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TECHNICAL ASSISTANCE AND CAPACITY BUILDING FOR THE WEST AFRICAN POWER POOL (WAPP)

330 kV VOLTA – MOME HAGOU – SAKETE
TRANSMISSION LINE

ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN
GHANA SIDE ESMP

August 2006

This publication was produced for review by the United States Agency for International Development. It was prepared by CEDA under the direction of Nexant, Inc. under **Contract No. 624-C-00-05-00024-00**

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ECONOMIC COMMUNITY OF
WEST AFRICAN STATES



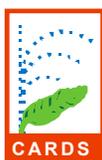
COMMUNAUTE ECONOMIQUE
DES ETATS DE L'AFRIQUE
DE L'OUEST

WEST AFRICAN POWER POOL 330 kV VOLTA - MOME HAGOU - SAKETE TRANSMISSION LINE

ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN



GHANA SIDE ESMP



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August 2006

LIST OF ACRONYMS

CDO	Community Development Officer
DA	District Assembly
DBO	District Budget Officer
DCD	District Coordinating Director
DCE	District Chief Executive
DDCD	Deputy District Coordinating Director
DDPO	District Development Planning Officer
EIA	Environmental Impact Assessment
ESIA	Environmental & Social Impact Assessment
ESMP	Environmental and Social Management Plan
IEC	Information, Education and Communication
LI	Legislative Instrument
MCD	Municipal Coordinating Director
MCE	Municipal Chief Executive
MDPO	Municipal Development Planning Officer
PAPs	Project-affected Persons
PIU	Project Implementation Unit
SEST	Socio-Economic Studies Team
TL	Team Leader
TMA	Tema Municipal Assembly
TOR	Terms of Reference
VRA	Volta River Authority

EXECUTIVE SUMMARY

The Volta River Authority (VRA) was set up as an electric power utility Company established by an Act of Parliament in 1961 (Act 46). The primary business of VRA is to generate electricity, transmit and distribute it in Ghana. The Authority also supplies power to neighbouring utilities in Benin, Togo and La Cote d'Ivoire.

VRA operates two hydroelectric plants on the Volta River, with installed capacities of 1,020 MW and 160 MW at Akosombo and Kpong Generating Stations respectively; a 30 MW Diesel Plant at Tema in a standby mode; a 330 MW Combined Cycle (CC) Takoradi Thermal Power Station (TTPS); and currently 220 MW CC Takoradi International Company (TICO) Thermal Plant. In addition VRA operates the 125 MW Osagyefo Barge.

The Volta River Authority (VRA) and Communauté Electrique du Bénin (CEB) in Togo - Benin presently operate a 128 km double-circuit high-voltage (161 kV) interconnection between Akosombo (Ghana) and Lomé (Togo) in the southern parts of the Countries, and a 60 km single circuit 161kV line (presently energised at 34.5 kV) from Bawku to Cincase and Dapaong (Togo) in the Northern parts of the Countries. The interconnection line in the south was commissioned in 1971 whilst the one in the north was commissioned in 1992. The interconnections have enabled CEB to meet a significant proportion of its energy and power requirements with imports from VRA.

Although the interconnection has performed adequately and met the supply requirements in the past, it is now operating at its limit and cannot meet the forecast demand because:

- The maximum power transfer capability is close to being exceeded
- The transmission losses have increased
- The security of supply has reduced
- The demand of the Volta Region of Ghana, which derives its supply from this line, is growing

The implementation of the West African Power Pool (WAPP) will ensure smooth power exchanges among the countries in the West African sub-region, particularly exchanges between Ghana, La Cote d'Ivoire through Ghana to Togo/Benin.

The proposed construction activities of the transmission line will be carried out across seven districts of the Greater Accra and Volta Regions of Ghana. The districts are as follows:

- Tema Municipal Assembly
- Dangme West District Assembly
- Dangme East District Assembly
- South Tongu District Assembly
- North Tongu District Assembly
- Akatsi District Assembly
- Ketu District Assembly

The project will be carried out within a narrow corridor of 40 m that will span the districts named above (and some of their communities) for a distance of about 135 Km. The project may therefore be termed a 'linear' one.

In the alignment of the proposed transmission line, the proponent has ensured that environmentally sensitive areas have been avoided as much as practicable. Deliberate efforts were made to avoid as many communities as possible.

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The Environmental and Social Management Plan has concentrated on issues that relate to delivery to site of equipment and materiel, erection of towers, stringing of lines, testing and commissioning of a 135 kilometre 330 KV transmission line.

In accordance with the VRA's engineering design and construction practice, the proposed project will consist of the erection of steel transmission towers along the route. The height of the towers will be such as to provide a minimum of 7.5 – 8 m clearance between the lines and open ground and 8 m clearance for roads. Typically, as with the existing system, the towers will be about 35 – 40 m high.

The proposed project is expected to adversely impact on the environment if mitigative measures are not put in place. The proponent however is conscious of the sustainability of the environment within which it operates, especially with regard to the socio-economic and socio cultural environments. The proponent is therefore committed to the implementation of all the measures put forward in this document.

- ***Legal and policy considerations***

An undertaking of this nature can only be carried out within certain legal and policy frameworks. The following relevant regulations guide the implementation of the undertaking:

- ❖ Environmental Protection Agency, 1994, (Act 490)
- ❖ Environmental Assessment Regulations, 1999 (LI 1652)
- ❖ Volta River Development Act, 1961 (Act 46)
- ❖ World Bank's Operational Directive 4.01, "Environmental Assessment"
- ❖ International Finance Corporation, Environmental, Health & Safety Guidelines for Electric Power Transmission and Distribution
- ❖ World Bank's Operational Directive 4.30, "Involuntary Resettlement"
- ❖ Factories, Offices and Shops Act, 328 of 1970 (For Occupational health and safety).
- ❖ Energy Commission Act, 1997 (Act 541)
- ❖ Lands (Statutory Wayleaves) Act, 1963 (Act 186)
- ❖ Lands (Statutory Wayleaves) Regulations, 1964 (LI 334)
- ❖ Lands (Statutory Wayleaves) (Amendment) Regulations, (LI 334)
- ❖ Volta River Authority (Transmission Line Protection) Regulations, 1967 (LI 542)
- ❖ The Land Policy, 1999

- ***Potential impacts***

The main potential impacts, which require mitigation measures, have been identified for the proposed project. These are loss of land, destruction of buildings, other structures and crops, noise pollution, waste management, water pollution, impacts on flora and fauna, public safety and health, occupational safety and health issues and socio-economic/socio-cultural issues.

- ***Mitigation***

The proponent has compiled a detailed list of all potential project-affected persons for the purposes of the payment of fair, adequate and prompt compensation. The

recommendations proposed in the Environmental and Social Management Plan will be strictly adhered to in order to alleviate the impact on the affected persons.

The proponent has put forward comprehensive mitigation measures against the perceived impacts. Adequate and regular maintenance of machinery and the avoidance (as much as possible) of constructional activities in the vicinity of local communities at night will minimise noise nuisance impacts on the local communities. Daytime noise levels are not expected to be a nuisance.

The management of waste in the work camp and the construction sites have been planned to exert minimum adverse effects on the environment.

The proponent acknowledges that the proposed investment in the transmission line project would be worthless if the safety, health and welfare of the employees are not safeguarded. Management will therefore do its utmost to ensure that safety, health and welfare provisions of the Factories, Offices and Shops Act 328 are strictly adhered to.

The use of personal protective equipment will be strictly enforced in order to protect workers and prevent accidents. In addition the VRA will ensure the provision of, among others, a first aid box, drinking water and sanitary facilities at the construction sites and work camp to provide for the health and welfare of all employees engaged on the project.

- **Monitoring**

The VRA will carry out the monitoring of such parameters as noise, water quality, socio-economic issues and occupational safety and health issues. The results will indicate whether predictions of impacts are accurate and also, whether mitigation measures are appropriate and adequate. The monitoring programme will also serve as an early warning system by uncovering unforeseen impacts and allowing additional corrective measures to be instituted to avert significant or irreversible damage.

Table 1 Summary of impact, mitigation, net effect analyses and monitoring

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
Line route survey & Construction	Loss of crops	Almost entire RoW & access tracks	Prompt, fair compensation payment	Negligible	During construction & operation
Construction	Loss of structures	Certain parts of line route	Prompt, fair compensation payment for resettlement	Removal from historical/ancestral roots	Monitoring during construction & operation to ensure all PAPs are adequately and fairly catered for
Construction	Loss of land	Entire RoW & access tracks	Prompt, fair compensation payment	Removal from historical/ancestral roots	Monitoring during construction & operation to ensure all PAPs are adequately and fairly catered for
Construction	Noise impacts	As indicated in report	Avoidance (as much as possible) of work at night	Minor disturbance during daytime	Noise pollution levels will be measured once every month
Construction	Air quality	As indicated in report	Spray the exposed soil surfaces of the tower corridor track as and when needed	Negligible	Monitoring - none
Construction	Potential soil erosion	Entire RoW & access tracks	Limit land clearance to minimum area required and early revegetation	Negligible	Monitor land clearance
Construction & operation	Public safety 1. Open excavations 2. Potential electrocution 3. Potential	Entire RoW & access tracks	Tower base excavations in or near settlements or farms will be clearly marked. All towers will be clearly marked with a	Negligible	Routine inspections of towers during operational phase

v

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
	collapse of towers 4. Others		red inscription on white background - "DANGER – 330,000 Volts" to warn off trespassers, etc.		
Construction & operation	Flora and Fauna	Entire RoW & access tracks	Limit clearance of vegetation	Negligible	Monitored carefully to ensure that the minimum area requirements are not exceeded
Construction & operation	Occupational safety and health	Entire RoW & access tracks	Provision of personal protective equipment. All work to be done according to corporate safety rules of VRA	Negligible	Availability and use of protective equipment.
Construction	Impacts on cultural and historical/archaeological sites/items	Cultural/historical/archaeological chance finds	Chance finds to be reported to appropriate authorities	Negligible	Areas of chance finds will be monitored and secured in order to be handed over to Museums and Monuments Board.
Construction	Public health-STDs/HIV AIDS	Mainly settlements along RoW	Education of workers to avoid casual sex	Potential single mothers, transmission of STDs/AIDS	None
Construction	Traffic impacts	Relevant roads indicated in report	Use of traffic wardens to control traffic at road crossings	Negligible	Presence of traffic wardens at all times during construction.
Construction	Water pollution	Rivers indicated in the report	Minimize erosion and manage excavated materials, wastewater	Negligible	Streams close to the site(s) of construction to be sampled and analysed monthly. During the

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
			from excavations and accidental spillage of oil, fuel and paints		maintenance phase monitoring will be carried out twice yearly.
Construction & operation	Solid Waste generation	Entire RoW & access tracks	Trees, tree stumps and wooden containers to be given out to the local communities as fuel wood Metal wastes to be collected and disposed of appropriately and/or recycled	Negligible	Collection and disposal of solid waste to be monitored
Operation	Effects of rust treatment and painting of towers	Tower locations	Spilt paint to be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites.	Negligible	No monitoring
Operation	Micro shock from a spark discharge	RoW	Minimized by multiple earthings	Negligible	Monitor earthing cables
Operation	Fire hazards	RoW	Public education on hazards of bush burning	Negligible	Routine patrols to discourage bush burning
Construction	Employment	Settlements along	Encourage contractors	Standard of	None

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
& operation	generation and incomes	RoW	to engage local labour	living improved	

- ***Consideration of Alternatives***

During the project planning stage, various alternatives were considered both in terms of equipment and the feasibility of the project itself. These included:

- The “no development scenario”
- Possibility of the use of alternate mode of transmission (underground transmission)
- Selection of optimal transmission line route alignment
- Alternative tower design
- Alternative route

The options above have been discussed in the report indicating the reasons for the choices made.

- ***Institutional arrangements and training***

The ESMP details active remedial measures and monitoring activities to be continuously carried out to prevent or minimize impacts on the physical and biological environments as well as to promote occupational safety and health of employees.

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1.0 INTRODUCTION

The Volta River Authority (VRA) was set up as an electric power utility Company established by an Act of Parliament in 1961 (Act 46). The primary business of VRA is to generate electricity, transmit and distribute it in Ghana. The Authority also supplies power to neighbouring utilities in Benin, Togo and La Cote d'Ivoire.

VRA operates two hydroelectric plants on the Volta River, with installed capacities of 1,020 MW and 160 MW at Akosombo and Kpong Generating Stations respectively; a 30 MW Diesel Plant at Tema in a standby mode; a 330 MW Combined Cycle (CC) Takoradi Thermal Power Station (TTPS); and currently 220 MW CC Takoradi International Company (TICO) Thermal Plant. In addition VRA operates the 125 MW Osagyefo Barge.

The VRA owns and operates a countrywide transmission system for the distribution of bulk electric power in Ghana, consisting of about 3,670 circuit-kilometres of the 161 KV transmission lines and 34 High Voltage/Medium Voltage substations.

In addition, the Volta River Authority (VRA) and Communaute du Benin (CEB) in Togo – Benin currently operate a 128 kilometre double-circuit 161 kV interconnection between Akosombo in Ghana and Lome in Togo in the southern parts of the respective countries, and a 60 km single circuit 161 kV line (currently energised at 34.5 kV) from Bawku to Cincase and Dapaong (Togo) in the northern parts of the respective countries. The interconnections have enabled CEB to meet a significant proportion of its energy and power requirements with imports from VRA.

Although the interconnection has performed adequately and met the supply requirements in the past, it is now operating at its limit and cannot meet the forecast demand because:

- The maximum power transfer capability is close to being exceeded
- The transmission losses have increased
- The security of supply has reduced
- The demand of the Volta Region of Ghana, which derives its supply from this line, is growing

The implementation of the West African Power Pool (WAPP) will ensure smooth power exchanges among the countries in the West African sub-region, particularly exchanges between Ghana, La Cote d'Ivoire through Ghana to Togo/Benin.

1.1 Project objectives

The Volta River Authority and Communauté Electrique du Bénin (CEB) in Togo- Bénin which at present operate a 128 km double-circuit high voltage (161 kV) interconnection between Akosombo (Ghana) and Lomé (Togo) in the southern parts of the countries. This interconnection line was commissioned in 1971. The interconnections have enabled CEB to meet a significant proportion of its energy and power requirements with imports from VRA.

Although the interconnection has performed adequately and met the supply requirements in the past, it is now operating at its limit and cannot meet the forecast demand because:

- The maximum power transfer capability is close to being exceeded
- The transmission losses have increased
- The security of supply has reduced
- The line is used to supply the Volta Region in Ghana whose demand is also growing.

The implementation of the West African Power Pool (WAPP) shall foster power exchanges among the countries in the West African sub region and ensure a high capacity transmission interconnection from La Cote d'Ivoire through Ghana to Togo/Benin.

1.2 Background information on proposed project

PROPOSED DEVELOPMENT	Construction of new 330-kV transmission line
NAME OF PROPONENT	ECOWAS/Volta River Authority
PROPOSED LOCATION	From the Volta substation in Tema in the Greater Accra Region to Tomu near Dzodze on the Ghana-Togo border.

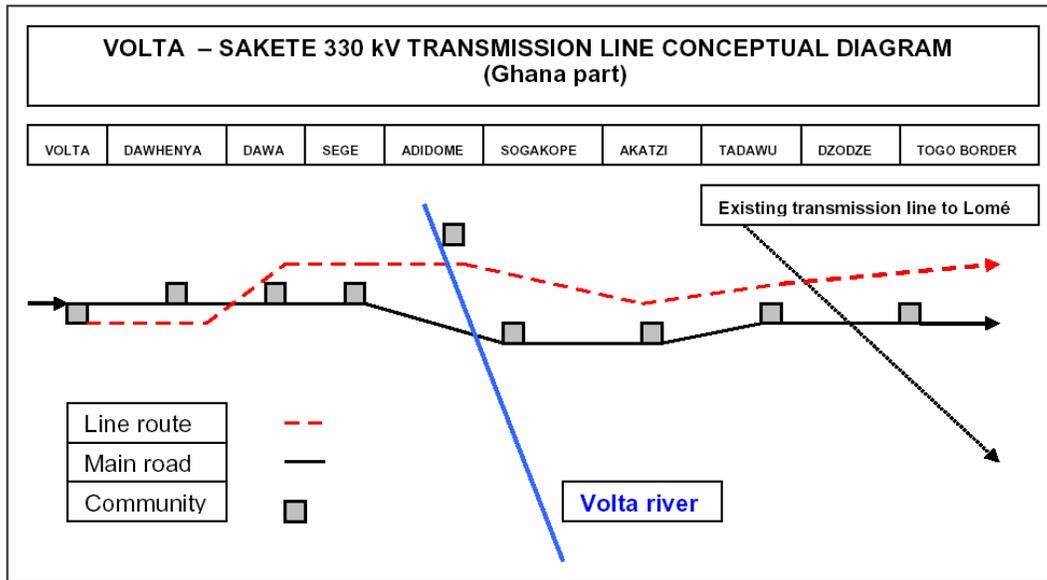


Figure 1 The conceptual diagram of the 330 kV line in Ghana

1.3 Policy, legal and administrative framework

Laws, regulations and policies of relevant agencies, departments and organisations, such as the EPA, VRA, Wildlife Division of the Forestry Commission, the Forestry Commission itself, the Ghana National Commission on Culture, Energy Commission, Land Valuation Board, Factories Inspectorate Department (for Occupational health and safety) are some of the frameworks expected to be considered in the implementation of the project.

These include the following:

- ❖ Environmental Protection Agency, 1994, (Act 490)
- ❖ Environmental Assessment Regulations, 1999 (LI 1652)
- ❖ Volta River Development Act, 1961 (Act 46)
- ❖ World Bank's Operational Directive 4.01, "Environmental Assessment"
- ❖ International Finance Corporation, Environmental, Health & Safety Guidelines for Electric Power Transmission and Distribution
- ❖ World Bank's Operational Directive 4.30, "Involuntary Resettlement"
- ❖ Factories, Offices and Shops Act, 328 of 1970 (For Occupational health and safety).
- ❖ Energy Commission Act, 1997 (Act 541)
- ❖ Lands (Statutory Wayleaves) Act, 1963 (Act 186)
- ❖ Lands (Statutory Wayleaves) Regulations, 1964 (LI 334)
- ❖ Lands (Statutory Wayleaves) (Amendment) Regulations, (LI 334)

- ❖ Volta River Authority (Transmission Line Protection) Regulations, 1967 (LI 542)
- ❖ The Land Policy, 1999

The Environmental Protection Agency (EPA) Act, 1994, (Act 490) and the Environmental Assessment Regulations, 1999 (LI 1652) gave mandate to the Agency to ensure compliance of all investments and undertakings with all laid down Environmental Assessment (EA) procedures in the planning and execution of development projects, including compliance in respect of existing ones.

The Factories, Offices and Shops Act, Act 328 promulgated in 1970 promotes and ensures the health, welfare and safety of persons employed in the country as well as the responsibilities of the employer. Under the Act, employers are required to ensure that a safe and healthy workplace is provided for the safety, health and welfare of all employees.

The VRA is provisionally licensed by the Energy Commission, which was set up under the Energy Commission Act, 1997 (Act 541) with the responsibility of the regulation, management, development and utilisation of energy resources in the country. The Act mandates the Commission to promulgate rules, standards and procedures and grant licences for the transmission, wholesale supply, distribution and sale of electricity and other services in the energy sector.

The provisions of the Energy Commission's 'PUBLIC NOTICE – EC. N. 003' require the Volta River Authority to register the proposed project with the Commission and to obtain a permit prior to the commencement of construction of the proposed project. This permit is subject to the granting of an environmental permit by the EPA.

The proponents have carried out a survey of the line route and have provisionally identified a potential route. To execute the project after all the relevant permits and licenses have been acquired, the Authority would have to legally acquire the Right-of-Way (RoW) in the project area.

The Volta River Act empowers the Authority to acquire the Right-of-Way for constructing and operating power transmission systems. The provisions of the Lands (Statutory Wayleaves) Act, 1963 Act 186, provide the framework for the acquisition of the RoW. This activity could

only be carried out with due consultations with the settlements, communities and District Assemblies within the proposed project's environmental sphere of influence. Sections 12 and 6 of Acts 46 and 186 make provisions for compensation payments to affected persons. VRA will be responsible for addressing all matters relating to the prompt payment of adequate and fair compensation. VRA normally pays compensation for loss of land, structures that have to be demolished and crops to be destroyed during construction.

Section 33 of the Volta River Development Act 1961, Act 46 empowers the VRA to enact regulations to facilitate the initiation and execution of its activities. To this end, the Volta River Authority (Transmission Line Protection) Regulations, 1967 LI 542 was enacted to provide security for VRA transmission lines and ensure public safety. This legislative instrument defines 'transmission line right-of-way' to include the area extending for a distance of fifty feet (30.5 m) on each side from the centre line of the 330-kV transmission towers. This regulation prohibits a number of activities in the RoW including mining, construction of buildings, and cultivation of some types of crops.

