entire construction period.

Furthermore, Contractor(s) will have to prepare and implement their own site specific Construction ESMP and Health & Safety Plan.

The liaison officers appointed, under the supervision of the environmental manager, will be in charge of ensuring that the work performed by subcontractors, respects health, safety and environment directives. All national health, safety and environmental regulations as well as ESMP and RAP recommendations that meet international best practices, will have to be respected.

Contractors must hold all necessary licenses and permits before the work begins. It will befall on them to provide the PMU with all of the required legal documents, including the signed agreements with owners, authorizations for borrow pits and for temporary storage sites, etc.

[1] Burnside and Associates Limited, 2006, Bujagali Interconnection Project Resettlement and Community Development Action Plan.

9 CAPACITY BUILDING AND TRAINING

Proper environmental and social management is based on a collaborative approach where stakeholders share responsibilities to various extents. The project management unit, in particular the environmental and social management committee, is a key player in the execution of the ESMP. Since several project-related impacts happen in the pre-construction and construction phases, the contractor, via its environmental manager, is liable for respecting its commitments. The concerned authorities, especially the Ministry of environment, play a major role in judging of the righteousness, in modulating the methodology and its effects on the field as well as overseeing the environmental and social conformity as the project develops.

In this context, the successful implementation of the ESMP, which relies on stakeholders' enhanced understanding of their responsibilities and individual implications regarding environmental and social management, is based on an institutional support and capabilities building program. This program includes the following points:

- → Raising awareness and informing all players (government representative, contractors and workers) about ESMP execution, the monitoring of environmental and social performance and their individual responsibilities.
- → Providing the institutions in charge of the ESMP monitoring with tools, techniques and necessary support (technical training, numeric cartography tools, stakeholders management, movable laboratories and sampling techniques etc.).
- → Through the PMU, NGOs and rural associations, promoting a greater community involvement in the project development, environmental and social performance and continuous improvement.
- → Through the PMU's technical, environmental and social committee, promoting a greater participation of concerned governmental departments into multi-sectorial planning meetings.

Those capacity strengthening initiatives should allow a continuous improvement of the environmental and social practices as well as the compliance to legal requirements and international best practices.

9.1 REINFORCEMENT OF WORKERS AND FIELD WORKERS' SPECIFIC CAPACITIES

From their main role in the project implementation, workers should be aware and adequately trained on how best practices can be integrated into their work.

In the same idea, employees directly assigned to the project implementation should follow particular training about environmental and social issues related to such types of projects and also on the various aspects of environmental and social management, such as environmental protection, relations with local communities as well as health and safety.

9.2 COMMUNITIES' AWARENESS AND TRAINING

Finally, experience gained from other power line projects reveals that some inhabitants still build various constructions within the right-of-way and that accidents with locals still occur. Accidents could be reduced by offering training and informative material adapted to the communities. Communities could also play an active role as control agents for supervision and environmental and social monitoring, since they live near the line. Training, targeting communities, will therefore reduce line related technological risks and allow their involvement in monitoring, in particular for birds mortalities, nesting, carcasses management etc.

Table 9-1 presents the main aspects of the training plan.