The World Bank Group OD 4.30 on Involuntary Resettlement is applicable to this project. The main features of this directive are as follows:

- All viable alternative project designs should be explored to avoid or minimise the need for resettlement and when it cannot be avoided, to minimise the scale and impacts of resettlement
- Resettlement measures are to be conceived and executed as development activities providing sufficient resources to give the persons displaced the opportunity to share in project benefits. Assistance should be given to the community in their efforts to improve former production levels, income earning capacity and living standards or at least restore them to the levels they would have without the project
- Displaced persons should be:
 - Compensated at full replacement cost prior to the actual movement
 - Assisted with relocation
 - Assisted and supported during the transitional period
- Particular attention should be given to vulnerable groups
- Communities should be given opportunities to participate in planning, implementing and monitoring their resettlement

- Resettlement should be linked to the main project implementation schedule, so that project-affected people should be resettled and/or compensated before being affected by the construction or other activities
- There should be adequate monitoring and evaluation
- The proponent should be encouraged to offer replacement land. Cash compensation may be appropriate when residual land holdings are economically viable. For households who lose assets/income large enough to make the remainder unviable, compensation should be provided as if entire holdings had been taken.

In selecting the proposed route, the over-riding consideration has been the avoidance of environmentally sensitive areas and settlements and the minimisation of the destruction of property and farms.

2.0 PROJECT DESCRIPTION

2.1 Volta – Mome Hagou – Sakete Transmission Project

The proponent intends to construct a 330 kV Transmission Line from the Volta substations in Tema, Ghana through Togo to Benin in the framework of the West African Power Pool. This is to foster power exchanges among the countries in the West African sub region and ensure a high capacity transmission interconnection from La Cote d'Ivoire through Ghana to Togo/Benin.

The proposed project will, among others, consist of the erection of steel transmission towers along the route. The height of the towers will be such as to provide a minimum of 7.5 – 8 m clearance between the lines and open ground and 8 m clearance for roads. Typically, as with the existing system, the towers will be about 35 – 40 m high.

2.2 Description of activities

2.2.1 Pre-construction phase

The activities to be undertaken during this phase of the proposed project include:

2.2.1.1 Project planning and design

This phase of the project cycle involves the conceptualisation, feasibility survey and preparation of feasibility report.

2.2.1.2 Line route survey

This activity was carried out by survey consultants contracted by the VRA to carry out the survey of routes, establish land profiles and select the best route from several different options taking several factors into consideration. Some of the factors taken into consideration in the choice of the proposed line route included overall route distance and the avoidance of the potential destruction of properties and other environmentally sensitive areas by the alignment of the route off industrial, residential and commercial areas, cultural resources such as sacred groves, cemeteries, and other potentially sensitive areas.

2.2.1.3 Consultations

During the social and environmental impact appraisal exercises, some traditional authorities, communities, opinion leaders, District Assemblies were consulted. This was to enable the

survey team gain access to the proposed routes since they had to clear vegetation and crops to make way for the survey.

2.2.1.4 Preparation and submission of an EIA.

Collection of baseline data such as information on flora and fauna, potential project-affected people, types and sizes of farms, socio-economic status of the inhabitants of the project area and other baseline data necessary for the preparation of the EIA and the compensation of all affected people.

2.2.1.5 Acquisition of the right-of-way (RoW)

Based on the issuance of an environmental permit from the EPA, the proponent will then goes ahead and acquire the right-of-way in compliance with all laws, regulations, operational directives and guidelines. The mode of acquisition of the RoW is as set out below:

The 1992 Constitution of Ghana by Article 20 prescribes that fair and adequate compensation should be paid to all persons affected by state acquisitions. The procedures used by VRA to ensure that all persons affected by the transmission line project are catered for are outlined below:

- Referencing of all properties, land, crops and buildings, by officers of the Land Valuation Board (LVB) to be monitored by Estate Surveyors from the Estates Department of VRA.
- Assessment of the compensatable values by the LVB and the valuation advice forwarded to VRA.
- The assessed report would be vetted and corrections effected where necessary to ensure that the amounts are accurate and fair to both claimants and the Authority. These would then be processed for payment.
- Offers would be made to the claimants on the basis of the LVB's advice.
- Claimants dissatisfied with the offer have a right to petition for reconsideration.
- In this regard, such claimants are required to submit counter proposals supported by valuation opinion prepared by private valuers of their choice. The private reports are considered by VRA in conjunction with the LVB to ensure that claimants are treated fairly.

- Where necessary, the dissatisfied victims would be invited to negotiate and arrive at acceptable figures.
- Project affected persons may resort to legal action in order to have their grievances addressed.

2.2.1.6 Sourcing of funds and award of contracts

Another activity that will depend to a large extent on the issuance of an environmental permit will be the sourcing of funding for such a major development. The proponent may source funding from the major funding agencies such as the African Development Bank. The EIS will have to be prepared in accordance with internationally acceptable standards.

With the availability of funds, the proponents can then go ahead and award the contract for the actual construction of the proposed transmission line.

2.2.2 Overview of constructional phase

The characteristics of the proposed project involve several activities and components. These will involve activities such as have been discussed below.

2.2.2.1 Tower spotting

Another activity that will be contingent upon the issuance of an environmental permit and the availability of funds will be tower spotting. This is the determination of the individual sites for the installation of the towers. It must be pointed out here that tower spotting will take place over the whole length of the transmission line.

Activities that go along with tower spotting will include final survey and soil investigation. These activities necessitate intrusive access and some clearing of vegetation, leading to possible destruction of crops. Geotechnical survey and tower spotting are therefore activities that shall be carried out subsequent to the issuance of an environmental permit and availability of funds from the lending agencies to identify the optimum foundation design for each tower. The selection of the foundation design type will follow the collection and analysis of the data of each tower location after soil investigations. At this stage minor adjustments may be made to the final tower location, due to the vertical profile of the transmission line corridor, and to avoid buildings that may have been constructed

subsequent to the collection of baseline data on structures in the proposed RoW. Such adjustments will be limited to a few metres in any direction.

2.2.2.2 Construction of access and tower corridor tracks

A tower corridor track of approximately 3 m width shall be constructed under the towers almost continuously along the centreline of the line route. Agricultural access tracks shall be used to gain access to the proposed line. Where there are no such tracks, access tracks will be constructed from the closest public roads to the RoW at intervals along the proposed line route. The access and tower corridor tracks, which will be constructed during the constructional phase, in addition to the tracks constructed during the line route survey, will be retained and maintained for the operational phase. This measure will prevent the clearing of additional vegetation to make way for new access tracks for the operational phase. The tracks will be used for this phase of the project cycle for the transportation of men and material to the line route for the installation of towers and the stringing of the lines. The tracks will be so constructed as to have a width of about 3 m and will be cleared of tree stumps, shrubs and other vegetation likely to obstruct the transport of construction machinery, equipment and operational and maintenance staff to the tower corridor. Cut trees will be neatly stacked to one side of the proposed tracks for the use of, or sale by, the communities close to the site of clearance.

2.2.2.3 Clearing of right-of-way

The construction and operation of the proposed line will require a right-of-way of approximately 20 m on each side of the centre line of the transmission line. The right-of-way will therefore be of width of 40 m. This 40 m wide corridor, which will run the total length of the transmission line from the Volta substation in Tema to Tomu on the Ghana-Togo border, shall be cleared of vegetation to a height of about 1.25 m above ground level.

Threatening trees beyond the 20 m width on each side of the centre line of the transmission line will be cut down or pruned as appropriate. These will be trees, which could damage the transmission line if they fall on it or those whose branches may grow so big as to foul the lines. All vegetation clearance will be done by physical means.

2.2.2.4 Clearing and excavation of tower base and foundation

Also to be cleared will be the proposed tower base areas. These will be selected spots within the RoW for mounting the towers. With a total of about 338 to 450 towers to be constructed, a total tower base area of about 13,500 m² will be cleared for the purposes of the construction of the transmission line. This total area to be cleared will not be in addition to the total area to be cleared for the RoW but will be within the RoW.

The area to be cleared for a single tower will be made up of the dimensions of the tower base (5 m x 5 m) with an additional buffer of 2 m on two sides of the base.

Tower foundations will vary according to the prevailing geology. A majority of them will however have footings of the pad and chimney type, which will be excavated mechanically. By this method, a concrete pad will be constructed at the bottom of the excavation, and each foot of the tower erected within its own 'chimney' of steel reinforced concrete. After about two days, the formwork will be removed, and the excavation will then be backfilled to original ground level and consolidated.

The ground surfaces of the tower sites will be so graded as to gently provide drainage away from the tower legs and to avoid the collection of water (leading to the creation of stagnant pools) at the tower bases. Where necessary, (particularly on side hills), terracing, cribbing or riprap may be used to provide protection for tower foundations.

In areas prone to flooding (swampy areas) a raft foundation for transmission line towers may be used. The raft foundation is similar in concept to the pad and chimney foundation except all four feet of each tower will be set on a single raft of concrete.

2.2.2.5 Clearing of tower track

A track of about 3 m width will be cleared and maintained under sections of the proposed line as far as is practicable. This track will be cleared of all obstructing tree stumps and roots in order to allow the unimpeded movement of light maintenance vehicles for patrolling the line and for the transportation of tools and maintenance crew during the constructional and operational phases of the transmission line.

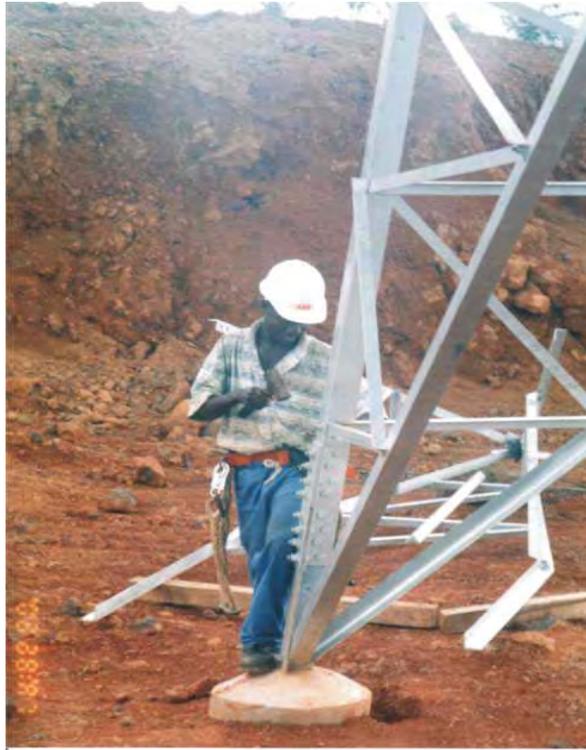


Plate 1 Tower base showing details of foot

2.2.2.6 Storage and transportation of equipment and materials

Almost all the materials to be used in the construction of the transmission line will be imported. Such components include tower steel and its components in broken down form, conductors, insulators, transformers, switchgear, etc. Materials that will be procured locally will include aggregates, cement, sand, stone and other miscellaneous supplies and services. The imported components will be delivered by ship to either the Tema or Takoradi port or by air through Kotoka International Airport. After clearance from the ports, the materials shall be stored at the Contractor's storage site. It must be noted that the materials for the towers will not be bulky and unwieldy. They will therefore not require any specialised vehicles.

During construction, the materials will be trucked to the site via public roads and access tracks. Vehicle movements will be minimal since the work camps will be sited close to the proposed sites.

The locations of the work camps cannot be specified now but their construction will not involve extensive vegetation clearance. In addition, the work camp will be constructed:

- At least 1 km from natural water courses and marshlands
- At least 1 km from settlements and on relatively level ground

The location of the work camp will not impact negatively on cultural properties, and on forest reserves. It will also be so located as to avoid the destruction of crops and buildings.

2.2.2.7 Erection of towers and stringing of transmission lines

After transporting the steelwork and its components from the yards to the site, erection of the transmission towers will proceed. Typically for the VRA, the average span between towers will be about 300 – 400 m giving a total number of towers for this project of about 450. The towers will have concrete footings with foundation depths of 2 – 3 m or more depending on the nature of soils at the selected tower spots. Once the towers are erected, the conductors and shield wires will be strung and appropriately ‘tensioned’ to provide the minimum clearance between ground level and the wires.

The proposed line is expected to cross overhead power and transmission lines, highways, roads, and rivers and streams. In crossing such lines, guard structures will be used when installing the conductor to ensure that the line does not cause hazards and nuisances to the public and construction staff alike. Due notification will be communicated to the appropriate authorities in cases where these lines will have to cross roads and utility lines.

Once the towers have been erected and the lines strung, tests and measurements shall be carried out to ensure that the line performs as expected. Minimum distances such as clearances between the lines and the ground level shall be checked and the lines shall be ‘tensioned’ as per specification. After the construction of the line, the soil conditions along the right-of-way will be assessed for such problems as compaction and erosion and mitigative action taken as appropriate. Areas of bare soil are expected to be re-colonised by native cover plants to stabilise the soil, reduce erosion and prevent invasion by undesirable plant species.

It must be pointed out here that no chemicals will be used for the control of vegetation and that all vegetation control measures shall be done manually.

As indicated elsewhere in this report, the line will be fitted with an optic fibre cable (OPGW), which will be used for power system protection and control and communication purposes.

2.2.2.8 Road crossings

The proposed transmission line will encounter major road crossing points with asphalt surfacing. Other minor roads shall also be crossed. These however are not surfaced with asphalt. A list of some road crossings to be encountered by the proposed transmission line is shown in below. A full list will be provided in the EIS.

Table 2 Road crossing list

No	Pillar Numbers	Road descriptions
1	AP2-AP3	Access Road to Volta substation, Tema
2	AP3-AP4	Kpone - Tema
3	AP5-AP6	VALCO Road
4	AP6-AP7	In front of VALCO
5	AP8-AP9	Kpone Roundabout
7	AP8-AP9	Barrier - Kpone
8	AP10-AP11	Dawhenya - Prampram
69	AP10-AP11	Tema - Aflao
10	AP13-AP14	Sege - Battor
11	AP18-AP19	Sogakope - Adidome
12	AP19-AP20	Akatsi - Wute
13	AP21-AP21A	Tadawu - Torkpo
14	AP21-AP21A	Dzodze - Afiadenyigba

2.2.3 Operational phase

The operational phase of the project will involve the commissioning of the line and maintenance of the RoW, the power lines and the towers.

The operation and maintenance of the transmission line will be based on accepted international standards, such as those of the International Electrotechnical Commission (IEC). The VRA has its own specific procedures for the operation and maintenance of its lines as set out in the 'Volta River Authority Corporate Safety Rules'. This document concerns itself with issues, which are considered of paramount importance such as public safety and the safety, health and welfare of maintenance crew.

The main activities to be carried out during the operating life of the transmission line include surveillance of the condition of the transmission line, towers and RoW; routine and emergency maintenance and repairs; and vegetation control.

The VRA maintains a Transmission Department headquartered in Tema that is responsible for the operation and maintenance of its transmission network in Ghana. The Department carries out its duties under three broad categories. These are discussed below.

2.2.3.1 Routine running maintenance

This consists of routine maintenance carried out by the Department to ensure the integrity and safety of the lines. The maintenance activities carried out here include:

- Aerial surveillance by helicopter. This is done to ensure that potentially hazardous defects are pre-empted and the integrity of the line is maintained and sustained. This is done on an annual basis.
- Foot patrol. The Line Maintenance team carries out routine physical examination of the transmission line and its component parts to ensure the safety, security and integrity of the line. Such activities are carried out at least twice a year.
- Security patrol. This is done to check on segments of the line close to populated areas for signs of vandalism, tampering, and general security of the lines. It is to ensure an early detection of and rapid response to acts of vandalism and to rectify such situations as promptly as possible.
- Tower auditing and repairs. This provides a means of assessing the ageing process of towers. It starts one year after the commissioning of a line section and it follows a one-year cycle. In a cycle of tower auditing, 10% of all suspension towers and all dead-end towers are thoroughly examined. As the line ages, it is subjected to wear and fatigue which may not be noticeable by a distant visual inspection. Detection and tightening of loose bolts on supports and hardware can reduce premature wear and indicate for replacement of worn components before failure.

In the course of operation defects that are identified are repaired. Such defects may include the replacement of defective conductors, flashed over insulators, defective dampers, vandalised components, and maintenance of access tracks and RoW.

2.2.3.2 Major maintenance

These are scheduled maintenance programmes that are carried out on the transmission line as a result of the ageing of towers, the lines and other accessories. The repairs may also arise out of the running maintenance activities. These maintenance programmes usually become necessary as a result of the lines running through aggressive environments (mining areas, industrial and coastal areas). Some of the activities carried out under the major maintenance programme include:

- Re-insulation of sections of the transmission line
- Treatment of rust and re-painting of tower components
- Replacement of corroded towers and transmission line components
- Replacement of conventional bolts and nuts with anti-theft fasteners on older line sections
- Rehabilitation of access roads and tracks

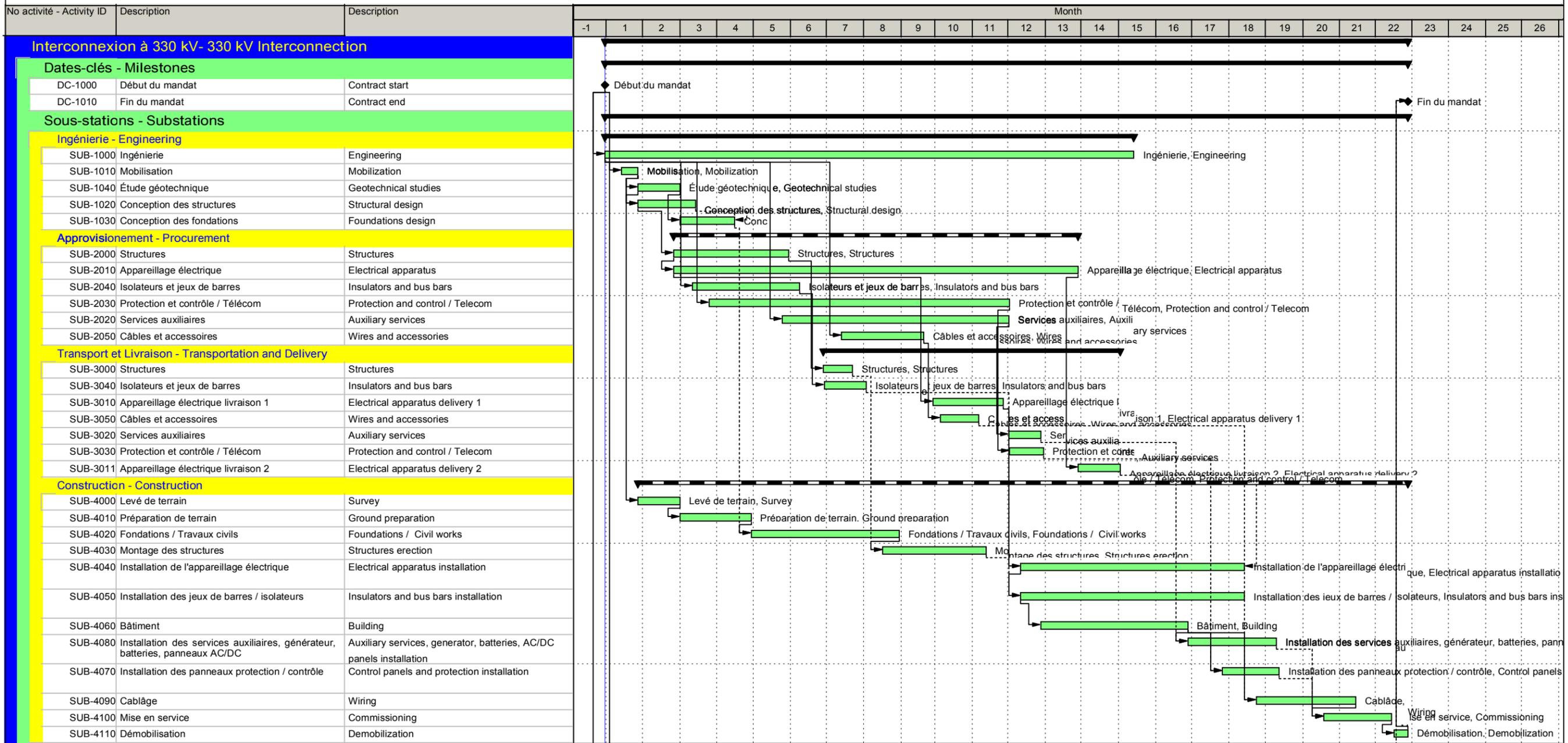
2.2.3.3 Emergency maintenance

These are activities relating to correction of sustained line faults. These could span a whole spectrum of minor faults (e.g. insulator failure) to such major defects as tower failures. Some of the activities carried out under this programme include the construction of temporary by-pass line to replace collapsed sections of lines, reconstruction of the collapsed section, and aerial and ground patrols to locate sustained line faults.

2.2.4 Project schedule

The milestone events of the proposed project have been shown graphically below. The figure shows events that have occurred in the past and the scheduled targets for events planned in the future. As indicated, the construction phase will span a period of 22 months.

Pre-construction activities have however started and these include the line route survey and the preparation of an Environmental Impacts Statement.



█ Actual Work
 █ Critical Remaining Work
 █ Remaining Work
 ◆ Milestone
 → Summary



3.0 CONSIDERATION OF ALTERNATIVES

During the project planning stage, various alternatives were considered both in terms of equipment and the feasibility of the project itself. These included:

- ***The “no development scenario”***

If the project is not implemented, the ever-increasing energy demands of the participating countries would not be met in the near future and economic stagnation may result.

- ***Possibility of the use of alternate mode of transmission (underground transmission)***

Other alternative means of transmission such as laying of underground cables over long distances is not practicable and might entail financial and environmental costs that might be too high to bear.

- ***Selection of optimal transmission line route alignment***

A provisional line route has been chosen based on several factors, the major considerations being the need to avoid environmentally sensitive areas, communities and settlements. This was to ensure that resettlement of communities and the destruction of farms and other properties is avoided or minimised as much as possible. This route will be further fine-tuned as the environmental studies continue.

- ***Alternative tower design***

VRA has opted for the erection and use of lattice steel towers for its transmission network based on the required strength, heights, safety and security. Wooden towers would not provide the same level of safety, security and strength required. In addition the use of wooden poles would entail the utilisation of a lot more wooden poles than the number of steel lattice towers for the same length of line due to the weak strength of the wooden poles.

- ***Alternative route***

A route selected in 1986 has been abandoned due to the now heavily built up nature of some sections. The new route has been provisionally established which seeks to reduce the possibility of resettlement.

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Location of proposed activities

The proposed construction activities of the transmission line will be carried out across seven districts of the Greater Accra and Volta Regions of Ghana. The districts are as follows:

- Tema Municipal Assembly
- Dangme West District Assembly
- Dangme East District Assembly
- South Tongu District Assembly
- North Tongu District Assembly
- Akatsi District Assembly
- Ketu District Assembly

The project will be carried out within a narrow corridor of 40 m that will span the districts named above (and some of their communities) for a distance of about 135 Km. The project may therefore be termed a 'linear' one.

In the alignment of the proposed transmission line, the proponent has ensured that environmentally sensitive areas have been avoided as much as practicable. Deliberate efforts were made to avoid as many communities as possible.

Figure 2 Map showing proposed line route

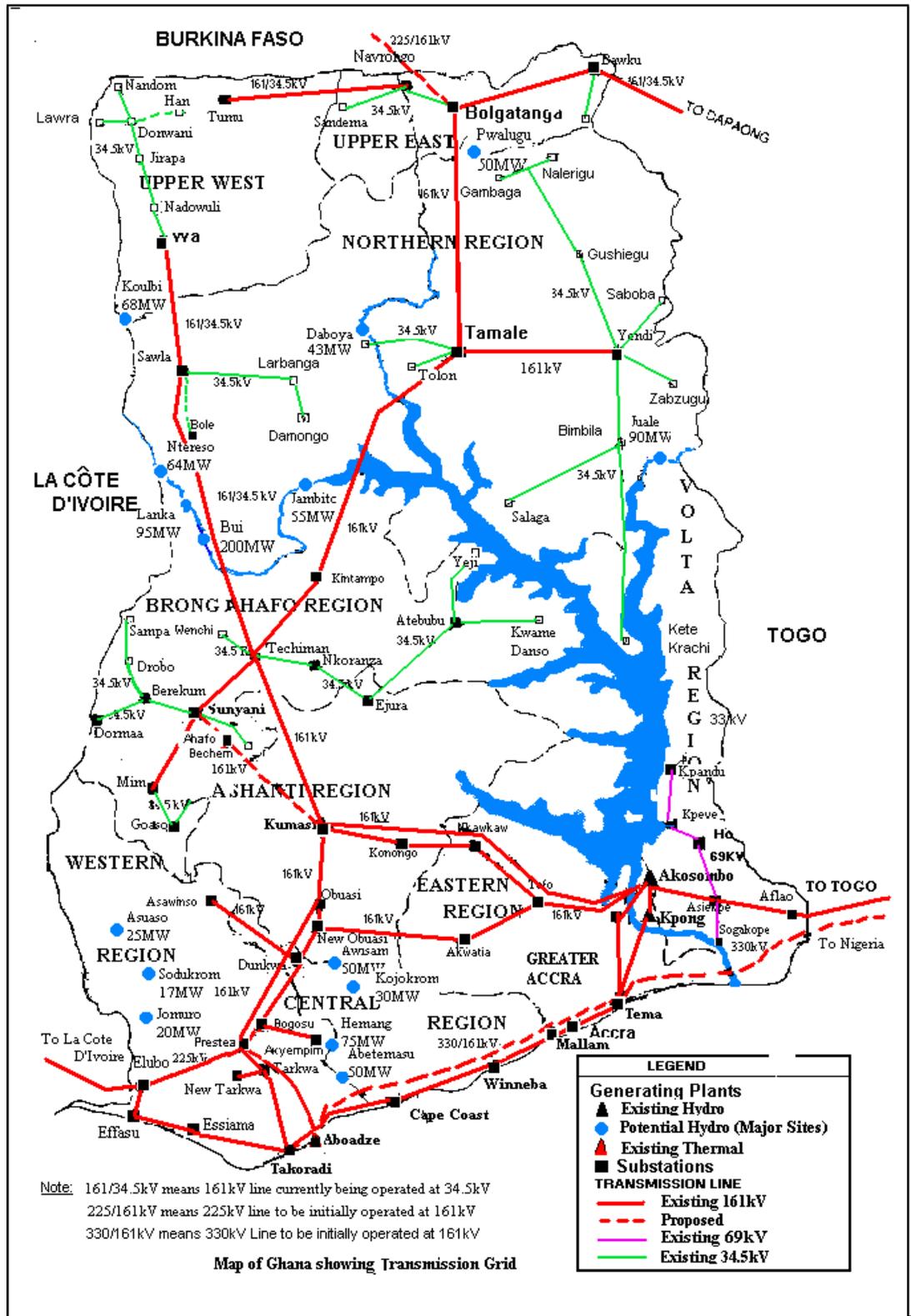
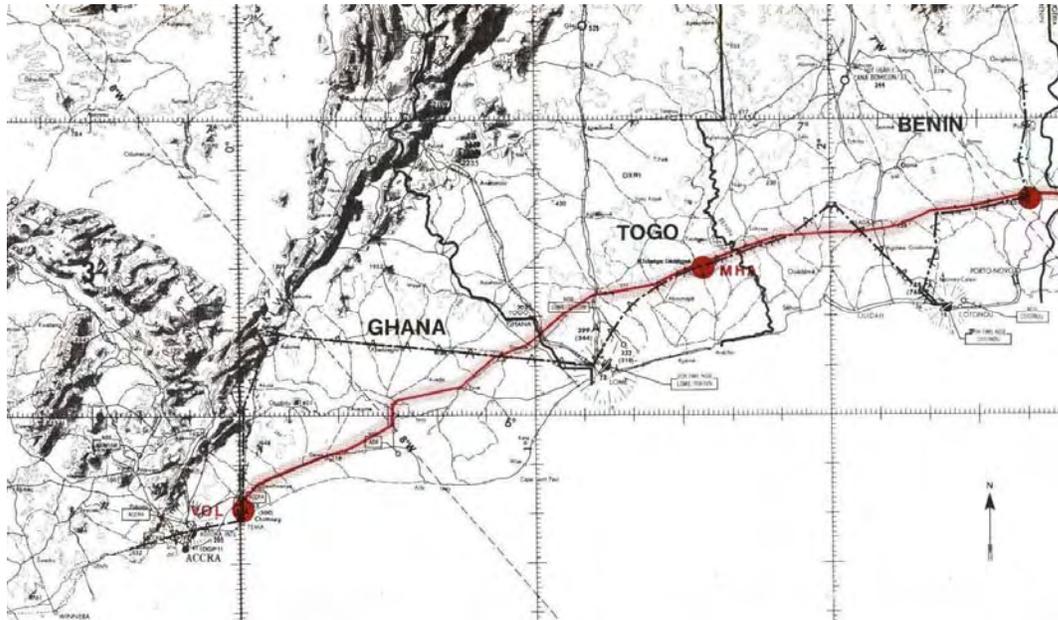


Figure 3 General location of project

4.2 Biological environment

A rapid appraisal of baseline conditions of the biological environment of the proposed project area was undertaken. The appraisal had the following objectives:

- Investigation of the presence or absence of rare or endangered species in the project's area of environmental influence
- Establishing whether or not there are factors that preclude the implementation of the proposed project

4.2.1 Vegetation

In addition to the study of the available literature, a species list was compiled by walking along the line route at random in the various districts traversed by the proposed transmission line and recording the species that were known to be present in the area.

Three main vegetation types are to be traversed by the line route corridor. The Coastal Savanna Grassland from Tema through Sege to Vume consists of grassland with isolated scrubland. Trees are mostly clusters of short neem trees with short grass grazed by cattle.

It is followed by the Guinea Savanna Woodland from just before Sogakope on the eastern side of the Volta river through Akatsi to Dzodze and Dedekope, consisting of tall grassland with isolated acacia, baobab and eucalyptus trees interspersed with mango and coconut trees, bamboo clumps and cassava and millet farms.

The Dzodze to Aflao part of the corridor passes through patchy growth mangrove swamps. Besides their obvious economic importance, most of the endemic species of the area may have some ethnobotanical importance. The most common, sparsely planted, exotic species around Sogakope to Dzodze area of proposed corridor is isolated plantations of *Eucalyptus tereticornis*.

Some of the common species of plants in the Coastal Savannah Grassland of Ghana include *Securinega virosa*, *Clausena anisata*, *Capparis erythrocarpus*, *Grewia* spp., *Eaeophorbia drupifera*, *Borassus* sp., *Anchomanes welwitchii*, *Xanthoxylum xanthoxyloides*, *Antiaris toxicaria*, *Heteropogon contortus*, *Sophora occidentalis*, *Eugenia coronata*. In seasonally flooded areas, species of plants such as *Mitragyna inermis* and *Cyperus articulatus* and *Vetiveria* spp may be found.

Life Form distribution

The life form distribution of the proposed study area is predominantly grass with thicket as anticipated of a coastal savanna (Dickson & Benneh, 1988). Of the shrub, trees and grasses, *Azadirachta indica* (neem), *Securinega virosa* and *Andropogon gayanus* occur widely. *Andropogon gayanus* is the most common grass species, and is sometimes found in association with other fodder plants like *Panicum* sp., *Imperata cylindrical* and *Vetivera fulvibarbis*. (Rose-Innes, 1977).

Rose-Innes, (1977) had identified 5 species including *Bapthia nitida*, *Antiaris africana*, *Griffonia simplicifolia*, *G. carpinifolia* and *Milletia thonningii* as the commonest browse species in the coastal plains of Ghana. Apart from *M. thonningii* and *G. carpinifolia*, the others have dwindled in density. *Azadirachta indica* (neem), *Concarpus erectus*,

Xanthoxylum xanthoxyloides were used for fuel wood. Currently neem is observed to be the most widely distributed species used for charcoal and fuel wood in the area.

One significant observation on the status and use of the vegetation in the area include the imminent erosion of tree species, especially neem, through persistent harvesting of thin stems and stumps for domestic energy, annual bush fires which destroy plant tissues slowing the growth rate, and prompting scarcity of fodder for livestock

The most important ecological factor in the coastal grassland is fire, which sweeps across the plains during the dry season. Although the grass recovers, many of the shrubs do not. Another important factor is the increasing number of cattle that graze the area.

a. Farms

The farmlands encountered in the project area had either cash crops or food crops and sometimes both. The major food crops encountered included cassava, maize, groundnuts, sweet potatoes, rice, beans, okro, onions, tomatoes, cabbage, pepper, etc. The cash crops were mostly vegetables, oil palm, eucalyptus, etc.

b. Swamp/marshes regrowth

The study area holds riverlets, ponds and tributaries of major streams and rivers. Wetlands including lagoons and estuaries are also found to occur in the proposed project area. Mangroves are the most dominant plant species found in the saline and brackish area and they are made up of species such as *Avicenia nitida*, *Rhizophora sp.*, *Phioxerus vermicularis* and *Paspalum portulacastrum*.

These water bodies especially the freshwater types primarily contain algae including benthic diatoms and a few true planktonic species. Notable among these include well known and common species like *Amphora sp.*, *Campylodiscus sp.*, *Cymbella sp.*, *Diploneis sp.*, *Gyrosigma sp.*, *Navicula sp.*, and *Nitzschia sp.* These species are all typical of shallow water bodies and most likely make a significant contribution to primary production of these water bodies. Other more planktonic groups like the green algae and blue- greens are thought to be not well represented due to the turbid nature of the water as a result of the colour of soils generally occurring in the area.

Freshwater plants (macrophytes) including *Typha domingensis*, *Scirpus littoralis*, and *Nymphaea lotus* also occur even in the zones around the lagoons and even towards the Volta River. The drier areas have associations of *Sesuvium* sp. and *Sporobolus pyramidalis*.

These water bodies also contain fauna dominated by three groups of organisms like annelids, mollusks and crustaceans. Aquatic insects are also very well represented.

Protected wetlands including lagoons and estuaries are also found to occur in some of the districts through which the proposed line will traverse. It is however not expected to cross any of the protected sites.

4.2.2 Fauna

The coastal savannah vegetation is known to support a diversity of animals including birds, small mammals and reptiles. These animals are not restricted to specific districts in the distribution within the proposed area. There seems to be a fair distribution of the fauna over the entire corridor.

The faunal survey carried out came up with the following faunal species as being present in the project area. A full list of faunal species will be included and discussed in the Environmental Impact Statement.

Birds of ecological importance found in the area include the White-faced tree duck (*Dendrocygna viduata*), White fronted plover (*Charadrius marginatus*), Ringed plover (*C. hiaticula*) and the grey plover (*Pluvialis squatarola*).

Others include Turustone (*Arenaria interpres*), Reshark (*Tringa glareola*), spotted redshark (*T. erythropus*), greenshark (*Tringa nebularia*), knot (*Calidris canutus*), and the little stint (*Calidris minuta*). The little egret (*Egretta garzetta garzetta*), reef heron (*Egretta garzetta gularis*), the grey heron (*Ardea cinera*) and the terns (*Sterna* spp.), are all known to perform significant functions in the ecology and recreation of the area.

The Togo hare (*Lepus zechi*) and the common rat (*Rattus rattus*) are the most common mammals occurring widely in the area. Reptiles that are very well represented in the proposed project area include the Agama lizard (*Agama agama*), the Nile monitor (*Varanus*

niloticus), Orange flanked skink (*Matugu perotteltii*) and the Puff adder (*Bitis arietans*) all perform functions vital to the maintenance of the ecological set-up of this type of vegetation zones.

4.3 Geology

The area is generally underlain by pre-Cambrian rocks. The proposed line route traverses the following formations:

Dahomeyan formation. This is the oldest rock formation in the country and constitutes the floor of the Accra plains and the southern part of the Volta Region. Rocks of this formation are mainly metamorphic, consisting of gneisses and schists, and were probably formed from sedimentary rocks. The Dahomeyan formation is highly folded as a result of earth movements.

Birimian formation. This covers more than three-fourths of the closed forest zone. The formation is divided into the lower Birimian which consists of such metamorphosed sediments as phyllites and schists and the upper Birimian which is the younger of the two and consists of rocks of the lower Birimian as well as metamorphosed lavas. Associated with the Birimian formation are extensive masses of granites, formed through the cooling of magma.

Togo Series. Rocks of this series were formed from eroded materials deposited in basins. They consist of sedimentary rocks and their metamorphosed versions, e.g., quartzites, schists, shale, and phyllites. These were strongly folded to form what are now known as the Akwapim – Togo Ranges.

A detailed discussion of geology shall be covered in the Environmental and Social Impact Study.

4.6 Water resources and their uses

All the major rivers and streams of the project area all flow in a north-south direction and eventually into the sea. There are two sources of water supply for the rivers: rainfall and springs.

Surveys of the communities whose lands and farms will be traversed by the proposed line indicate that both streams and ground water are used for domestic, sanitary and for drinking purposes.

The proposed transmission line will traverse the following rivers and streams. Most of the streams are seasonal in nature and may flow for brief periods after major rains.

Table 3 River crossings

Reference point	Rivers	Reference point	Rivers
AP9 – AP10	Gyrokorgyor	AP18 – AP19	Mortor
AP10 – AP11	Dawhe	AP19 – AP20	Tordzi
AP11 – AP12	Polupolu	AP19 – AP20	Agblorgborloe
AP11 – AP12	Blabiabor	AP20 – AP21	Tohwi
AP11 – AP12	Sagremi	AP20 – AP21	Wuwure
AP12 – AP13	Dofasi	AP20 – AP21	Etu
AP13 – AP14	Tanodor	AP21 – AP21A	Agortor
AP16 – AP17	Amide	AP20 – AP21	Anwatoe
AP17 – AP18	Volta	AP20 – AP21	Kplikpa
AP18 – AP19	Torndor	AP20 – AP21	Agali

4.7 Background information on affected districts

In accordance with the terms of reference (TOR) and in fulfilment of carrying out the “**overall socio-economic description of the project area**” the Consultant undertook district reconnaissance visits to the 7 districts within the project corridor on 15th, 16th and 18th May 2006. The purpose of the visit was to familiarise with the project area and initiate the sensitization process to the seven District Assemblies (DAs) in order to:

- Introduce the Socio-economic and survey teams;
- Introduce the project, in particular, purpose, benefits, likely environmental risks; mitigating issues, etc.;
- Discuss and articulate concerns of DAs and community members;
- Obtain available documentation, information, census and socio-economic data on the districts district/community development/action plans, etc.; and
- Hold discussions with DA officials and, in a participatory manner, identify villages/hamlets not captured on the project map with assistance DA officials.

The ECOWAS Volta -Mome Hagou – Sakete 330 kV Transmission line affects communities in seven districts in Greater Accra and Volta, two administrative regions of Ghana. The seven districts of the Project are the Tema Municipal Assembly, Dangme West, Dangme East, South Tongu, North Tongu, Akatsi and Ketu District Assemblies.

The office of the District Assembly functions as the secretariat of each District, and wields the highest political, administrative, deliberative and executive functions. The office of the District Assembly is headed by the District Chief Executive (DCE) and the District Coordinating Director (DCD), who together with the Heads of Department provides the technical support and advice to the Assembly. The office of the District Assembly also co-operates with Non-Governmental Organizations as well as the Traditional Councils, which revolve around the chieftaincy institution. Details of the traditional social structure will be provided in another report.

Each District has sub district structures which facilitate development at the grassroots level. These are Town/Area Councils immediately below the Assembly and Unit Committees.

Table 14 - List of DA Authorities Consulted is included as Annex to this Report. A programme for the sensitization with the list of persons consulted is also submitted as Table 15 in the Annex together with available district maps.

Consultation and Sensitization Process - At each of the meetings at the various DAs, the Socio-Economic Studies Team (SEST) was introduced to the authorities by the team leader (TL) followed by a brief background to the project highlighting the benefits, likely environmental risks as well as mitigating issues etc. and thereafter a brief questionnaire was administered.

The community sensitization team (CST) made up of representatives of the socio-economic and the topographic survey teams undertook the sensitization exercise in the seven project districts beginning from Friday 26th May 2006 and ending on Saturday 7th June, 2006

Concerns raised - While the various authorities anticipated the project to bring benefits in general, they nonetheless raised a number of concerns especially regarding negative effects that may result from the project. For differences in emphasis the concerns expressed are captured on a district by district basis below. On the whole, the district authorities conceded that since the project is a national one, they had not objections to its execution in principle.

4.7.1 Tema Municipal Assembly

The Tema Municipal Assembly is a coastal municipality situated about 30 kilometres east of Accra, the capital city of Ghana. The Assembly shares boundaries on the north-east with the Dangme West District Assembly (DWDA), on the west with the Accra Metropolitan Assembly (AMA) and on the north-west with the Ga District Assembly (GDA), east by Akuapim South District Assembly and the south by the Gulf of Guinea. The Greenwich Meridian 0° longitude passes through the city of Tema. The Municipality covers an area of 396 sq. kilometres made up of 163 square kilometres (45%) government acquired area, and the remainder (55%) belongs to traditional authorities, stools and families. TMA lands belong to the indigenous Ga people.

4.7.1.1 Demographic Characteristics

The 2000 Ghana Population Census and Household Survey put the total population of the Municipality at 511,459 made up of 252,109 males and 259,350 females. The Municipality is

also known to have a high population growth rate of 2.6%. Ashaiman, which is a migrant community, has the highest population growth rate in Ghana (4.6%).

The Municipality is also polarized into urban (90%) and rural (10%) settlements with population, economic and social conditions following distinct patterns.

4.7.1.2 Economic Development

The Municipality has the country's biggest port and harbour facilities situated in Tema, the capital of the Municipal Assembly. Tema is also the leading industrial city in the country. Tema is thus the most important production sector of the country in terms of local revenue generation as well as employment opportunities with companies such as The Volta Aluminium Company (VALCO), Ghana Textile Printing Company (GTP), Ghana Ports and Harbours Authority (GPHA), and the Ghana Agro Foods Company Ltd. (GAFCO), each employing more than 1000 people. There are over 400 factories in Tema which have been categorized into 8 major areas – Chemical, Textiles, Food Processing, Engineering, Paints, Fish Cold Stores, Printing and Woodwork industries

4.7.1.2.1 Tema Harbour

The Tema Harbour which officially opened to traffic in February 1962 is the hallmark of economic activities in the Municipality. It has the main Harbour, the Fishing Harbour, Shipyard and Dry-dock which is capable of docking both large and medium size fishing vessels. There is also a canoe beach where smaller boats/canoes land. Recently, an outreach Clinic for Maternal and Child Health/Family Planning (MCH/FP) services has been located there.

4.7.1.2.2 Free Zone Enclave

Factories to operate in the Free Zone areas are expected to enjoy tax holiday.

4.7.1.2.2 Commerce

Being a port city, commercial activities are carried out extensively in Tema with goods ranging from consumables to automobiles, though trading in foodstuffs appeared to be the most common activity. The Community 1 market serves as the most important daily market in the Municipality, with a few markets of relatively less significance dotted in other parts of the Municipality, such as Community 2, Ashaiman and Tema Manhean.