Table 9-1 Training and Capabilities Reinforcement Program

RECIPIENTS	TRAINING MODE	TOPICS	AGENCY PROVIDING THE TRAINING	APPROXIMATE COST
Environmental employees of the electricity society Staff from concerned ministries	Workshops and seminars Case studies at current and other existing project sites	Global view of environmental aspects for energy projects Environmental rules and by-laws related to energetic activities ESMP implementation Specific workshops on health and safety Specific workshops on documentation management (quality procedures)	Ministerial delegation National external consultants International experts	US $100,000
Ministries, local authorities, NGO	Technical training on ESMP monitoring and updating	Specific workshops on monitoring and evaluating Computer monitoring tools Mapping and meetings with stakeholders Portable laboratories and training on sampling techniques.	Ministerial delegation National external consultants International experts	US $100,00 (*US $50,000 material*)
Site operation and line maintenance staff	Workshops Case studies at existing project sites Training at the project site	ESMP implementation Environmental best practices Integration of environmental and social management measures in plans and specifications Environmental works supervision Environmental and social monitoring	Ministerial delegation National external consultants International experts	US $25,000
Contractor staff	Technical training Case studies at existing project sites Training at the project site	Environmental global perspective Environmental rules and bylaws ESMP implementation Environmental supervision Management of respectful, environmental and health and safety (for workers and communities) construction	National external consultants International Experts	US $25,000
Communities	Presentations in communities	Appraisal of risks and opportunities related to the construction and operation of the power line Respect of the ROW, electrocution threat, permitted/forbidden activities in the ROW, monitoring of bird mortalities and nesting (if applicable), opportunities from electrification and efficient electricity management	Contractors and NGO Local external consultants	US $20,000

10 SCHEDULE AND BUDGET

A detailed ESMP powerline and substation implementation schedule is presented in this chapter as well as well as a summary of the main costs for the implementation of plans, programs and main management measures.

10.1 IMPLEMENTATION SCHEDULE

On top of being a reference source in the management of environmental project impacts, the ESMP is also a guide for the rolling-out of various steps and procedures that are necessary for its sound implementation. The following provides an overview of the logical key steps necessary to ensure the efficiency of the ESMP, avoid doubling efforts and making sure that information is shared among all key parties in the project.

The pre-construction phase enables the creation of both PMU, including the technical committee as well as the environmental and social committee, according to the guidelines provided above. The fact that several individuals have to contribute to either the PMU or committees on a regular basis calls for a sound selection of the members. Institutional continuity is key in this process, and changes in the composition of the teams should be kept to a minimum to maximise their efficiency. Therefore, nearly three months are attributed to the identification, selection and preparation (including training) of the PMU and POU teams.

When the final right of way will have been selected, the pre-construction phase will lead to the land acquisition associated to resettlement, and compensation of affected households. It is proposed that compensation of affected households start one year prior to the beginning of construction activities. An awareness program for PAPs will also be undertaken.

The construction phase is characterized, in regards to the ESMP, by the clearing of the ROW. Also, and in parallel with these activities, is the implementation of the ESMP and its PMU monitoring. It is crucial that responsibilities, for the ESMP implementation, supervision and monitoring, are clearly defined. In the first year of the operation phase, some ESMP measures will be implemented associated to impacts arisen during the construction phase, as the monitoring of vegetative state for revegetated areas and well-being of resettled households. More generally, during the operation phase, a lot of efforts will be devoted to the monitoring of the project performance according to environmental and social indicators.

A detailed ESMP powerline and substation implementation schedule is proposed in tables below.