4.7.1.2.3 Services

A number of light industrial estates have been zoned for use by persons engaged in mechanical repair sector, namely Kpone Light Industrial estate, Community 9 Light Industrial Area.

4.7.1.2.4 Mining & Quarrying

Stone quarrying and sand winning activities are carried out in rural areas of the Municipality, notable among them are gravel winning at Kpone, sand winning at Santeo, Zenu, Katamanso, Appolonia.

4.7.1.2.5 Agriculture Sector

Agricultural activities in the Tema area are growing due to the collapse of much of the formal economy. The activities that can be identified in the Tema Municipal area are the following: -

4.7.1.2.6 Fishing and Fish Processing

This is one of the major economic activities especially for the indigenous inhabitants of Tema; the latter being the income generation and processing activity, mainly for women.

4.7.1.2.7 Livestock Production

Raising of poultry and pigs in the peri-urban area is done for sale to urban market. Cattle rearing is common in the rural segments

4.7.1.2.8 Food Crop Production

Food crops such as maize, cassava and cowpeas are cultivated in the rural segment of the TMA. Irrigated market oriented production of vegetables such as okra, tomatoes, onion, cabbage etc. are practised and usually along main drains and water bodies.

4.7.1.2.9 Tourism Resources

The major tourist and cultural sites are the beaches, the harbour and the 'Meridian Rock', which is believed to be located at the exact centre of the world. A point at the Presbyterian Church in Community One has been selected to represent it and it serves as a tourist site.

4.7.1.3 Social Development

4.7.1.3.1 Education

The Educational system in the Municipality has undergone tremendous changes due to the Government's new educational policy. The Ministry of Education gives the policy direction on all educational matters in the country and the Ghana Education services (GES) implements these policies. The Tema Municipal Directorate of Education handles educational matters relating to Basic school in the Municipality. The education statistics for the municipality are shown in Table 4

Table 4 Statistics of schools (Public, Private)

Level	N° Of Schools In public	N° Of Schools In Private	Grand Total
Nursery	31	127	158
Primary	133	133	266
J.S.S	172	65	237
S.S.S	7	5	12
Vocational /Technical	1	2	3
Total	344	332	676

Source: Ghana Education Service, Tema.

Enrolment in both public and private schools in the Tema Municipality is as follows: -

Table 5 School enrolment

Level	Public		Private		Grand
	Boys	Girls	Boys	Girls	Total
Nursery	1512	1441	6607	6146	15,706
Primary	16500	17277	13729	13486	60,992
J.S.S.	10429	10686	3420	3352	27,887
S.S.S.	2521	2592	353	623	6,087
VOC./ Tech.	747	126	40	243	1,156

Source: Ghana Education Service, Tema.

Table 6 Staffing in Public schools

Level	Trained Teachers		Untrained Teachers		Grand
	Male	Female	Male	Female	Total
Nursery	-	61	2	39	102
Primary	119	715	-	2	836
J.S.S.	387	485	3	-	875
S.S.S.	140	72	28	6	246
VOC./ Tech.	54	4	-	-	58

Source: Ghana Education Service, Tema.

Table 7 Staffing in Private Schools

Level	Trained Teachers		Untrained Teachers		Grand
	Male	Female	Male	Female	Total
Nursery	13	23	32	447	515
Primary	114	76	509	191	890
J.S.S.	175	50	214	21	460
S.S.S.	24	6	34	2	66
VOC./ Tech.	1	-	10	2	13

Source: Ghana Education Service, Tema.

The Municipality can boast of more than six hundred (600) educational facilities, there are still many children who have no access to these educational facilities in the urban centres. The number of pupils in a classroom exceeds 40 compelling most schools to run the shift system. Besides, most teachers prefer to teach in urban areas leading to lack of teachers for the rural communities.

4.7.1.3.2 Health

There are six (6) government and twenty-eight (28) private health facilities available in the municipality. There are 69 satellite clinics organized by the staff of the Government facilities. These facilities are available for dealing with various occupational related health problems.

Services rendered include Maternal and Child Health (MCH), Family Planning, Home Visits, Supervision of traditional Birth Attendants (TBAs) and Psychiatric Health.

4.7.1.3.3 Road Network

Tema has an extensive network of arterial roads. Road network within communities 1 – 22 consists of collector and access roads. Roads at Ashaiman are inadequate, whilst storm, roadside drains and pedestrian facilities are insufficient. Roads in the newly developed and depressed areas at Kpone, Baatsonaa, and Adjiriganor etc. have earth/gravel surfaces and are in poor conditions with some portion of the road network non-existent. The existing roads have no drains. The total length of roads within the Municipality is 418.05km, constituting 24.4%. The remaining 75.6% is classified as local roads. Table 8 shows the existing network by surface type and condition mix: -

Table 8 Surface Type split for road network in Tema

Surface Type	Length (Km)	%
Asphalt cement concrete roads	31.55	7.6
Surface dressed roads	304.50	72.8
Gravel and earth roads	82.00	19.6
Total	418.05	100

Source: Urban Roads Unit, Tema

4.7.1.3.4 Water Supply

Majority of settlements within the municipality have access to pipe-borne water from the Kpong water works. The rural parts of the municipality have some settlements still lacking pipe-borne water facility and depend on water from streams, rivers and wells.

4.7.1.3.5 Electricity

Adequate provisions have been made for the supply of electricity for the urban community. Industries in Tema consume the largest part of all electricity power generated in the country. The Volta Aluminium Company (VALCO) for instance, consumes a greater portion of the total power produced by the Akosombo dam

4.7.1.3.6 Transport Facilities

There are private and commercial transport systems operating in the Municipality including, a web of taxi services which are available on a 24-hour basis. Heavy-duty trucks and Lorries come from all over the country carting goods to and from the harbour and the industries in Tema.

4.7.1.3.7 Post & Telecommunication

The Ghana Postal Service and the Ghana Telecom (GT) provide these services in the Municipality. Private postal agencies like BHC FEDEX operate in the Municipality.

4.7.1.4 District Sensitization

All the officials contacted said they were aware of the project though not in much detail. Even though they were not privy to the decision for the transmission line passing through the TMA, the officials were nonetheless unanimous that they would not have had any objection to the project as it is a national project. Moreover, they believed the advantages of the project outweigh the disadvantages. Loss of land and livelihood and respect for cultural heritage sites were their major concerns amongst others but intimated that this could be mitigated if the TMA were consulted in order to facilitate the acquisition of lands and the prompt payment of appropriate compensation for all lost properties to the affected persons.

4.7.1.4.1 Community Sensitization

Members of the socio-economic team undertook an initial sensitization and consultation with the chief of Kpone and two of the Assembly Members (AMs). The chief confirmed acceptance and support for the project and the need for compensation or resettlement of those community members whose land would be affected by the project. Their concerns were on likely passage of the transmission line through residential zones within Tema and Kpone which will entail destruction of housing infrastructure and the loss of land by users e.g. crop lands and hence loss of their livelihoods.

4.7.2 Dangme West District Assembly

The Dangme West District is situated in the south-eastern part of Ghana in the Greater Accra Region within Latitudes 5° 40' and 6° 10' North and from Longitude 0° 20' West to 0° 30' East. The district has total land area of about 1442 square km, representing 41.5% of the region. The district has Dodowa as its capital. The District shares boundaries with the

Yilo and Manya Krobo Districts on the north-west, Akwapim North District on the west, Tema District on the south-west and the Dangme East District on the east. The Volta River and the Atlantic Ocean border the north-eastern and the southern portions of the district respectively.

4.7.2.1 Demographic Characteristics

The total population of Dangme West is 96,809 (HPCS 2000). This shows a population growth rate of 2.1 percent for the periods 1960 to 1970, 1970 to 1984 and 1984 to 2000. The 2000 population census report revealed that the District share of Ghana's total population is only 3.3%.

4.7.2.2 Economic Development

4.7.2.2.1 Industry

The district lacks large-scale industrial establishments. The sole and only major manufacturing industry in the District was the Asutsuare Sugar Factory. The brick and tile factory at Prampram, has also folded up. Small-scale industries abound in the district. A study conducted in 1990 revealed that there were about 360 small-scale industries in the district.

4.7.2.2.2 Commerce

Trade in the Dangme West District is dominated by retail activities. Trading is undertaken at the local markets or in small retail shops or outlets such as in kiosks, or on tables located in front of houses and along major roads. The district has only three weekly markets (Dodowa, Old Ningo and Asutsuare). The main goods sold are agricultural produce (maize, cassava, vegetables, fruits, fish) from the district hinterland and manufactured goods (clothing, plastics, stationery, etc) from Tema and Accra. The marketing patterns and commodity flows in the district have been greatly influenced by the relatively short commuting distance to Accra and Tema – city region. Dodowa as the administrative capital of the district has very little trading links with the rest of its own 'region'. A substantial portion (80%) of agricultural products is shipped from Dodowa to Ashaiman/Tema or to Accra.

4.7.2.2.3 Mining & Quarrying

The main mining activities carried out in the district are salt mining and sand winning.

4.7.2.2.4 Agriculture Sector

The most important sectors of the economy are crop production, fisheries, livestock and industry. Although agriculture dominates the district, the leading sectors in terms of provision of revenue to the district Assembly and remuneration to workers are the Service sectors. The prevalent cropping system is rotational bush fallow with fallow periods ranging from 2 to 4 years. The five major crops grown in the district are cassava, maize, vegetables (for example, tomato, okro, pepper) fruits and rice. Some farmers also practice mixed cropping

4.7.2.3 Social development

4.7.2.3.1 Education

The Dangme West District has the following educational establishments, 75 pre-schools (24 public and 51 community/private), 90 primary schools (67 public and 23 private), 44 Junior Secondary Schools (41 public and 3 private), 3 Senior Secondary Schools, 7 Vocational Training Institutes.

4.7.2.3.2 Health

There are ten (10) static MOH health facilities in the district: 4 Rural Health Centres and 6 Community clinics. In addition outreach services are run from these facilities to numerous small communities in each sub-district. There are no hospitals in adjacent districts where in-patient services are available. The district itself has no hospital. The district health Post at Dodowa is in the process of being upgraded to a hospital. There are two medical officers in the district based at the District Health Administration. Nearly all the physical structures of the health facilities in the district are in varying states of disrepair and staff accommodation is inadequate at all facilities.

4.7.2.3.3 Road Network

The district has about 252 kilometres of road network. 40 per cent is surfaced while the rest are feeder roads. Track and footpaths also link villages. The total road network when compared to other districts appears to have a good spatial distribution. Apart from the central portion of the district, which is devoid of roads, the rest of the district is fairly linked up. The road surface condition of the national trunk roads is of an appreciably good condition. However, the local arterials such as the Dodowa-Afienea road and Doryumu-Agameda road need urgent improvements. Statistics about traffic on those roads such as

traffic volume, vehicle fleet, traffic composition, hourly distribution, peak hour traffic, passenger and freight movement are non-available for the district.

4.7.2.3.4 Water Supply

The supply of potable water is woefully inadequate. The last project involves treatment of fresh water from the River Volta to some communities.

4.7.2.3.5 Electricity

About 30% out of the 124 settlements in the district are linked to the national electricity grid. However, plans are underway for some other communities to be connected within the next three years under the Self Help Electricity Project.

4.7.2.3.6 Transport Facilities

There is an average passenger waiting time of about two hours on non-market days and 1 hour on market days for people travelling between the larger centres of Prampram to Accra/Tema or Dodowa to Accra/Tema. The combination of inadequacy of vehicles using these roads and the poor maintenance of both vehicles stock and road network has led to a poor integration of the settlements within the district. This adversely affects the marketing of goods and the spread of innovation. The District Assembly in addressing the transport problem in the Shai area, recently commissioned two high occupancy Tata Buses owned by a private operator, Conca Engineering Co. Ltd.

Railway - There is a disused 14.8 kilometre railway line from Tema through Afienya to the Shai Hills used for the construction of the Tema Harbour. This line can be rehabilitated for urban transport.

Navigable Water - The 20.7-km stretch of the Volta River is navigable by the use of outboard powered boats and small dugout canoes.

4.7.2.3.7 Posts & Telecommunication

Telephone facilities in the district are not well developed because Ghana Telecom is yet to have the District connected to its main line. The Ghana Telecommunication Company has started installing relay stations in two centres (Prampram and Afienya) to boost and install telecommunication equipment. About 90% of the District population relies on Radio

Telephone System, which is unreliable. Regarding postal services, as high as 109 (90 per cent) of the settlements have no postal services. Dissemination of information is thus impaired.

4.7.2.4 District Sensitization

Until the sensitization exercise, the DA officials were not aware of the power transmission line but rather associated it with the West Africa Gas Pipeline project. DA officials were of the opinion that the project when implemented will lead to reliable supply of power that will promote development in the area - cold storage facilities, improved irrigation e.g. at Dawhenya and the establishment of small-scale agro-processing industries.

4.7.2.4.1 Community Sensitization

The CST met with DA officials and identified three (3) AMs from Dawhenya, Dawa and Nyigbenya as those whose areas fell within the project corridor. These AMs who were subsequently consulted by the CST, assisted with the community sensitization. Loss of livelihoods through the loss of farmlands within the project corridor and poor resettlement and compensation packages were the main concerns of community members. DA authorities stated that availability of enough alternative land for resettlement if the need arises.

4.7.3 Dangme East District Assembly

The Dangme East District is located in the Eastern part of the Greater Accra Region within Latitudes 5⁰45' and 6⁰00' North and from Longitude 0⁰20' West to 0⁰35' East. It shares common boundaries with North Tongu District at the north, south Tongu District at the west and Dangme West District at the east. The District covers a total land area of about 909 sq. km about 28% of the total area of the Greater Accra Region.

4.7.3.1 Demographic Characteristics

The Dangme East District has a population of 93,112 with female slightly dominating at an estimated population of 448,913 while male population was estimated at 44,199 (2000 PHCS).

Ethnicity and Religion - According to the analysis of the survey in terms of religion, Christians dominate, comprising 70 percent, while Traditional Religion and Moslems

represent 25 percent and 5 percent respectively. With regards to ethnicity, the district is a homogeneous society with Dangmes forming about 85 % of the population, the remaining 15 % from other ethnic groups across the country (Ewes, Akans, Ga etc.).

4.7.3.2 Economic Development

4.7.3.2.1 Commerce

In the Dangme East District there are three main markets in the district namely Kasseh, Ada Foah and an undeveloped one at Sege. The Kasseh market operates on Tuesdays and Fridays. Traders come from all parts of the country and Togo to either buy or sell goods. Work is currently underway to upgrade the Kasseh market to a modern market complex under the Village Infrastructure Projects (VIP). Revenue Collection is likely to improve at the end of the project. Ada Foah market operates on Wednesdays and Saturdays.

4.7.3.2.2 Mining & Quarrying

Mining - The main mining activity carried out in the District is salt mining. The Salt Development Project Ltd. is a major salt mining complex in the district. It produces over 70,000 metric tones of salt annually for the local market and for export to Togo, Burkina Faso, Niger and Nigeria.

Sand And Gravel Winning - Large scale sand and gravel winning occurs in Tojeh, Sege, Volta Estuary and along the coast for road construction and building industry. The organisations pay licenses, levies and royalties to the District Assembly and landowners.

4.7.3.2.3 Agricultural Sector

Agriculture forms the leading sector in the economy of the District. It provides employment for about 51 percent of the adult population. It also provides livelihood of the people through direct farming, distribution and marketing of farm produce and other services to the agricultural sector. It forms the basis of successful operation of the thriving markets in the district. The main agricultural activities considered here include farming (crop production) fishing, livestock production and Agro-forestry.

Crop Production - The District is noted for the cultivation of cassava, maize, legumes and a range of vegetables. The livestock production identified in the district includes cattle rearing,

sheep and goat keeping, pig rearing, poultry keeping including fowls, turkey, ducks and guinea fowls.

Fishing - Dangme East District is noted for both Marine (Sardines Arichovey, Mackerel, Tuna Species and Shrimp) and inland (Tilapia Species, Grey Mullet, Shrimps, Crabs and Prawns) fishing activities.

4.7.3.2.4 Tourism Resources

Dangme East District is endowed with numerous tourism potentials, notably:

Bird watching site - In the dry season, the Songor Ramsar site provides feeding, breeding and resting ground for over 100,000 migrant and local birds such as curlew, greenshark, sanderling, black winged avocet, little stint. The large concentration of bird population in the Songor catchment area is a great tourism potential, which can be harnessed for the development of the District.

Marine turtle breeding site - Every year during the nesting season (between August and February), three species of marine turtles come to the beach to lay their eggs. It takes between 6-8 weeks for the egg to hatch and the hatchlings proceed to the sea almost immediately.

Traditional village life and economic activities - Traditional life styles and related economic activities of the indigenous people around the Songor lagoon are of much interest to tourists.

Other interesting features - The District is also endowed with some historical buildings/monuments. Indigenous methods of winning salt, pot making, mat and basket weaving in addition to the traditional fetish shrines are sources of tourist attraction.

Sport fishing/cruising - Sport game fishing in the Volta River is another potential attraction for tourist. Domestic and commercial dugout canoes and modern boats are well developed and the competence of the indigenous fishermen is well known in the District. Apart from the fishing the boat cruising on the River Volta for pleasure is also attractive to tourists.

Groves and Shrines - There is a triplet Baobab tree at Kunyanya, which is believed to possess supernatural powers. There are also sacred Groves, the Okorhue and Okornmleku forests in Goi and southern part of Luhuor respectively. It is believed that there are dwarfs and other supernatural forces existing in the forests.

4.7.3.3 Social Development

4.7.3.3.1 Education

The Dangme East District has the following educational establishments, 53 pre-schools (10 public and 43 community/private), 76 primary schools (67 public and 9 private), 36 Junior Secondary Schools, 2 Senior Secondary Schools, 1 Technical Institute, and 1 Teacher Training College.

4.7.3.3.2 Health

The District has one (1) newly constructed Hospital and two (2) Health centres, three (3) Health Posts and one (1) Clinic. With the completion of a new hospital, the district would have a very fair distribution of health facilities. However, some community based Clinics need to be established. The existing health service delivery is saddled with many problems.

4.7.3.3.3 Road Network

The total length of the road network is about 172 km, made up of primary road (28km), secondary roads (20.2 km), and feeder roads (123.3km) The District has a fair distribution of road network with almost every settlement connection to a road. However, much of the roads network, especially the feeder roads, is in very bad state with some becoming unmotorable during the rainy season. The roads linking Songor lagoon area and Koluedor linking the northern parts of the district are in bad condition.

4.7.3.3.4 Water Supply

The supply of potable water is available in some major settlements like Ada Foah, Big Ada and Kasseh, which benefited from South Eastern District Water Supply Project (SEDWSP) under Department for International Development (DFID) and Ghana Government sponsored programme. About 37 % of the district population has access to pipe-borne water or a tanker services, whilst 6 % use a well or borehole. The remainder depends on untreated water from ponds, dams, rivers, streams, dugouts and periodic harvesting of rainwater.

4.7.3.3.5 Electricity

The District has been linked up to the national electricity grid. At present the following major sixteen communities have been connected to electricity under SHEP 1,2,3, Programme.

4.7.3.3.6 Transport Facilities

Transport - The lower section of the Volta River provides a suitable water transport system along the south-eastern section of the District. The Ghana Highway Authority runs water transport services to link settlements along the lower Volta up to Akuse in Manya Krobo District. Private boats and canoes also operate alongside the launches. The sea, apart from providing fishing grounds, is also used by fishermen to link up settlements along the coast.

4.7.3.3.7 Post & Telecommunications

There are two post offices located at Ada Foah and Big Ada and four postal agencies located at Tamatoku, Kasseh, Sege and Hwakpo. The main functions of these facilities are delivery of letters, to and from the district. Ada Foah and Big Ada have telecommunication facilities, which depend on the Telecom Exchange at Ada Foah. Currently there are 228 telephone lines in the District with 10 telephone Booths, (6) located at Ada Foah and (4) at Big Ada. There are 14 private communication centres in the district.

4.7.3.4 District Sensitization

The district authorities contacted were aware of the ECOWAS Power Project.

4.7.3.4.1 Community Sensitization

Concerns raised were that lands in Ada are owned by individuals/families and are not stool lands. It is therefore important that the public is sensitized and that the DA is involved in order to facilitate the acquisition of land. Prompt and adequate compensation for loss of properties should be paid to all affected persons.

4.7.4 South Tongu District Assembly

The district is located in the southern part of the Volta Region and bounded to the north by the North Tongu District, to the east by the Akatsi and Ketu Districts, to the west by Dangme East District of the Greater Accra Region and to the south by the Gulf of Guinea. The district has a total land area of 820 sq. km and lies between latitudes 5° 45' and 6° 10' North and Longitudes 0° 30' and 0° 45' East.

4.7.4.1 Demographic Characteristics

The population of the district is estimated at 64,811 with female slightly dominating at an estimated population of 35,404 while male population was estimated at 29,407 at growth rate of 1.35% per annum. The inter census growth rate were 1.35 % between 1984 -2000.

4.7.4.2 Economic Development

The major occupations in the district have been identified as Agriculture, Services, Industry, and Commerce. Of these agriculture still remains the major employer in the district.

4.7.4.2.1 Industry

The industrial activities existing in the district are small scale and include milling, gari processing, distilling, blacksmithing, carpentry, tie & dye, dressmaking) and pottery and bricks.

4.7.4.2.2 Commerce

The major items traded in by both sexes are mainly foodstuffs, other agricultural produce and provisions. However, foodstuffs constitute the highest items traded. There is only one modern market in the district at Dabala. The second district market at Sogakope is still under construction.

Banking - There are two banks in the district, which provide banking services. These are the Ghana Commercial Bank Limited at Sogakope and the Agave Rural Bank.

4.7.4.2.3 Mining Quarrying

Clay deposits are located at Lolito, Vume and Sokpoe areas and are mined for pottery. Sand winning activities are undertaken at Sokpoe, Agordome, Agortaga, etc. Gravel winning takes place at Tadze. Salt mining also takes place at Gamenu.

4.7.4.2.4 Agricultural Sector

Agriculture activities include crops, livestock and fisheries. Major crops that are produced in the district include cereals, legumes root tubers, vegetables and fruits. Farming is generally subsistence with a few exceptions of commercial farming. The average farm size in the district is four (4) acres. There are three major commercial farmers in the district who

produce for the local and the export markets. Livestock production consists of both ruminants (cattle, sheep goats) and non-ruminants (poultry, pigs, rabbits, and ostrich)

Fishing - The communities lost the economic advantages of tidal and creek fisheries after the construction of the Akosombo High Dam. This resulted in low fish production, with intense fishing shifting on to the lower Volta River, Avu and Agu lagoons. This is leading to over fishing and depletion of fish stock in these water bodies.

4.7.4.2.5 Tourism Resources

Tourism in recent times has gained prominence as a new area of development planning. The identified sites or potentials include:

- ◆ The River Volta for water sport development;
- ◆ Development of chalets along the Volta; and
- ◆ The development of the Avu lagoon into an eco-tourism site, believed to be the habitat of rare species of animals.

4.7.4.3 Social Development

4.7.4.3.1 Education

There are presently one hundred and eighty two (182) educational institutions in the district as compared to 125 during the preparation of the 1996-2000 MTDP. An additional forty-three (43) schools were built over the period, probably aimed at making education more accessible to the people. The breakdown of educational institutions is presented in Table 9.

Table 9 Types of educational institutions in the District

TYPES OF SCHOOL	Number of Institutions		
	1996	2000	2004
Nursery	23	47	49
Primary	68	80	91
JSS	31	39	39
SSS	2	2	2
Vocational Training Inst.	1	1	1
Total	125	169	182

Source: GES, Sogakope and 2003/2004 Education Profiles

4.7.4.3.2 Health

The South Tongu District has twelve (12) health facilities comprising a hospital, two health centres, six health posts, two private clinics and one maternity home. The Sogakope Hospital with only sixty (60) beds is the major health facility. Plans are however far advanced for the building of a hospital with modern facilities to improve health care delivery. Based on the above, the total number of hospital beds in the district is one hundred and twelve (112), giving a bed –citizen ratio of 1:580. The construction of a 60-bed District Hospital is currently underway to bring the situation under control.

4.7.4.3.3 Road Network

With the exception of the international road passing through Sogakope and the Dabala-Srogbe road, roads in the district generally, are poor. Most of the communities are linked with feeder roads which become un-motorable often time, especially during the rainy season. The movement of goods and services is hence not easy for most parts of the year.

4.7.4.3.4 Water Supply

The major sources of drinking water are pipe borne water, river, boreholes, streams, and harvested rain. In 1996 there was no pipe scheme existing in the district. However, with the completion of the South Eastern Districts Water Supply Project, which was sponsored, by the Government of Ghana and DFID a number of communities now enjoy pipe borne water. A total of 27,363 people in the district now get access to portable water. This represents 21% of the district's population.

4.7.4.3.5 Electricity

Electricity is the most dominant energy source in the district. All the big towns in the district are connected to the national grid. Rural communities, which have not been connected, yet are also taking advantage of the Self Help Electrification Project and are getting connected.

4.7.4.3.6 Transport Facilities

Water Transport - The lower section of the Volta River provides a suitable water transport system along the south- eastern section of the District. The Ghana Highway Authority runs water transport services to link settlements along the lower Volta up to Akuse in Manya Krobo District.

4.7.4.3.7 Post & Telecommunications

Telephone facilities/services in the district are poor. Ghana Telecom is now in the process of extending its services to the district, and it is hoped that would bring development to the sector.

4.7.4.4 District Sensitization

Officials of the DA said they were not aware of the transmission line project passing through their district. However, if they had been part of the decision making process they would have approved of the project once compensation would be paid and risks mitigated. There is high premium on land in the district as migrant farmers –mainly expatriates are engaged in cultivation of pineapples, mangoes etc. The DA officials intimated that alternative land for resettlement is available. Their main concern is that the area has to be opened up by way of construction of roads. Potable water will also have to be provided, as places are saline.

4.7.5 North Tongu District Assembly

The North Tong District lies within latitudes 5° 47' and 6° 0' North and Longitudes 0° 5' and 0° 45' East. It shares common boundaries with South Tongu, Akatsi and Ho Districts in the Volta Region, Asuogyaman, Yilo Krobo and Manya Krobo in the Eastern Region, Dangme West and Dangme East in the Greater Accra Region. The total area of the district is 1460 Km², which is about 7.1% of the regions total area. The district is divided into two unequal halves by the Volta River, stretching from the lower Volta gorge near Akosombo in the north to Awadiwoe Island, located north of the lower Volta Bridge at Sogakope.

4.7.5.1 Demographic Characteristics

The population of the district as recorded in the 2000 Ghana Population and Housing Census is 126,834 with a growth rate of 3%. About 48.45% of the population is males whilst 51.55% are females.

4.7.5.2 Economic Development

4.7.5.2.1 Industry

The District has not caught up well in industrial activities. Gari processing is done by women using various traditional methods at Mafi Kumase, Anfoe, Mawoekpor, Kpedzeglo, Juapong, Bakpa – Avedo areas. The technology and equipment used are indigenous.

The only established company in the district is Juapong Textiles Company, which has closed down. There is also a Brick & Tile factory at Adidome that employs about 40 workers. Pottery production is done at small scale level.

4.7.5.2.2 Commerce

The major items traded in are mainly foodstuffs, other agricultural produce and provisions. The two major markets are at Juapong and Mafi-Kumase. There are smaller ones at Adidome, Battor, Mafi-Avedo and Mafi-Zongo.

4.7.5.2.3 Mining & Quarrying

The main mineral deposits in the district are clay, oyster shells, feldspar, nepheline gneiss, sand and granite but have not been exploited.

4.7.5.2.4 Agricultural Sector

Food crop farming is the major economic activity in the district, engaging about 84% of the population. The crops grown include cowpea, maize, cassava, vegetables and groundnuts. The district has a large livestock population where the low grassland vegetation and numerous dugouts provide pasture and water for livestock. River fishing mostly in the Volta River has declined considerably due to the formation of the Volta Lake. Oyster shell and lime production is found in the district.

4.7.5.2.5 Tourism Resources

The main tourism resources in the District include Traditional drumming (Agbadza, Atsiagbekor, Kenka, Borborbor etc.), swimming in rivers and streams and boat racing mainly at Mepe and Bakpa. Despite viable tourist attractions, tourism in the District is very minimal because of the bad roads, lack of hotels, restaurants and the undeveloped tourist centres.

4.7.5.3 Social Development

4.7.5.3.1 Education

The North Tongue District has the following educational establishments, 96 pre-schools (48 public and 48 community/private), 148 primary schools (127 public and 21 private), 82 Junior Secondary Schools (75 public and 7 private), 4 Senior Secondary Schools (2 public and 2 private), 3 Public Technical Institute, and 1 special Handicapped School.

4.7.5.3.2 Health

There are two hospitals and 9 Health centres/Clinics in the district.

4.7.5.3.3 Road Network

The District has very few motorable roads. The only tarred roads in the District are the Mepe – Sege road, the 1 km Asiekpe – Mafi Kumase road, and the Tema – Akosombo road passing through Juapong at the periphery of the District. The Adidome – Sogakope, Adidome – Ho roads are the only roads linking the District; and though not tarred and in bad condition most of the year, are the only all year round motorable roads in the District. All other areas are accessible by tracks and earth roads only in the dry season. The two tarred roads mentioned are at the periphery of the District and have limited impact on the economy of the District.

4.7.5.3.4 Water Supply

Apart from Juapong, Mafi Kumase and their immediate surroundings that have pipe borne water, the main sources of water supply in the District are rivers, wells, dams and rainwater. The Volta River, which runs through the southern portion of the District, provides an important source of water supply to the towns and villages, which are located along it. Those settlements that are located away from the river depend on wells, dams and streams. These are however not reliable sources of water supply because rainfall is low in the District and hence the small streams and wells become dry especially during the long dry season. DANIDA water project provides pipe- borne water to Tedeafenui, and other communities in the Adidome area.

4.7.5.3.5 Electricity

Adidome; Akyemfo, Battor, Mepe, Mafi Kumase Asiekpe and Juapong are currently supplied with hydroelectric power. Extension of electric power to towns/villages outside the District Capital is dependent on community self-help but now under the Government rural electrification programme the lines are being extended and very soon most of the major settlements will have electricity.

4.7.5.3.6 Post & Telecommunications

Postal Services in the District are not up to standard due to the poor nature of the roads and low volume of mails from the existing Post Offices and Postal Agencies. The only existing

Post Offices are at Adidome and Juapong. There are only a few public telecommunication facilities at Adidome, Mepe, Battor and Juapong.

4.7.5.4 District Sensitization

The DCD stated that the DA authorities were aware of the transmission line project passing through the area. He cautioned that all persons whose properties would be affected should be paid the appropriate compensation. He further stated that should there be the need for resettlement this should be done properly with the provision of appropriate housing infrastructure and basic social facilities such as health, water and sanitation, education, etc.

He also indicated that land for any resettlement scheme would be available.

4.7.6 Akatsi District Assembly

It is located in the South-eastern part of the Volta Region. It has a total land area of about 906,445sq km and is bounded at the South by Keta District and to the east by Ketu District, the North and South Tongu district to the west, the Ho district and the Republic of Togo to the north complete the demarcation of the Akatsi district. The district is located between latitudes 6° 0' and 7° 0' North and Longitude 0° 30' and 1° 0' East.

4.7.6.1 Demographic Characteristics

The population of the District according to 2000 Population and Housing Census is 93,477, which is made up of 46.9% (43,843) male and 53.1% (49,634) female. About 96.3% of the total population is resident. The District share of the total Regional Population is 5.7%. 79% (88,373,860) of the population lives in the rural area while 19,617 (21%) lives at the urban area.

Between 1984 and 2000 the district recorded about 2.5 % population growth.

4.7.6.2 Economic Development

Agriculture is the leading employer of the District's workforce as expected in a rural economy. This accounts for 75.5% of the total labour force compared with the national figure of 49.2%. Commerce employs 18.3%, Service 3.5% and Industry 2.7%.

4.7.6.2.1 Industry

Manufacturing - The manufacturing sector of the district is still developing. Current manufacturing industries are small scale or cottage industries, centred around carpentry, blacksmithing, basketry, mat weaving, processing of cassava into dough and gari for local consumption and local market. The District has large clay deposits used locally for pottery.

4.7.6.2.2 Commerce

Trade and Commerce is reasonably well developed in the district, by Ghana rural standard. It is mainly in the district capital. The private entrepreneur operating shops, petrol-filling stations, grain wholesaling, etc carry out the commercial activities in the district. The market day falls on every fifth day and rotates among the major towns; i.e. Akatsi, Ave- Dakpa, Ave- Afiadenyigba, very important growth centres in the district.

4.7.6.2.3 Mining & Quarrying

The district has a vast stretch of deep clay deposits at Suipe, Dakpa, Wute, Dzalele and Kpeduhoe. There are four major quarry sites at Atsiekpui, Asaiagborvi, Agornikope and Matsrikasa, major source of chippings and boulders for the Keta Sea Defence Project. Sand winning is also carried out at Live and Gagbakope.

4.7.6.2.4 Agricultural Sector

Agriculture is the leading employer of the District's workforce and accounts for 75.5% of the total labour force. The crops grown are mainly food crops such as maize, cassava, cowpeas, pepper etc. The blackberry fruits are native to the Akatsi district in Ghana, which has much economic potential for accelerated development of the district. The Department of Forestry has made an impressive impact in the district. In almost every village, there are farmers who have cultivated fuel woodlots.

Fishing is minor and secondary activity as a result of its land-locked geographical location.

4.7.6.2.5 Tourism Resources

There are major attractions in the District that include Xavi Bird Watching and River-tours Project, Klu Adela Museum, Awakpe (War rock) at Kpodzivi, Akatsi Central Market and Traditional festivals.

4.7.6.3 Social Development

4.7.6.3.1 Education

There are 204 educational institutions made up of 36 private units and 168 District Assembly established schools.

Table 10 Educational institutions – Akatsi District

No.	Type	Public	Private	Total
1	Pre-school	17	24	41
2	Primary	109	10	119
3	Junior Secondary School	39	2	41
4	Secondary/Technical School	2	-	2
5	Tertiary	1	-	1
6	Total	168	36	204

4.7.6.3.2 Health

There are 18 health facilities in the district. There is no district hospital however; serious cases are referred to the two private hospitals in neighbouring districts. Out of the thirteen government facilities, five were health centres three were Maternal Child Health clinics and five were VRHA/Africare Child Survival Clinics. The health centres provided curative, preventive and maternity services whilst the MCH clinics provided only preventive and promotive services.

The VRHA/Africare clinics provided both curative and preventive services modelled along the Navrongo Family Health Project.

4.7.6.3.3 Road Network

The District is linked up with two main trunk roads namely Accra –Aflao and Akatsi-Ho trunk roads. There are a number of feeder roads, most of which are not motorable during rainy season, among this feeder roads are Akatsi-Wute-Ziope, Abor-Avenorpeme, Akatsi-Tuime-Kpodzivi-Adzikame, etc.

4.7.6.3.4 Water Supply

The main sources of water in the district include rivers, hand/dug wells, dam/dug-out, boreholes, and rain catchments. Wells and boreholes form the major source of domestic

water supply. It is estimated that the District will need over 460 wells and boreholes to satisfy the water needs. Besides being inadequate, the water is generally unhygienic. This has contributed to water borne diseases such as guinea worm, diarrhoea and intestinal worms.

4.7.6.3.5 Electricity

Few towns in the District have access to electricity. In view of this, the Assembly has programmed the extension of electricity to the hinterland under the SHEP programme. Ave-Dakpa, Havi, Hevi, Wlitye, Wute and Avenorpeme, among a lot are benefiting under the SHEP 3 phases 1 and 2.

4.7.6.3.6 Post & Telecommunications

Telephone facilities exist and private communication centres with fax machines are springing up in Akatsi. The District capital is the only town served with Ghana Telecommunication Network. There is radio communication equipment at the District Health Administration offices, the District Education office and the Electricity Company office, and the district assembly, all in Akatsi.

4.7.6.4 District Sensitization

According to officials of the DA an official of VRA together with one consultant visited the assembly in 2005 and spoke about the transmission line project, collected some data from the DA but have since not contacted the assembly again.

Concerns raised by the authorities included:

- ◆ The loss of properties such as houses, farmlands, crops, etc within the project corridor. The affected persons should be paid prompt and appropriate compensation.
- ◆ Emphasis that sensitization on the proposed project should be carried out through the political leadership in the communities-assembly members, MP, DCE, etc. (people who have the trust of the communities) in order that the people are convinced to dispel doubts.

4.7.7 Ketu District Assembly

Located between Latitudes 6° 0' and 6° 15' North and Longitude 0° 15' and 1° 0' East. The district, which has its capital at Denu, is bordered to the east by Togo, to the south by Akatsi

District. Importantly, Ketu district lies just across the border from Lome, the Togolese capital, which makes it an area of utmost importance in terms of Ghana's international trade, as gateway to the West African sub-region.

4.7.7.1 Demographic Characteristics

Ketu District with the total population of 237,261 has become the most densely populated district in the Volta Region. The district has a population growth rate of 1.7% by sex composition, female constitute 53.2% of the total population with a sex ratio of 88.1% of the total population 47.5% are children below 18years and 3.1% are adults above 75 years. By settlement only 34.8% of the population live in the urban areas of Aflao (38,927) Dzodze (18,957), Avoeme (7,251), Klikor (6,856), Penyi (5,403), and Agbozume (5,073) while 65.2% are found in 707 settlements. In all, there are about 713 settlements in the district. With the population density of about 210 persons per square kilometre, land holdings are small especially in the farming communities. In addition, the heavy population in the district puts pressure on the existing social infrastructure.

Ethnicity and Religion - The district is heterogeneous in ethnicity: a feature, which promotes development. The ethnic groupings include Ewes, Akans, Gas, Hausas and Ga Adangmes. Christians constitute 44%, traditionalists 40% and Muslims 16%.

4.7.7.2 Economic Development

4.7.7.2.1 Industry

One major manufacturing Industry that has been established in the district recently is the Diamond Cement Factory located at Aflao. Large-scale production of cement has begun at the factory. Clinker is taken from neighbouring Togo to feed the factory at Aflao. The factory offers employment to a large number of youth in the vicinity.

Clay processing-large clay deposits can be found at Kuli. Ceramics such as flowerpots, tea cups and water pots could be produced on a large scale:

Other industrial activities are categorised into food processing, alcoholic beverages, manufacturing and service industries. Processing comprises treatment of cassava to produce cassava dough, gari and biscuits. The Ewe-Kente (the traditional cloth) is produced by numerous weavers at Agbozume and its surrounding villages. The Bobbo Ewe-Kente

Weaving Institute at Hatsukope trains the youth to acquire skills of weaving the traditional cloth.

There are small-scale workshops with basic equipment located in the urban centres to produce metal products such as hand tools for farming and cassava graters. Manufacturing which constitutes woodcarving, furniture, tie and dye, soap making is dominant in the district.

Small Scale Industrial Activities

The industrial activities are categorised into food processing, alcoholic beverages, manufacturing and service industries. Processing comprises treatment of cassava to produce cassava dough, gari and biscuits. Handicrafts like works of metal; clay, fibre and wood dominate the relics and jewellery of the shrines in Ketu. Ritual wood carvers are found in Klikor, Dzodze, Aflao, Agbozume, Tokor, Afife, and Weta and in the remotest Villages. Apart from the above, there is pottery works at Kuli-Dzogbefeme. Craftsmen in the streets, at market places and in the villages, with simple tools, turn out beautiful products.

4.7.7.2.2 Trade and Commerce

Ketu district abounds in markets. The district has its marketing centres as Denu, Agbozume, Dzodze and Aflao. Other satellite markets are found at Weta, Afife, Penyi, Tadzewu and Wudoaba. The major markets specialize in fish especially smoked herrings and agricultural produce. The Border market of Aflao is a commercial distribution centre for agricultural produce from Western, Brong-Ahafo and Central regions of Ghana. The goods are subsequently exported to Togo.

There are two (2) Commercial Banks in the district. These are the Ghana Commercial Banks located at Aflao and Dzodze and the Agricultural Development Bank at Denu. There is also a branch of the Avenor Rural Bank located at Dzodze.

4.7.7.2.3 Mining & Quarrying

Mining and quarrying activities are insignificant occupation in the district.

4.7.7.2.4 Agricultural Sector

About 60% of the total land area is under agricultural production. Farming is near subsistence with most farmers growing food crops such as maize, cassava, potatoes,

cowpea and groundnuts. An appreciable number of farmers along Tsiyi, Kpli and Kplikpa Valleys grow rice, sugar cane and vegetables.

Animal Husbandry - Almost every household owns small ruminants and local poultry, which are reared on free range. A flourishing 'goat' market at Agbozume provides ready market for sheep, goats and local poultry. Anoenue close to the Ghana – Togo boarder also serves as a market for livestock.

Fishing - The sea stretching along the coastline from Aflao to Blekusu provides the source of fishing. Some of the important species of fish landed from the sea include anchovy, sardine, mackerel scad, frigate mackerel and horse mackerel. In land fishing is equally important at Dekpor. Fishermen, like most farmers in the district also lack capital to procure their fishing inputs. The extended part of the Keta Lagoon, Blekusu to Aflao and beyond, provides opportunity for aquaculture activities. The Lagoon is a potential source for salt mining.

4.7.7.2.5 Tourism Resources

There is a great potential for tourism in the Ketu District. Nice beaches fringed with coconut trees along the coastline, stretch from Aflao to Blekusu. Over 200 weavers including women are involved in weaving the traditional kente cloth at Agbozume and Klikor. The kente cloth, mufflers, smocks, table covers etc are sold at Agbozume kente market. Traditional festivals, celebrated by the Nyigbla shrine of Afife, the Zakadza shrine at Nogokpo and the Adzima shrine of Klikor attract hundreds of people all over the country and especially European tourists. Hotels which provide reliable restaurant services in the district include Vilcabamba Hotel at Denu, White Dove Hotel at Dzodze, Plain View Hotel at Agbozume, Ewotsige Hotel, Makavo Hotel and Kplormdedie at Aflao.