Table 10-1 ESMP and RAP Implementation Schedule – Line

	Activities	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	11	12
Phase 0 : Preparatory activities for Pre-construction phase (6 months)																																															
0,1	Setting-up of PMU's Environmental Committee and PIU NGO witness recruitement		x	x		x	x		x	x	x	x	x																																		
0,2	Implementation of training program							x		x		x																																				
0,3	Communities information and awareness		x	x			x		x	x			x						x					x								x					x										
0,4	Instruments, procedures and monitoring and compensation processes									x	x																																				
0,5	Right of way identification and establishment									x	x																																			
0,6	Plot/land investigation and structure identification										x	x																																			
0,7	Implementation of local resettlement committee (LRC)											x	x																																		
0,8	Compensation standards identification												x																																		
0,9	Compensation evaluation and signing of an agreement						x						x	x																																	
0,10	Preparation of Detailed Management Plans			x	x	x	x	x	x	x	x	x	x																																	
Phase 1 : Pre-construction (6 months)																																															
1,1	Reconstruction of houses and community structures													x	x																																	
1,2	Payment of compensations to PAP														x	x																															
1,3	Assessment and resolution of grievances														x	x																															
1,4	Population resettlement															x	x																													
1,5	Right of way freeing																	x	x																											
1,6	Implementation of Compensation and Revegetation Plan																	x	x																											
1,7	Implementation of Revegetation and Erosion Control Plan																	x	x																											
1,8	Implementation of Stakeholder Engagement Plan																	x	x																											
Phase 2 : Purchase and Construction (18 months)																																															
2,1	Mitigation and improvment measures implementation																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
2,2	Assessment and resolution of grievances																			x				x							x						x									
2,3	Implementation of Waste Management Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
2,4	Implementation of Vegetation Management Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
2,5	Implementation of Physical Cultural Resources Management Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
2,6	Implementation of Emergency Management Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
2,7	Implementation of Higiene, Heatlh and Safety Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
2,8	Implementation of environmental monitoring program																				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
2,9	Implementation of Stakeholder Engagement Plan																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
2,10	Restauration of income generator assets																					x	x					x	x								x	x								
2,11	Achievement of community support activities																							x	x							x	x					x	x						x	x
Phase 3 : Operation and Decommissioning (3 months)																																															
3,1	Implementation of mitigation and improvment measures																																					x	x	x								
3,2	Environmental monitoring program implementation																																						x	x								
Operated by TCN																																															
TCN.1	Implementation of mitigation and improvment measures																																								x	x	x	x	x	x	x	x	
TCN.2	Vegetation Management Plan																																								x	x	x	x	x	x	x	x	
TCN.3	Revegetation and Erosion Control Plan																																								x	x	x	x	x	x	x	x	
TCN.4	Waste Management Plan																																								x	x	x	x	x	x	x	x	
TCN.5	Physical Cultural Resources Management Plan																																								x	x	x	x	x	x	x	x	
TCN.6	Emergency Management Plan																																								x	x	x	x	x	x	x	x	
TCN.7	Hygiene, Health and Safety Plan																																								x	x	x	x	x	x	x	x	
TCN.8	Implementation of Stakeholder Engagement Plan																																								x	x	x	x	x	x	x	x	
TCN.9	Implementation of environmental monitoring program																																								x	x	x	x	x	x	x	x	
TCN.10	Environmental and social audits																			x									x									x									
TCN.11	ESMP update																							x								x						x							x		

Table 10-2 ESMP and RAP Implementation Schedule – Substation

	Activities	Year 1												Year 2												Year 3										
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	11	12
Phase 1 : Designing and approving (5 months)																																				
1,1	Implementation of Compensation and Revegetation Plan				x	x																														
1,2	Implementation of Revegetation and Erosion Control Plan				x	x																														
Phase 2 : Purchase and Processing (9 months)																																				
Phase 3 : Construction (14 months, of which 6 in parallel with phase 2)																																				
3,1	Implementation of mitigation and improvment measures									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,2	Implementation of Waste Management Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,3	Implementation of Vegetation Management Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,4	Implementation of Physical Cultural Resources Management Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,5	Implementation of Emergency Management Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,6	Implementation of Higiene, Heatlh and Safety Plan									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,7	Implementation of environmental monitoring program									x	x	x	x	x	x	x	x	x	x	x	x	x	x													
3,8	Achievement of community support activities											x	x					x	x						x	x								x	x	
Phase 4: Operation and Decommissioning (5 months)																																				
4,1	Implementation of mitigation and improvment measures																							x	x	x	x	x								
4,2	Implementation of environmental monitoring program																								x	x	x	x								
Operated by TCN																																				
TCN.1	Implementation of mitigation and improvment measures																												x	x	x	x	x	x	x	x
TCN.2	Vegetation Management Plan																												x	x	x	x	x	x	x	x
TCN.3	Revegetation and Erosion Control Plan																												x	x	x	x	x	x	x	x
TCN.4	Waste Management Plan																												x	x	x	x	x	x	x	x
TCN.5	Physical Cultural Resources Management Plan																												x	x	x	x	x	x	x	x
TCN.6	Emergency Management Plan																												x	x	x	x	x	x	x	x
TCN.7	Hygiene, Health and Safety Plan																												x	x	x	x	x	x	x	x
TCN.8	Implementation of environmental monitoring program																												x	x	x	x	x	x	x	x
TCN.9	Environmental and social audits							x								x									x											
TCN.10	ESMP update												x						x						x						x					