4.7.7.3 Social Development

4.7.7.3.1 Education

There are 397 educational institutions in the district. 111 are at the pre-school level, 172 at the primary level, 105 at the JSS level, eight at the SSS level and only one for a vocational School. The public and private sectors continue to provide educational facilities in the district. The private sector contributes about 17% of the facilities and

Table 11 Educational Institutions in Ketu District

No.	Type	Public	Private	Total
1	Pre-school	37	74	111
2	Primary	120	52	172
3	Junior Secondary School	77	28	105
4	Secondary/Technical School	8	-	8
5	Vocational	1	-	1
6	Total	243	154	397

4.7.7.3.2 Health

There are 7 hospitals and 16 clinics in the district. The service providers are the public, private sectors and the traditional practitioners. The district is zoned into nine sub- districts that coincide with the local government sub-structures, to facilitate proper health administration.

4.7.7.3.3 Road Network

There are 104kms stretches of trunk roads, which link the district with the rest of the country. These are the Denu-Ho and Aflao-Tema roads. The later is in a bad state. Additionally, there are a further 227kms of feeder roads, which facilitate access to most parts of the district. Some of the feeder roads, however, become unmotorable during the rainy season

4.7.7.3.4 Water Supply

There are 52 boreholes currently serving some rural communities. The Volta Region Community Water and Sanitation Program (VRCWSP) have constructed these. There is also the Ghana – German Technical Co-operation (GTZ) water scheme for Dzodze, Penyi and Ehi. In all, there are about 87 bore holes, 1,304 pipe stands, 7 dams, 37,921 hand-dug wells, 1,042 water harvesting systems, 6 hand pumps in the district which provide water. Many people in the district lack potable water supply. There is therefore, the need to extend potable water supply to a much greater number of rural communities to improve their living conditions.

4.7.7.3.5 Electricity

Most of the towns of the towns and villages in the district are connected to the national grid.

4.7.7.3.6 Post & Telecommunications

Telephone services are available in all the six major towns. Mobile phones services of Ghana Telecom and Areeba are also available.

4.7.7.4 District Sensitization

The Ketu district was aware of the project as a team from VRA/Consultant was in the district to inform about the project and to make the district aware that some communities would be affected. The team collected the district profile and some maps. Even though the DA did not take part in the decision on the route of the transmission line through the district, the district authorities do not have any objection to the decision.

5.0 IDENTIFICATION AND ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS

The proposed transmission line project has the potential to impact significantly on the environment. These potential impacts require proper management in order to minimise or eliminate the negative impacts and, if possible, maximise the beneficial ones to ensure the sustainability of the environment. In recognition of this fact and in fulfilment of the requirements of permitting and funding agencies, the proponents incorporated an Environmental Impact Study in the project cycle.

This section of the Environmental and Social Management Plan deals with the identification and assessment of the relevant potential environmental issues expected to be associated with the planning and implementation of the proposed project. The methods used in the identification and assessment of the potential issues were based on the outcomes of desk study, field observations, rapid appraisals of the biological, physical and socio-economic and cultural environments and consultations with stakeholders.

The potential impacts have been identified and assessed under the three main phases of the project. These are:

- Pre-constructional
- Constructional and
- Operational phases

5.1 Pre-constructional phase

The activities to be undertaken during this phase of the proposed project include:

- Project planning and design
- Assessment of alternative routes
- Line route survey
- Consultations
- Acquisition of the right-of-way (RoW)
- Sourcing of funds and contractors
- Collection of baseline data such as flora and fauna survey, socio-economic and other baseline data for the preparation of the EIA report.
- Preparation and submission of an Environmental Impacts Assessment report.

- Acquisition of Project Environmental Permit

Most of these activities are expected to have negligible impacts on the environment and will therefore require no mitigation measures.

However, the acquisition of the right-of-way (RoW) and line route survey will have potential effects on land ownership, land-use characteristics, flora and fauna within the project environment.

5.1.1 Loss of buildings and land ownership issues

The proposed project is a linear one. The land-take required by the RoW will be 5,400,000m² and 99,000 m² estimated for 22 access tracks. This gives a total land requirement of 5,499,000 m² (550 ha).

The acquisition of the RoW and access tracks has the potential to adversely affect land ownership and land-use characteristics, as land will have to be acquired from some individuals, communities and/or stools. The land to be affected by the implementation of the proposed project has the following categories of land-uses:

- Agricultural lands
- Potential agricultural lands (or fallow agricultural lands)
- Residential lands (affecting buildings and residential plots) and

The Volta River Authority (Transmission Line Protection) Regulations, 1967 LI 542 prohibits activities such as mining, construction of buildings, crops cultivation and farming in the RoW.

This potential adverse effect on land ownership and land-use requires mitigation measures to minimize the impact on individuals, communities and stools.

5.1.2 Line route survey issues

Prior to the acquisition of the RoW and the start of constructional activities the proponent had to undertake a line route survey to determine the most suitable alignment for the transmission line. Impacts on flora and fauna during the line route survey were not considered to be significant since only a narrow path (about 1.0 - 1.5m) was cleared for the survey work.

5.2 Constructional phase

The constructional phase of the project will involve activities such as construction of access and tower corridor tracks, clearing and excavation of tower base areas, clearing of tower base buffer and RoW, cutting of trees considered too close to the RoW, transportation of equipment and materials and the erection of towers and stringing of transmission lines.

These activities have the potential to impact significantly on the physical, biological and socio-cultural/socio-economic environments within the project's area of environmental influence. The key potential issues relating to this phase of the proposed project have been identified through field visits and surveys, literature study and consultations with stakeholders. The significant potential impacts have been assessed below.

5.2.1 Noise impacts

Noise due to construction machinery during clearing and grading of access and tower corridor tracks, clearing and excavation of tower base areas, clearing of tower base buffer and RoW, cutting of trees, transportation of equipment and materials and the conversational shouts of construction workers could increase ambient noise levels in the immediate vicinity of the project area. This potential rise in noise level could have impacts on some local communities, fauna along the RoW, and on the construction crew.

Some of the local communities likely to be affected by ambient noise increases are Tema, Dawhenya, Dawa, Sege, Adidome, Sogakope, Akatsi, Tadawu, Dzodze, etc.

It is however expected that impacts on fauna will be temporary and will not be significant. In addition, fauna that will be scared away during this phase of the project will quickly return to the vicinity of the RoW once construction ceases. No further mitigation is proposed for potential noise impacts on fauna.

Mitigation measures have been proposed for the management of potential noise impacts on some local communities along the RoW and the construction crew.

5.2.2 Impact on air quality

Constructional activities, including vegetation clearing, excavation, grading and haulage of construction equipment and materials could cause the release of particulate matter into the

air resulting in potential adverse impacts on air quality in the immediate environs of the proposed project. Air quality can also be affected by soot in exhaust fumes of the construction machinery. Although this potential impact will be short-lived or temporary – limited only to the constructional phase- mitigation measures have been proposed to minimize the impact, especially on local communities.

5.2.3 Erosion

Clearing and grading of access and tower corridor tracks, excavation of tower base areas and the construction of access tracks during the constructional phase will expose the disturbed ground surface, which will at least be temporarily unprotected, to the agents of soil erosion such as heat, wind and rain. This potential impact requires mitigation measures to ensure that impacts such as soil loss, pollution of near-by streams and siltation of natural waterways are minimized.

5.2.4 Public Safety

The transportation of heavy plant and equipment through settlements and the presence of unprotected tower base excavations could pose potential safety problems for the local populace. Mitigation measures have been proposed for this potential impact.

5.2.5 Flora and Fauna

During construction, the removal of vegetation for access tracks, the tower corridor track and the tower base areas will result in permanent loss of vegetation in these areas and lead to potential faunal displacement.

Other sections of the RoW outside the tower corridor track will also be partially cleared of vegetation up to a height of about 1.25 m. In addition, trees, which are located just outside the RoW and are considered to threaten the safety of towers and transmission lines, will be felled. As stated earlier, this action of vegetation clearing could have potential adverse impacts on flora and fauna. As stated in section 5.1.1, the proposed line route traversed agricultural lands, potential agricultural lands (or fallow agricultural lands) and residential lands.

Measures will, however, be put in place to mitigate the potential impact on flora and fauna.

5.2.6 Occupational safety and health

During this phase of the project, there will be the potential for occupational safety and health hazards. The potential for safety and health hazards will be most acute when:

- Technical specifications relevant to safety measures are disregarded in the planning and erection of plant and equipment (e.g. the use of low quality components, inadequate sizing of cables, negligent execution of works, general non-observance of safety rules leading to inherently unsafe systems
- The operating personnel have not received sufficient training and experience in connection with safety measures and their observance
- Improper and insufficient supervision of workers are undertaken.

The key issues of concern here are noise pollution, machine safety, provision of sanitary/welfare facilities, injuries from falling/swinging objects, accidental falls from heights and the possibility of snakebites.

Mitigation measures are proposed to minimize the potential occupational safety and health hazards to safeguard the safety, health and welfare of the construction workers.

5.2.7 Socio-economic/cultural issues

The proposed project has the potential to impact significantly on the socio-economic and socio-cultural life of the local people within the project's sphere of environmental influence.

The relevant socio-economic/cultural issues are discussed in the next section.

5.2.7.1 Loss of buildings and land ownership issues

As stated earlier, the acquisition of the RoW and access track areas has the potential to adversely affect land ownership and land-use characteristics, as land will have to be acquired from some individuals, communities and/or stools. The land to be affected by the implementation of the proposed project has the following categories of land-uses:

- Agricultural lands
- Potential agricultural lands (or fallow agricultural lands)
- Residential lands (affecting buildings/structures and residential plots) and

The Volta River Authority (Transmission Line Protection) Regulations, 1967 LI 542 prohibits activities such as mining, construction of buildings, crops cultivation and farming in the RoW.

The tables below show the numbers of people and the types of properties to be affected by the proposed project.

Number of PAPs by region and type of property

Property type	Greater Accra Region	Volta Region	Total
Field crops	262	163	425
Houses	32	58	90
Plots for Building	20	0	20
Total	314	221	535

Number of affected community properties by region

Community Property	Greater Accra Region	Volta Region	Total
Shrines	0	5	5
Cemeteries	0	1	1
Primary School	1	1	2
Teachers Bungalow	1	0	1
Church	0	1	1
Total	2	8	10

This potential adverse effect on land ownership and land-use requires mitigation measures to minimize the impact on individuals, communities and stools.

5.2.7.2 Land-use conflicts

The constructional activities will result in land-use conflicts. Agricultural lands, potential agricultural lands and residential lands will be affected by the proposed RoW. Constructional activities will result in destruction of crops and structures.

Potential land-use conflicts are considered to be significant and therefore require appropriate mitigation measures.

5.2.7.3 Impacts on cultural and historical/archaeological sites/items

The implementation of the proposed project has the potential to impact significantly on cultural properties and historical sites and items.

Although the constructional activities will not involve much earthmoving, it is possible to make cultural and/or archaeological ‘chance finds’ during the constructional phase of the project. Such finds may be the following:

- Sites of cultural significance such as sacred woods or trees or rock outcrops which the local residents may have not mentioned at the survey stage
- Archaeological heritage which may have remained unnoticed in the past

Issues regarding cultural properties and the possibility of cultural and/or archaeological ‘chance finds’ are considered to be significant requiring mitigation.

5.2.7.4 Impacts on population and demography

Only about 25% of the construction work-force (during the peak of constructional activities), which is expected to be skilled labour, will be recruited from outside the local communities. The skilled workers from outside the local communities will be accommodated at the work camps. Potential impacts on population and demography are therefore not expected to be significant and will not require any mitigation.

5.2.7.5 Employment generation and incomes

Some employment openings are expected to be created for the local people during this phase of the project. Those local people who will be employed will benefit from the payment of salaries and/or wages. This is expected to lead to improvement in local incomes. On the other hand, there is the potential for loss of income resulting from loss of crops, land and structures. Mitigation for this potential impact is required to minimize the effects on the local people.

5.2.7.6 Potential impacts on public health

The proponents intend to utilize local manpower as much as possible during this phase of the project. Only about 25% of the construction work-force will be recruited from outside the local communities. The skilled workers from outside the communities will be accommodated at the work camps. Despite this small number of ‘outsiders’ and the fact that they will be accommodated at the work camps, the potential danger of the spread of sexually transmitted

diseases (STDs) including HIV AIDS still exists. The spread of these diseases by construction workers, truck drivers and prostitutes attracted to the work camp and construction sites could occur. Mitigation measures are required to minimize this potential impact.

5.2.8 Visual intrusion

Constructional activities have the potential to impact on scenic landscape values at the project site. It is expected that the local visual characteristics and expressions of the RoW will be affected by the presence of the transmission towers and lines. Mitigation measures have been proposed to minimize the potential 'tower-glare' effects on people especially in settlements such as Dawhenya, Dawa, Sege, Adidome, Sogakope, Akatsi, Tadamu and Dzodze.

5.2.9 Traffic impacts

Transportation of equipment and materials on public roads may result in some road safety problems. The potential hazards include vehicular-vehicular conflicts, vehicular-pedestrian conflicts and falling of improperly secured equipment and materials on roads. The potential for vehicular traffic conflict situations exists especially at the points where access tracks join the main roads. The proposed transmission line route crosses public roads such as the Tema – Aflao, Dawhenya – Prampram, Denu – Dzodze, etc. The stringing of transmission lines across these public roads may cause temporary traffic disruptions. Measures have been proposed to minimize potential traffic impacts.

5.2.10 Potential pollution of water bodies

Clearing and grading of access and tower corridor tracks, excavation of tower base areas and the construction of access tracks during the constructional phase will expose the ground surface to the agents of soil erosion. High sediment loads of run-offs from these areas could be discharged into nearby water bodies such as the Gyrokorgyor, Dawhe, Polupolu. Volta, Tohwi, Tordzie, Etu, Rivers, etc, causing high turbidity conditions and subsequently possible siltation of these watercourses. The potential for water pollution by oil, lubricants and paints also exists. This potential impact requires mitigation to minimize the possibility of water pollution and also minimize the effects on downstream water usage of these rivers, which is mainly for domestic purposes.

5.2.11 Work camps

Work camps will be established along the RoW during the constructional phase of the proposed project. The contractors will, in addition, exploit the option of renting of properties within the communities for accommodation purposes.

Issues relating to the establishment, location, waste management and decommissioning of the work camps need to be properly addressed.

5.2.12 Waste generation

Solid wastes in the form of vegetative matter, damaged cables and conductors, rags, excavated materials and packaging materials such as paper cartons, wooden crates and empty containers will be generated. Also, the potential for the generation of liquid wastes due to spent oils, water from excavations and accidental spillage of fuel and paint exist. These wastes must be properly handled to avoid or minimise adverse effects on the environment. Measures have therefore been proposed for waste management.

5.3 Operational phase

Some potential impacts have been identified and assessed for the operational phase of the proposed project. These are as follows:

5.3.1 Vegetation clearing

In wooded areas, the safe operation of the overhead power lines will necessitate the maintenance of unobstructed lanes. Vegetation control measures will therefore have to be applied during the operational phase of the project to manage vegetative growth within the RoW. The method to be used will be physical or mechanical clearing of vegetative growth for the maintenance of the RoW. RoW maintenance could also result in opening-up effects especially the activities of hunters and fuel-wood harvesters. These potential effects are not considered to be significant since much of the area is already extensively farmed and 'opened'. Mitigation measures have however been put in place to minimize the effects of RoW maintenance.

5.3.2 Effects of rust treatment and painting of towers

Rust treatment and painting of towers, although expected to be infrequent, are likely to cause pollution of nearby rivers and streams such as those mentioned above. This potential impact requires mitigation measures.

5.3.3 Solid waste generation

Solid wastes in the form of vegetative matter, packaging materials, damaged or broken cables, conductors and insulators will be generated during this phase. Measures have been proposed for the management of these wastes.

5.3.4 Liquid waste generation

Washing of equipment will constitute liquid waste during this phase of the proposed project. It is, however, not anticipated that liquid wastes from equipment washings will be generated in significant quantities. No mitigation measures have therefore been proposed for this potential impact. Accidental spillage of oil, fuel or paints will however need to be managed.

5.3.5 Occupational safety and health issues

Some occupational safety and health hazards are expected during the operational phase of the project. These hazards could be from falling and/or swinging objects, potential collapse of towers, electrocution, falling from heights and snakebites. These hazards pose potential threat to the safety and health of the workers. However, collapse of towers is not a common occurrence because during the over 40 years of VRA's transmission line operation and maintenance activities, the VRA has experienced only two tower collapses caused by rain storms and two collapses due to acts of vandalism. Mitigation measures have however been proposed to minimize these potential hazards.

5.3.6 Public safety

Potential public safety hazards are enhanced for a project such as the proposed transmission line project when the local populace has not been properly educated with regard to the potential hazards. In addition to the hazards posed to the public due to transportation of equipment and materials, other hazards such as potential exposure to Electromagnetic field (EMF) effects, potential collapse of towers and electrocution will exist during this phase of the project.

The falling of a live electrical conductor could cause severe burns of any object on which it falls. An electrical conductor could fall from the towers as a result of either a mechanical failure of an insulator string on the tower or snapping of the conductor itself. The mechanical failure of an insulator string could be the result of a lightning stroke, rusting of insulator pins or a heavy object falling on the transmission line. The failure of a conductor joint could also cause snapping of the conductor.

These potential hazards require mitigation to ensure the safety of the public.

One other potential impact of the proposed project is the perceived danger of transmission lines. Issues relating to electromagnetic fields are not normally understood by the public. The misconception that EMFs may cause cancer or harm children could create fear and perhaps panic among the local populace. This issue has been further dealt with below.

5.3.7 Electromagnetic field (EMF) effects

According to the World Environmental Library, WEL 1.1, information derived from prolonged observations and experiments in numerous countries indicate that the electric and magnetic fields around power transmission and distribution facilities exhibiting frequencies between 50 and 60 Hz have no harmful effects on human health. Magnetic field strengths below 0.4 mT at 50 – 60 Hz induce no detectable biological reaction in humans. The magnetic fields acting on the ground below overhead lines develop maximum field strength of only 0.055 mT for frequencies between 50 and 60 Hz. Hence potential effects of EMFs on human health are non-existent according to current knowledge.

However, an electrically grounded person touching an ungrounded metallic object or a conductor in a static or oscillating field may draw electric current from the object and may experience a micro shock from a spark discharge. This potential effect needs to be mitigated.

Mitigation will also be required to address the notions that EMFs may cause cancer or harm children and the resulting fear and possible panic among the local populations.

5.3.8 Effects of weed control chemicals

The improper application or misuse of weed control chemicals could adversely affect the environment and the health of workers handling these chemicals. To avoid these potential problems the VRA will employ only physical or mechanical clearing of weed for the maintenance of the RoW. No further mitigation measure is therefore required for this potential impact.

5.3.9 Socio-economic issues

Potential socio-economic issues such as land ownership, land-use conflicts and compensation issues are expected to persist during this phase of the project. Measures have been proposed to manage the residual effects of these potential issues. Impacts on population and demography are however not expected to be significant and will not require any mitigation.

5.3.10 Effects on birds

The presence of towers and power transmission lines in the RoW has the potential to impact on birds. There is the potential danger of debasement of breeding grounds, electrocution, collision with lines and interference in the navigation of birds. No specific breeding grounds of birds have been identified within the RoW hence the potential danger of debasement of such areas does not exist. Mitigation measures for the other potential effects on birds have therefore been proposed to minimize the effects.

5.3.11 Fire hazards

There is the potential for fire hazards as a result of bush fires and electrical faults during this phase of the proposed project. The bush fires could either originate from VRA operations during RoW maintenance or through the activities of farmers, hunters and palm wine tappers. This potential hazard will have to be mitigated to minimize the occurrence of fires.

5.3.12 Impact on telecommunications

Consultations with Ghana Telecom indicated that in cases where telephone lines run parallel or close to high-tension lines, subscribers experience interferences as a result of 'induction effect.

It is known also that resonance effect of power frequency fields may also affect telecommunications.

However, this does not occur with the VRA transmission lines as they usually run outside settlements where interferences are likely to occur. In addition the VRA adopts the procedure of “transpositioning” of the conductors (interchanging the individual phases from tower to tower) along the line route, in order to reduce the impedance that causes resonance. The phases are restored to the original at the termination of the lines.

Some mitigation measures have however been proposed for this potential impact.

6.0 MITIGATION MEASURES

This section of the ESMP report presents the mitigation measures that have been proposed to minimise potential adverse environmental impacts and maximise beneficial impacts that are associated with the implementation of the project. To ensure that environmentally sound practices are adhered to and to safeguard the safety and health of persons or any group of persons working on the project during project implementation, the following mitigative measures are proposed for significant potential impacts at the pre-constructional, constructional and operational phases.

6.1 Pre-constructional phase

6.1.1 Loss of buildings and land ownership issues

The proposed project is a linear one. This means land ownership structures and land-use characteristics will have to change within the affected area. The Volta River Authority (Transmission Line Protection) Regulations, 1967 LI 542 prohibits activities such as mining, construction of buildings, crops cultivation and farming in the RoW.

In order to minimize the adverse effects of the acquisition of the RoW and access track areas on individuals, communities and/or stools, a detailed survey of project-affected persons was carried out as part of this ESMP for the purposes of compensation payment. Prompt, adequate and fair compensation will be paid to all project-affected persons before the start of constructional activities.

6.2 Constructional phase

The constructional phase of the project involves activities that have the potential to impact significantly on the physical, biological and socio-cultural/socio-economic environments within the project's area of environmental influence. The following mitigation measures have been proposed for the significant potential impacts:

6.2.1 Noise impacts

Noise impacts from constructional activities will be temporary- limited only to the constructional phase of the project. All construction machinery and equipment will be maintained regularly, paying particular attention to all noise-reducing devices or mufflers to ensure that they are in good working condition to minimize noise generation.