10.2 COST SUMMARY

The majority of costs associated with the implementation of mitigation measures and improvement cannot be specified at this stage of the study. Many of these measures are to be under the responsibility of the contractor(s) who will build the project, therefore, those costs will be integrated with other construction costs. It should be mentioned that the present ESMP imperatively needs to be appended to the construction tender documents to be published in order to ensure that those costs are placed under the responsibility of the project contractor(s).

The table below shows a summary of the main costs for the implementation of plans, programs and some management measures.

Table 10-3 Preliminary ESMP Budget Estimate

ACTIVITIES	COSTS (USD) (5 years)	NGN (5 years)*
Phase 1 : Pre-construction		
Capacity Building and Training Program	270 000	85 050 000
Survey of sensitive areas for bird populations and nests surveys	50 000	15 750 000
Involvement of a botanist for clearing activities	10 000	3 150 000
Stakeholder Engagement Activities during preconstruction/construction phase	60 000	18 900 000
Sub-total Pre-construction Phase	**390 000**	**122 850 000**
Phase 2 : Purchase and Construction		
Install warning signs and anti-climbing devices	10 000	3 150 000
Document and report all spills to the FMEnv	5 000	1 575 000
Development of local and regional emergency plans in case of infrastructure breakdowns	50 000	15 750 000
Revegetation and Erosion Control Plan	25 000	7 875 000
Environmental and social surveillance	80 000	25 200 000
Sub-total Purchase and Construction Phase	**170 000**	**53 550 000**
Phase 3 : Operation		
Prepare and implement an Emergency Response Plan	20 000	6 300 000
Spill Containment Kits and spill response training of on-site staff	10 000	3 150 000
Document and report all spills to the FMEnv	5 000	1 575 000
Grade ground surface at each tower site to provide drainage away from tower base.	6 000	1 890 000
Implementation of the Vegetation management plan, including invasive alien species monitoring program in identified sensitive areas	15 000	4 725 000
Involvement of a botanist for maintenance activities to implement a selective vegetation clearing	15 000	4 725 000
Invasive alien species control program	20 000	6 300 000
Implement a sensitization program in order to educate and increase local communities' awareness on natural resources protection.	15 000	4 725 000
PAP compensation for any damage to their crops or assets during maintenance activities	10 000	3 150 000
Minimize the number of permanent access roads to and in the ROW. When possible, proceed to early closing and rehabilitation of temporary access roads nearby sensitive scenic areas	25 000	7 875 000
Stakeholder Engagement activities during Operation phase	80 000	25 200 000
Monitoring of environmental and social performance, including the development of adapted mitigation measures (notably for birds)	100 000	31 500 000

ACTIVITIES	COSTS (USD) (5 years)	NGN (5 years)*
Environnemental Audit	20 000	6 300 000
Supervision of environmental and social monitoring from designated responsibles	45 000	14 175 000
Prepare and implement a Vegetation Management Plan	60 000	18 900 000
Prepare and implement a Waste Management Plan	40 000	12 600 000
Prepare and implement a Hygiene, Health and Safety Plan	100 000	31 500 000
Sous-total Operation Phase	**586 000**	**184 590 000**
Implementation of the ESMP	**1 146 000**	**360 990 000**
Implementation of the RAP	**4 398 850**	**1 385 637 783**
TOTAL	**5 544 850**	**1 746 627 750**

* Exchange rate : 315 NGN = 1 USD