The unnecessary hooting of horns during transportation of equipment and materials through settlements will be avoided as much as possible. Construction site workers will also be advised to avoid unnecessary noise making. Also, nighttime work especially near communities will be avoided as much as possible to prevent undue noise impacts on local communities. Construction crew near noisy machinery and power tools will be provided with earmuffs to protect them from hearing loss damage.

It is expected that the full implementation of the above measures will minimize the potential noise impacts on local communities.

6.2.2 Impact on air quality

Wind pick up of dust from exposed unprotected land surfaces will be minimized by limiting land clearance to minimum area requirements for the constructional activities. For instance, excavation of the tower base areas will be restricted to the required dimensions of 9.6m x 9.6m. To further reduce dust pollution, a water bowser will be used to spray the exposed soil surfaces of the tower corridor track as and when needed to minimize wind pick up of dust. This potential impact will be short-lived or temporary since it is expected that the exposed areas will be covered quickly by vegetative re-growth. The vegetative cover will however be maintained so as to allow the passage of vehicles.

In addition, the construction machinery and equipment will be maintained regularly to minimize the release of soot in the exhaust fumes.

Furthermore, trucks that supply sand, gravel and stone aggregates will be properly covered with tarpaulin during transit to prevent wind pick-up of dust, spill of materials and the release of dust into the atmosphere.

These measures, when fully implemented, are expected to minimize the potential impact of dust pollution on local communities.

6.2.3 Erosion

Activities during the constructional phase will expose the disturbed ground surface, which is at least temporarily unprotected, to the agents of soil erosion such as heat, wind and rain. Erosion of soil from exposed unprotected land surfaces will be minimized by limiting land

clearance to minimum area requirements for the constructional activities. For example, excavation of the tower base areas will be restricted to the required dimensions of 9.6m x 9.6m. Also, the erection of towers/tower footings on steep slopes will be avoided as much as possible to prevent slip erosion.

This potential impact will, however, be short-lived or temporary since it is expected that the exposed areas will be covered quickly by vegetative re-growth to stabilize the soil and minimize erosion.

6.2.4 Public safety

The transportation of heavy plant and equipment through settlements will be done in a manner not to jeopardise the safety of the local people. Equipment and materials will be properly secured when being transported to prevent them from falling and posing potential danger to people. (It is important to note that it is not the constructed towers that will be transported to tower locations but rather the tower members or parts). Legally mandated speed limits on the roads and highways shall be strictly observed in all settlements.

Also, tower base excavations in or near settlements or farms will be protected or clearly marked to prevent people from inadvertently falling into these excavations.

Tree felling will be done by a certified timber contractor with competent workers. Adequate warning will be given to ensure that public safety is not compromised during this activity.

6.2.5 Flora and Fauna

Care will be taken to minimise the area that will be cleared and the number of trees that will have to be cut. Construction workers will be closely supervised to ensure that only the minimum area requirements, as given earlier, for access trucks, tower corridor track and tower base areas are cleared of vegetation to minimize potential impacts on flora and fauna. Also, surveys conducted and desk studies carried out during the baseline study have not revealed the presence of any floral and faunal species of conservation concern that will be irreversibly impacted by the proposed project. Felling of trees will also be properly supervised to ensure that only trees that are, of necessity, to be felled are actually felled.

It is expected that impacts on fauna will be temporary and will not be significant. In addition, fauna that will be scared away during this phase will quickly return to the vicinities of the RoW once construction ceases. No further mitigation is proposed for potential impacts on fauna.

6.2.6 Occupational safety and health

The Volta River Authority will ensure that the contractor for the project carries out the work in compliance with the relevant provisions of the Factories, Offices and Shops Act, 1970 Act 328) and the VRA Corporate Safety Rules, 1993 to minimize the potential occupational safety and health hazards and prevent or minimise accidents. To further minimize the potential safety and health hazards, the VRA will ensure that the contractor employs properly trained and experienced operatives and adhered to all technical specifications relevant to safety measures in the execution of the works. In addition, the contractor will be expected to provide an “All Risk Insurance” cover for the contractor, subcontractors, project management staff and all other employees. The specific issues considered are:

6.2.6.1 Noise

Construction workers working with or near noisy equipment like pumps and power tools will be provided with earmuffs to protect them against noise-induced hearing loss damage.

6.2.6.2 Machine safety

All potentially hazardous machinery such as lifting appliances (cranes, fork lifts, etc) and unfired pressure vessels (compressors, etc) will undergo statutory examination by certified engineer. This will ensure that accidents due to material failure are pre-empted. All electrical cables of mobile or hand-held machines (electric hand drills, temporary lights) will be examined for flaws in insulation and when any flaws are detected the cables will be promptly replaced.

6.2.6.3 Sanitary/welfare facilities

Mobile toilet facilities will be provided for construction workers. This is to ensure that decent and comfortable places of convenience are provided for the workers and also to prevent environmental pollution with human waste.

In addition, lifting of excessive weights at the workplace will be prohibited. Lifting appliances (e.g. cranes and fork lifts) will be provided for lifting heavy objects. First aid facilities and good drinking water will be made available for the use of workers in accordance with the Factories, Offices and Shops Act, 328, 1970.

A first aid box stocked with all the items prescribed by the Factories, Offices and Shops Act, 328 will be provided and maintained. In addition, a vehicle will constantly be on standby for use as an ambulance for the conveyance of all persons who may sustain major injuries during the course of the implementation of the project to the nearest Health Centre. Raincoats, Wellington boots, etc will be provided for construction workers who will be working in rainy or wet conditions.

6.2.6.4 Injuries from falling/swinging objects

Protective clothing such as hard hats and safety boots will be provided for all employees at the proposed project site for protection against falling and/or swinging objects. Tree felling will be done by competent and adequately trained workers. Adequate warning will be given to ensure that safety of workers is not compromised.

6.2.6.5 Accidental falls from height

Due to the hazard of potential accidental falls from heights during construction works all workers who will be required to climb and work on the towers will be provided with the necessary safety equipment such as body harnesses, (climbing belts). In fact, experience gained from similar projects carried out by contractors of the VRA show that the use of safety equipment to mitigate height hazards is strictly enforced.

Plate 1 shows a worker engaged in routine VRA tower installation equipped with a typical safety belt. The VRA will, in addition, ensure that only well-trained and experienced personnel work at heights on the towers.

6.2.6.6 Snakebites

Construction workers will be protected from the potential hazard of snakebites by providing them with safety boots long enough to cover the leg up to the knee. Workers will be required to wear these boots at all times during working hours.

6.2.7 Socio-economic/cultural issues

The relevant socio-economic/cultural issues are:

6.2.7.1 Loss of buildings and land ownership issues

The proposed project is a linear one. Land ownership structures and land-use characteristics will have to change within the affected area. The Volta River Authority (Transmission Line Protection) Regulations, 1967 LI 542 prohibits activities such as mining, construction of buildings, crops cultivation and farming in the RoW.

In order to minimize the adverse effects of the acquisition of the RoW and access track areas on individuals, communities and/or stools a detailed survey of project-affected persons was carried out as part of the ESMP for the purposes of compensation payment. A total estimate of ₵17,885,046,981 (US\$1,944,027) will be paid for loss of land and destruction of structures. Prompt, adequate and fair compensation will be paid to all project-affected persons before the start of constructional activities.

6.2.7.2 Land-use conflicts (including compensation issues)

In order to minimize the adverse effects of the proposed project a detailed survey of project-affected persons was carried out as part of this ESMP for the purposes of compensation payment. A total estimate of ₵472,932,814 (US\$51,406) will be paid as compensation for crops. Compensation will be paid to all project-affected persons before the start of constructional activities.

6.2.7.3 Basis of assessment of compensation

Several valuation approaches are available for an appraisal depending upon the nature and purpose of valuation. There are normally three traditional approaches to valuation viz: the Income, Market and Cost Approaches. The VRA adopts the following methods to compensate its project-affected persons to ensure fair and adequate compensation:

6.2.7.3.1 Basis of valuation

a. Agricultural produce

Agricultural loss is generally limited to the crop loss and crop damage due to construction. Landowners who cultivate the affected plot receive compensation for the entire crop within the right of way (ROW) whether or not the entire ROW is cleared.

The methodology for the calculation of crop compensation rates takes into account both the market value of agricultural produce and the reestablishment period of perennial crops. This method operates by the capitalisation of the net income that accrues to the property at an appropriate rate. The net income is arrived at by making allowance for outgoing as land preparation, maintenance expenses, etc from the gross income accruing to the investment.

b. Residential properties

Two methods were adopted in the valuation of the buildings, depending on the location and other factors affecting values.

The Replacement Cost Method was adopted in the valuation of the affected structures/buildings. This method is based on the assumption that the value of the property tends to reflect the value of the accommodation provided, plus current costs of improvement, without any consideration for depreciation due to age, architectural obsolescence, etc. This method was applied where data on current sale of property is virtually non-existent.

In the Direct Comparison Method or Market Approach, rates adopted take the market condition in the building industry into consideration. This is a direct method of comparing the property to be valued with similar properties in terms of design, quality of construction, finishes, amenities/facilities available, location, neighbourhood characteristics, interest among others, which have changed hands in the recent past. The prices obtained for similar properties are thus analysed and a unit rate per square area is adopted after making the necessary adjustments and applied to the net floor area of the subject property to arrive at its reasonable value. This approach is based on the principle of substitution, which infers that a prudent purchaser acting knowledgeably will not pay more for a property than what it will cost him to acquire a comparable substitute if these are available on the market. The comparative approach is used where there is available and reliable data on what is actually paid in the market for similar or comparable properties.

6.2.7.4 Potential destruction of sacred, cultural and/or historical/archaeological sites/items

In line with current international practice and the desire to ensure the sustainability of the environment within which the Authority operates, the VRA will avoid intruding into or interfering with cultural properties of the local communities as much as possible.

Archaeological chance finds

Consultations with the Museums and Monuments Board have been carried out in connection with any historical or archaeological ‘chance finds’. The following procedure, which is derived from the National Museum Decree 1969, (NLCD 387), for dealing with all such finds will be followed:

Upon the discovery of any such chance finds:

- i. The Director of the Ghana Museum and Monuments Board shall be notified immediately in writing, stating the exact site or location of the item. The letter shall include adequate photographs of the antiquity.
- ii. VRA shall permit and facilitate such access to, and inspection of the site of discovery as the Director may so require. VRA shall also permit to be affixed or applied thereto, any seal or identification mark of the board.
- iii. VRA shall not alter, damage, destroy or remove any antiquity from its original site without the consent of the Board.

If removal of the item becomes immediately necessary for safety or security reasons, the exact location shall be noted and the retrieved artefacts shall be sent to the custody of the Board.

- iv. Through liaising with the Board, the lawful owners of the land shall be duly informed and where necessary, payment shall be made by the Board after due assessment.

Further decisions with respect to site sampling or further excavation will be under the jurisdiction of the Board. The above will ensure that issues relating to archaeological/cultural ‘chance finds’ are properly handled.

Cultural “chance finds” - sites of cultural significance such as sacred woods or trees or rock outcrops which the local residents may have not mentioned at the survey stage – will be properly managed to the satisfaction of both the local communities, the EPA and the funding agencies. Where possible, such cultural properties will be left undisturbed or avoided. In cases where complete avoidance of such sites is impossible, every necessary step will be taken to minimize the potential impact of intruding into the site. This will be done in consultation with and to the satisfaction of the chiefs, elders and opinion leaders of the local communities.

6.2.7.5 Impacts on population and demography

The project is not expected to have significant impacts on the populations and demography within the local communities. Only about 25% of the construction work-force is expected to be skilled labour may be recruited from outside the local communities. This may only be done if such skill labour is unavailable in the local communities. To further minimize potential impacts on populations and demography of the local communities skilled workers from outside the communities will be accommodated at the work camp that will be established. It is therefore not expected that there will be any significant impacts on populations, demography and gender within the local communities during the duration of the project.

6.2.7.6 Employment generation and incomes

Some employment openings may be created for the local people. Those local people who may be employed will benefit from the payment of salaries/wages. This is expected to lead to improvement in local incomes. On the other hand, there will be loss of income resulting from loss of crops and land. Mitigation for this potential impact is provided in Section 6.2.7.2 of this report.

6.2.7.7 Potential impacts on public health

With the introduction of migrant workers into the communities along the proposed line route, mitigation measures will be required to minimize the potential danger of the spread of sexually transmitted diseases (STDs) including HIV AIDS.

The VRA will assist the District Response Initiative HIV/AIDS Team who are already involved in public education in the local communities to create awareness about STDs including HIV AIDS among the local populace. The VRA will ensure that, as part of each worker's initial orientation, public education information about STDs in general and HIV AIDS transmission and preventive measures in particular, are provided. The workers will also be continually educated about the dangers of indulging in casual unprotected sex.

6.2.8 Visual intrusion

Optical impairment of the landscape by the presence of the transmission towers and lines is unavoidable and could be regarded as a residual impact. The galvanised towers tone down after two to five years of operation to a dark grey colour. In addition, the line route was

selected such that the lines blend with the natural landscape and mostly away from settlements. The 'glare effect' will therefore be minimal and unnoticeable.

6.2.9 Traffic impacts

Equipment and materials will be properly secured in vehicles while being transported to avoid the falling of such items on public roads to create potential hazards or safety problems for the public. Also, trucks and vehicles conveying such materials will display appropriate road safety signals - red flag and flashing amber lights. The VRA will ensure that deliveries are only made during daylight hours. Existing speed regulations shall be observed within settlements to minimize the potential for accidents.

To minimise traffic conflicts at the junction where the access tracks join public roads the VRA will ensure that road signs are erected at appropriate distances on either side of the junction to warn motorists of the potential danger of heavy-duty trucks turning into and off the main road. Obstructing vegetation at the junctions will be cleared to allow drivers to properly view and assess situations before joining main roads. Also, warning notices like **“NO ENTRY”** or **“NO TRESPASSING”** will be placed at entry to access tracks. In addition, random security patrols will be carried out to ensure that the local people do not unduly endanger their safety.

Furthermore, certain constructional activities like the stringing of transmission lines across public roads will cause temporary traffic disruptions. Traffic wardens will be employed to direct traffic during such times to avoid confusion and prevent accidents. In addition, in all cases, where line stringing will cross public roads due notification to the general public and appropriate authorities (GHA and/or DUR) will be given as required.

6.2.10 Potential pollution of water bodies

Clearing and grading of access and tower corridor tracks and the excavation of tower base areas will be limited to the minimum area requirements. Other measures proposed in other sections of this report for minimizing erosion and managing excavated materials, wastewater from excavations and accidental spillage of oil, fuel and paints are valid for the prevention of pollution of water bodies.

The contractor will use galvanised steel pipes across water bodies to allow for access in order to avoid blockage of streams, rivers and other water bodies.

The VRA will not employ herbicides/weedicides for weed control or vegetation clearing hence any potential pollution from this source is eliminated.

The measures above are expected to minimize the possibility of water pollution and also minimize the effects on downstream water usage of the streams/ivers.

6.2.11 Work camp management

First and foremost, the VRA will ensure that the work camp is not established close to any water body to avoid water pollution problems. The camp will also be established at least 500m from the closest settlement to minimize noise impacts on the community. The VRA will also ensure that employees from the local communities are not accommodated at the camp.

During maintenance of construction machinery/equipment and vehicles care will be taken to avoid accidental oil spills, which could lead to soil contamination. Accidental spillage of oil, fuel and paints will be avoided as much as possible. Any spilt materials will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be collected and disposed of at appropriate public waste dumping sites. Waste oil will be drained into impermeable sumps at the work camp for collection and disposal.

Metal wastes will be collected and sold as scrap to dealers who will in turn sell them for recycling.

Other solid wastes such as damaged cables and conductors, rags, paper cartons and domestic wastes will be collected and disposed of at appropriate public waste dumping sites. The use of empty paint and oil containers for storage of water will be prohibited.

Mobile toilet facilities will be provided at the work camp to avoid the pollution of the environment with human waste. The holding tanks of the mobile toilets will be emptied as and when required for disposal at appropriate sites.

6.2.12 Waste management

Solid wastes in the form of trees, tree stumps and wooden containers will be gathered together and made available to the local communities as fuel wood.

Metal wastes will be collected and disposed of appropriately and/or recycled.

Wastewater from tower base excavations is not expected to be significant. No towers will be sited in permanently wet locations requiring the extraction of large volumes of wastewater. At worst, towers will only be allowed to be sited at seasonally wet locations. The required dewatering will therefore be temporary, limited and localized. Hence only small quantities of wastewater will be pumped and discharged through sediment traps or silt screens into surrounding marshlands. The effects of discharging the wastewater into the surrounding marshlands will be insignificant and short-lived.

Accidental spillage of oil, fuel and paints will be avoided as much as possible. Any spilt materials will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites.

6.3 Operational phase

This section of the report presents the proposed mitigation measures put forward to minimise the significant potential environmental impacts that are expected to be associated with the operational or maintenance phase of the proposed project.

6.3.1 Vegetation clearing

The method that will be used for vegetation control to manage vegetative growth within the RoW will be physical or mechanical clearing. Tree stumps will be uprooted to prevent re-growth. Threatening trees outside the RoW will be cut only to a height of 1.25m. Chemicals such as weedicides or herbicides will not be used. This is to eliminate the potential harmful effects of these often-persistent chemicals on the environment. In addition, the physical clearing will enable the management of vegetative growth within the RoW to be done in a more controlled manner – limiting the clearing strictly to the tower corridor track. This is expected to have a limited effect on vegetation.

Also, the non-use of chemicals will eliminate issues of potential pollution of nearby surface water bodies and possible seepage of chemicals into ground water. In addition, all potential risks to workers arising from improper handling of these chemicals will be eliminated. The potential opening-up effects are not significant since most of the affected area is already

extensively farmed and opened. Any limited effect could only be regarded as a residual impact.

6.3.2 Effects of rust treatment and painting of towers

Accidental spillage of paints will be avoided as much as possible. Any spilt paints will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites. Painting will be done as frequently as necessary to prevent towers and tower members from rusting. The VRA will ensure that situations of extensive rusting of towers and tower members are avoided to pre-empt difficult rust treatment.

6.3.3 Waste management

During the maintenance phase, solid wastes in the form of trees, tree stumps and wooden containers will be gathered together and made available to the local communities as fuel wood.

Metal wastes will be collected and disposed of appropriately and/or recycled. Other solid wastes such as damaged cables, conductors and insulators, rags and paper cartons will be collected and disposed of at appropriate public waste dumping sites.

Accidental spillage of oil, fuel and paints will be avoided as much as possible. Any spilt materials will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites.

6.3.4 Occupational safety and health issues

The VRA will carry out the operation and maintenance of the proposed transmission line based on accepted international standards, such as those of the International Electrotechnical Commission (IEC) and the VRA's own 'Corporate Safety Rules.

However some specific potential occupational safety and health hazards expected during the operational phase of the project are dealt with below:

6.3.4.1 Potential collapse of towers

As stated earlier, collapse of towers occurs only rarely. Since the hazardous effects (e.g. falling on people and electrocution) of the collapse are normally felt only within the RoW public safety will be ensured by restricting public access to the right-of-way. In line with existing VRA practice, all towers will be clearly marked with a red inscription on white background - “**DANGER – 330,000 Volts**” to warn off trespassers and prevent them from exposing themselves to the potential dangers of electrocution.

Regular maintenance will minimize corrosion and wearing out of parts of the towers and their accessories. The VRA already has a comprehensive planned and emergency maintenance programmes for the existing transmission lines. It is expected that the same level of care will be applied to the new transmission lines to be constructed.

In addition, tower members will be secured and improved by anti-theft fasteners to check acts of vandalism and its harmful consequences on the towers. Security patrol will be conducted on sections of the transmission line especially the outskirts of urban areas and towns, which are more prone to acts of vandalism. It is expected that the patrols will ensure early detection of any acts of vandalism and signs of tower corrosion. Prompt and necessary remedial actions will be taken to repair the structures to forestall the possible collapse of towers.

6.3.4.2 Falling and/or swinging objects

The measures proposed earlier to minimize the potential hazards posed by falling and swinging objects are valid for the maintenance phase of the project and will be fully implemented.

6.3.4.3 Falling from heights

Potential accidental falls from heights during the operational or maintenance phase of the proposed project will be minimised through the provision of appropriate personal protective equipment such as body harness, climbing belts, etc. The VRA will insist that only well-trained and experienced personnel work at heights on the towers.

6.3.4.4 Machine safety

All potentially hazardous machinery such as lifting appliances (cranes, fork lifts, etc) and unfired pressure vessels (compressors, etc) will undergo statutory examination by certified engineer. This will ensure that accidents due to material failure are pre-empted. All electrical cables of mobile or hand-held machines (electric hand drills, temporary lights) will be examined for flaws in insulation and when any flaws are detected the cables will be promptly replaced to forestall the hazards of electrical burns and electrocution of employees. In addition, employees will be required to wear protective clothing in the course of work to protect them from undue exposure to electrical power.

6.3.4.5 Snakebites

The measures proposed earlier to minimize the potential danger of snakebites will also be implemented during the maintenance phase of the project to safeguard the safety of employees.

6.3.5 Public safety

Tower members will be secured and improved by anti-theft fasteners to check acts of vandalism and its harmful consequences on the towers. Furthermore, anti-climbing guards will be installed to discourage adventurous individuals from endangering their lives and limbs.

The shattering of insulators, which could pose potential danger to passers-by, will be minimized by the use of quality insulators as well as the periodic washing of the insulators.

Measures proposed earlier to minimize public safety hazards relating to transportation and potential tower collapse are valid for ensuring public safety. These measures will be fully implemented to enhance public safety. Other public safety issue of potential health and other implications of electromagnetic field (EMF) effects have been dealt with below.

Threatening trees will be felled as stated earlier in the report to prevent them from falling onto the transmission lines during stormy weather conditions. This will minimize the potential of the fall of live electrical conductors which could pose safety hazards to the public. Insulator pins will also be checked regularly for signs of rusting and any defective

pins found will be promptly replaced to prevent the live electrical conductors from falling from the towers.

A potential positive public safety impact is the possible use of transmission lines and towers as landmarks to aid in “navigating” when driving through the countryside since they are clearly marked on Ghana’s topographical maps.

6.3.5.1 Electromagnetic field (EMF) effects

According to the World Environmental Library, WEL 1.1, information derived from prolonged observations and experiments in numerous countries indicate that the electric and magnetic fields around power transmission and distribution facilities exhibiting frequencies between 50 and 60 Hz have no harmful effects on human health. Magnetic field strengths below 0.4 mT at 50 – 60 Hz induce no detectable biological reaction in humans. The magnetic fields acting on the ground below overhead lines develop maximum field strength of only 0.055 mT for frequencies between 50 and 60 Hz. Hence potential effects of EMFs on human health are non-existent according to current knowledge.

However, an electrically grounded person touching an ungrounded metallic object or a conductor in a static or oscillating field may draw electric current from the object and may experience a micro shock from a spark discharge. This potential effect will be minimized by the VRA, as usual, by multiple earthings. Protective multiple earthings minimize the chances of people getting electric shocks and the chances of such shocks being fatal.

In order to debunk the misconception that EMFs may cause cancer or harm children and minimize fear and avoid panic among the local populations, the VRA will undertake public education and create awareness in the local communities wherever such concerns are expressed. The VRA will also ensure that dwelling houses and other structures are not built within the RoW in contravention of existing regulations.

6.3.6 Socio-economic/cultural issues

6.3.6.1 Land ownership/land-use issues

Land ownership issues are expected to persist during this phase of the project. In cases where property owners could not be traced after all efforts have been made during the

constructional phase additional efforts will be made during the operational phase to locate such people. Prompt compensation payment will then be effected.

6.3.6.2 Grievance resolution

Grievances are sometimes raised by some project-affected persons (PAPs) during this phase of the project. Grievance resolution procedures have therefore been put in place with the sole objective of minimising disputes that may arise in relation to the compensation payments. The grievance/dispute processing and settlement mechanism will be based on the following:

- **Traditional dispute resolution**

Dissatisfied claimants would be invited for negotiation together with the traditional authorities of the area or Assembly members of the area in order to arrive at acceptable figures. This process had been employed at the survey stage to resolve grievances that arose from joint ownership of land, tenant-landlord conflicts and boundary between farm disputes. Mediation took place in the palaces of the traditional rulers. Resolutions were amicably arrived at to the satisfaction of all.

- **Submission of counter proposals**

The second stage of the mechanism is to request the claimant to submit counter proposals supported by valuation opinion prepared by private valuers of their choice. The private reports will be considered by VRA in conjunction with the Land Valuation Board, the witness NGO and the PAP (with his/her counsel, if any) to ensure that claimants are treated fairly.

At such meetings efforts will be made to arrive at amicable settlements in order to ensure that the third stage of the dispute resolution is not triggered.

- **Resort to Legal action**

PAPs may, in the event of dissatisfaction with the decisions taken in the instances discussed above or without resort to any of the instances above resort to legal action to have the dissatisfaction resolved. Given the mechanisms described above, it is unlikely that disputes will end up in the law courts.

6.3.7 Effects on birds

No specific breeding grounds for birds have been identified within the RoW hence the potential danger of debasement of such areas does not exist. The potential dangers of birds flying into or colliding with the lines and interference in the navigation of birds exist and can only be regarded as residual hazards.

6.3.8 Fire hazards

Potential fire hazards as a result of electrical faults will be minimized by adhering to technical specifications relevant to electrical safety. The use of low quality components, inadequate sizing of cables, negligent execution of works and general non-observance of safety rules will be avoided to minimize the potential hazard of electrical fires. Also, the operating personnel will be sufficiently trained in connection with electrical safety measures and their observance. Proper and sufficient supervision of workers will be undertaken.

In addition, the VRA will not allow the use of fire for the maintenance of vegetative growth within the RoW. Bush fires originating from the activities of farmers, hunters and palm wine tappers will be minimized through public education.

It is expected that the full implementation of the above measures will minimize the occurrence of fires.

6.3.9 Impact on telecommunications

A mitigating factor for this potential impact is the fact that the proposed transmission line route traverses mainly farmlands and potential agricultural lands. Efforts have been made to avoid built up areas and therefore the possibility of the transmission lines passing close to Ghana Telecom lines will be avoided.

In addition the telephone lines normally run within road reservations, whereas the proposed transmission line has been routed outside road reservations.

Even when the transmission line crosses over telephone lines, the vertical distance between the two lines will ensure that interference is non-existent or minimal.

7.0 Monitoring programme

A monitoring programme has been developed to determine impacts on the physical, biological and socio-economic/cultural environments within the project's area of influence.

The monitoring results are expected to indicate whether the predictions of potential environmental impacts are accurate and also whether the mitigation measures proposed for the management of the impacts are appropriate and adequate. The programme will also serve as an early warning system by revealing unforeseen impacts and allowing additional corrective measures to be implemented to arrest the situation and ensure that irreversible damage is not caused.

The programme is also expected to provide useful guidance for the successful planning and implementation of future power transmission line projects that will be undertaken by the VRA.

The monitoring programme has been developed for the following parameters:

7.1 Noise pollution

Noise pollution levels will be measured once every month close to the areas where construction activities are being carried out including settlements such as indicated earlier.

7.2 Water quality of rivers/streams

At any point during construction the rivers and streams close to the site(s) where constructional activities are being carried out will be sampled and analysed monthly at locations just before and just after the river or stream crosses the RoW. During the maintenance phase monitoring will be carried out twice yearly. The relevant parameters that will be considered for analysis are:

- BOD
- pH
- DO
- Turbidity
- Total suspended solids
- Conductivity
- Total coliform

7.3 Vegetation clearing

During the constructional phase, clearing of vegetation cover within the tower corridor and access tracks and the tower base areas will be monitored carefully to ensure that the minimum area requirements are not exceeded. Individual tree felling activities will be monitored to ensure that environmental and safety measures proposed under mitigation are fully implemented. Clearing of vegetation and cutting of trees within the RoW but outside the tower corridor track will be monitored to ensure that the specified height of 1.25m is complied with. Monitoring will also ensure that fire is not used for vegetation clearing.

These measures, apart from the clearing of tower base areas, are also relevant for vegetation maintenance during the operational phase.

7.4 Transportation effects

The following parameters/activities will be monitored:

- Speed limits of vehicles especially within settlements. Random checks on speed limits of vehicles will be carried out daily.
- Loading of vehicles. Vehicle loading procedures will be monitored at all loading points to ensure that materials and equipment are properly secured in truck/vehicles.
- Covering of vehicles conveying dust-generating materials. Random checks will be carried out daily on vehicles.
- Trucks/vehicle conditions and maintenance (i.e. road worthiness of vehicles). Daily checks on conditions of vehicles. A monthly check will also be conducted on vehicles to ensure that maintenance schedules are adhered to.
- Vehicular accident records. All vehicular accidents or dangerous occurrences relating to vehicles will be recorded in the accidents record book or register.

7.5 Occupational safety and health issues

The availability and use of personal protective equipment will be closely monitored continuously during both the constructional and operational phases. All employees who refuse to use the protective equipment provided will be properly sanctioned. To ensure that personal protective equipment is always readily available, all defective equipment will be promptly replaced.

Regular safety tests as recommended by manufacturers will be conducted on equipment such as cranes and winches.

7.6 Fire hazards

Construction work will be monitored continuously to ensure that the execution of works is done adhering strictly to technical specifications relevant to electrical safety. The use of low quality components, inadequate sizing of cables, negligent execution of works and general non-observance of safety rules will be monitored regularly. Proper and sufficient supervision of workers will be monitored.

7.7 Dewatering operations

Dewatering of tower base excavations will be monitored to ensure that de-silting of the wastewater is achieved to minimize the potential impact of polluting water bodies with suspended earth matter.

7.8 Waste management

The collection and use of wooden wastes as fuel wood by the local communities will be monitored on monthly basis. Also, the collection and sale of scrap metal to dealers will be monitored monthly to ensure that metal wastes are managed efficiently. The management of other solid wastes will be monitored on weekly basis to ensure that the wastes are collected promptly and disposed of at appropriate public waste dumping sites.

The clean up of accidental spills of oil, fuel and paints whenever they occur will be monitored to ensure that the clean up is promptly and properly done.

7.9 Transmission lines

Transmission lines will be monitored annually through aerial inspections for signs of damages and/or deterioration of insulators and accessories. Replacements of any such damaged parts will be promptly carried out.

7.10 Accidents

Occurrences of accidents involving transmission lines and structures that affect public safety or worker safety will be monitored and recorded whenever they happen. The frequency and

severity of such occurrences will be recorded. This will eventually indicate whether additional mitigation measures are required to make the system safer.

7.11 Identification of project-affected persons and compensation payment

Monitoring of project-affected persons will be carried out for two years to ensure that all affected persons have been identified and payment of adequate compensation duly effected without further delay.

7.12 Cultural/archaeological ‘chance finds’

During constructional phase, cultural/archaeological ‘chance finds’ - sites of cultural significance such as sacred woods or trees or rock outcrops and historical or archaeological heritage/items or sites which the local residents may have not mentioned at the survey stage – will be monitored to ensure that such sites or items are properly managed to the satisfaction of both the local communities, the EPA and/or the Museums and Monuments Board.

Table 12 Summary of impact, mitigation, net effect analyses and monitoring

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
Line route survey & Construction	Loss of crops	Almost entire RoW & access tracks	Prompt, fair compensation payment	Negligible	During construction & operation
Construction	Loss of structures	Certain parts of line route	Prompt, fair compensation payment for resettlement	Removal from historical/ancestral roots	Monitoring during construction & operation to ensure all PAPs are adequately and fairly catered for
Construction	Loss of land	Entire RoW & access tracks	Prompt, fair compensation payment	Removal from historical/ancestral roots	Monitoring during construction & operation to ensure all PAPs are adequately and fairly catered for
Construction	Noise impacts	Communities and settlements close to RoW	Avoidance (as much as possible) of work at night	Minor disturbance during daytime	Ambient noise levels shall be measured once every month in communities close to RoW
Construction	Air quality	Communities and settlements close to RoW	Spray the exposed soil surfaces of the tower corridor track as and when needed	Negligible	Monitoring - none
Construction	Potential soil erosion	Entire RoW & access tracks	Limit land clearance to minimum area required and early revegetation	Negligible	Monitor land clearance
Construction & operation	Public safety 1. Open excavations 2. Potential electrocution 3. Potential collapse of towers	Entire RoW & access tracks	Tower base excavations in or near settlements or farms will be clearly marked and made inaccessible to the public. All towers will be clearly marked with	Negligible	Routine inspections of towers during operational phase

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
	4. Others		a red inscription on white background - “DANGER – 330,000 Volts” to warn off trespassers, etc.		
Construction & operation	Flora and Fauna	Entire RoW & access tracks	Limit clearance of vegetation	Negligible	Monitored carefully to ensure that the minimum area requirements are not exceeded
Construction & operation	Occupational safety and health	Entire RoW & access tracks	Provision of personal protective equipment. All work to be done according to corporate safety rules of VRA	Negligible	Availability and use of protective equipment.
Construction	Impacts on cultural and historical/archaeological sites/items	Cultural/historical/archaeological chance finds	Chance finds to be reported to appropriate authorities	Negligible	Areas of chance finds will be monitored and secured in order to be handed over to Museums and Monuments Board.
Construction	Public health-STDs/HIV AIDS	Mainly settlements along RoW	Education of workers to avoid casual sex	Potential single mothers, transmission of STDs/AIDS	Keep close contact with communities during construction to detect incidences of STDs/AIDS
Construction	Traffic impacts	Relevant roads indicated in report	Use of traffic wardens to control traffic at road crossings	Negligible	Presence of traffic wardens at all times during construction.
Construction	Water pollution	Rivers indicated in the report	Minimize erosion and manage excavated materials, wastewater from excavations and accidental spillage of	Negligible	Streams close to the site(s) of construction to be sampled and analysed monthly. During the maintenance phase monitoring will be carried out twice yearly.

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
			oil, fuel and paints		
Construction & operation	Solid Waste generation	Entire RoW & access tracks	Trees, tree stumps and wooden containers to be given out to the local communities as fuel wood Metal wastes to be collected and disposed of appropriately and/or recycled	Negligible	Collection and disposal of solid waste to be monitored
Operation	Effects of rust treatment and painting of towers	Tower locations	Spilt paint to be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites.	Negligible	No monitoring
Operation	Micro shock from a spark discharge	RoW	Minimized by multiple earthings	Negligible	Monitor earthing cables
Operation	Fire hazards	RoW	Public education on hazards of bush burning	Negligible	Routine patrols to discourage bush burning
Construction & operation	Employment generation and incomes	Settlements along RoW	Encourage contractors to engage local labour	Standard of living improved	None

7.13 Contractors' obligations and legal requirements

Prior to the commencement of construction works, all contractors should be required to prepare their own EMPs. The plan should spell out environmental targets and objectives as outlined in the EIA/EMP and how these could be achieved. The Contractor's EMP shall include, to the extent practicable, all steps to be taken by the Contractor to protect the environment in accordance with the current provisions of national environmental regulations and/or the EIA/EMP for this project.

1 Notwithstanding the Contractor's obligation spelt out above, the Contractor shall, in addition, endeavor to implement all measures necessary to restore the project sites to acceptable standards and abide by environmental performance indicators specified in the EIA/EMP to measure progress towards achieving objectives during execution or upon completion of any works. These measures shall include but not limited to the following:

(a) Minimizing the effect of dust on the surrounding environment resulting from earth mixing sites, asphalt mixing sites, dispersing coal ashes, vibrating equipment, temporary access roads, etc. to ensure safety, health and the protection of workers and communities living downwind of dust generating activities.

(b) Ensuring that noise levels emanating from machinery, vehicles and noisy construction activities are kept at a minimum for the safety, health and protection of workers within the vicinity of high noise levels and communities near rock-blasting areas.

(c) Ensuring that existing water flow regimes in rivers, streams and other natural or irrigation channels is maintained and/or re-established where they are disrupted due to civil works being carried out.

(d) Preventing bitumen, oils, lubricants and waste water used/produced during the execution of works from entering into rivers, streams, irrigation channels and other natural water bodies/reservoirs and also ensure that stagnant water in uncovered borrow pits is treated in the best way to avoid creating possible breeding grounds for mosquitoes.

(e) Preventing and minimizing the impacts of quarrying, earth borrowing, piling and building of temporary construction camps and access roads on the biophysical environment including

protected areas and arable lands; local communities and their settlements. In as much as possible restore/rehabilitate all sites to acceptable standards.

(f) Ensuring that the discovery of ancient heritage, relics or anything that might or believed to be of archeological or historical importance during the execution of works is reported to the National Commission on Culture (NCC) in fulfillment of measures aimed at protecting such historical or archaeological resources.

(g) Discouraging construction workers from engaging in the exploitation of natural resources such as hunting, fishing, collection of forest products or any other activity that might have a negative impact on the social and economic welfare of the local communities.

(h) Implementing soil erosion control measures in order to avoid surface run off and prevents siltation etc.

(i) Ensuring that garbage, sanitation and drinking water facilities are provided in construction workers camps.

(j) Ensuring that in as much as possible, local materials are utilized to avoid importation of foreign material and long distance transportation.

(k) Ensuring public safety and meeting traffic safety requirements for the operation of moving machinery in order to avoid accidents.

2. The Contractor shall indicate the period within which he/she shall maintain status on site after completion of civil works to ensure significant perturbations arising from such works have been taken into account.

4. The Contractor shall adhere to the proposed activity implementation schedule and the monitoring plan/strategy to ensure effective feedback of monitoring information to both project management and the Director/EPA so that impact management can be implemented properly, and if necessary, adapt to changing and unforeseen conditions.

5. Besides the regular inspection of the sites by the Site Supervisor for adherence to specification, the Consultant for Engineering Supervision shall appoint an Inspector to oversee the compliance with and to inspect significant sites where works have been carried out and proposed mitigation measures implemented and shall give certification regarding the adequacy or inadequacy of rehabilitation measures carried out on the bio-physical environment and compensation for socio-economic disruption resulting from implementation of any works.

6. If the Contractor fails to implement the approved Environmental Management Plan after written instruction by the Engineer to fulfill his obligation within the requested time, the Client reserves the right to arrange through the Engineer for execution of missing action by third party and the costs debited against the Contractor.

Worksite/Campsite Waste Management

7. All vessels (drums, containers, bags, etc.) containing oil/fuel/surfacing materials and other hazardous chemicals must be banded in order to contain spillage. All waste containers, litter and any other waste generated during the construction shall be collected and disposed of at designated disposal sites in line with the Waste Management Regulations of the Environmental Protection Agency of Ghana.

8. All drainage and effluent from storage areas, workshops and camp sites shall be captured and treated before being discharged into the drainage system in line with the Water Pollution Control Regulations of the Environmental Protection Agency of Ghana.

9. Used oil from maintenance operations shall be collected and disposed of appropriately at designated sites or be re-used or sold for re-use locally.

10. Entry of runoff to the site shall be restricted by constructing diversion channels or holding structures such as banks, drains, dams, etc. to reduce the potential of soil erosion and water pollution.

11. Construction waste shall not be left in stockpiles along the road. Waste and other excess material shall be used for rehabilitating borrow areas and landscaping around the road.

12. If other spoil disposal sites are necessary, they shall be located in areas, approved by the Engineer, of low land use value and where they will not result in material being easily washed into drainage channels. Whenever possible, spoiled materials should be placed in low-lying areas and should be compacted and planted with species indigenous to the locality.

Material Excavation

13. Contractors will have to indicate the source of material such as gravel for concrete production, sand bedding of pipes or any other purpose.

14. Contractors shall obtain appropriate licenses/permits from relevant authorities to operate quarries or borrow areas.

15. The location of quarries and borrow areas shall be subject to approval by relevant authorities including traditional authorities if the land on which the quarry or borrow areas fall in traditional land and by the Environmental Protection Agency of Ghana.

16. New Extraction sites shall not be located in the vicinity of settlement areas, cultural sites, wetlands or any other valued ecosystem component and shall not be located at less than 10km from such areas.

17. New Extraction sites shall not be located adjacent to stream channels wherever possible to avoid siltation of river channels. Where they are located near water sources, borrow pits and perimeter drains shall surround quarry sites.

18. New Extraction sites shall not be located in forest reserves. However, where there are no other alternatives, permission shall be obtained from the Ministry of Lands Forestry and Mines and an environmental impact study shall be conducted.

19. New Extraction sites shall not be located on high or steep ground or in areas of high scenic value.

20. Only sites that can easily be rehabilitated shall be chosen. Areas with minimal vegetation cover such as flat and bare ground or areas covered with grass only or covered with shrubs with height of less than 1.5 m.

21. New Extraction site boundaries shall clearly be demarcated and marked to minimize vegetation clearing.

22. Vegetation clearing shall be restricted to the area required for safe operation of construction work. Vegetation clearing shall not be done more than three months in advance of operations.

23. New Extraction sites shall not be located in archaeological areas. Excavations in the vicinity of such areas shall proceed with great care and shall be done in the presence of NHCC staff.

24. Stockpile areas shall be located in areas where trees can act as buffers to prevent dust pollution. Perimeter drains shall be built around stockpile areas. Sediment and other pollutant traps shall be located at drainage exits.

Material Deposit

25. The Contractor shall deposit any excess material in accordance with the principles of the EMP at areas approved by local authorities and/or the Engineer.

26. The Contractor shall in advance of the commencement of work clarify with the local authorities dumpsites or areas for hazardous deposits for contaminated liquid and solid materials, that can not be used any longer as backfill.

Rehabilitation and Soil Erosion Prevention

27. To the extent practicable rehabilitate the site progressively so that the rate of rehabilitation is similar to the rate of construction.

28. To always remove and retain topsoil for subsequent rehabilitation. Soils shall not be stripped when they are wet as this can lead to soil compaction and loss of structure.

29. Topsoil shall not be stored in large heaps. Low mounds of no more than 1 to 2m high are recommended.
30. Re-vegetate the stockpile to protect the soil from erosion, discourage weeds and maintain an active population of beneficial soil microbes.
31. Locate stockpiles where they will not be disturbed by future construction activities.
32. To the extent practicable reinstate natural drainage patterns where they have been altered or impaired.
33. Remove toxic materials and dispose of them in designated sites. Backfill excavated areas with soils or overburden that is free of foreign material that could pollute ground water and soil.
34. Identify potentially toxic overburden and screen with suitable material to prevent mobilization of toxins.
35. Ensure the reshaped land is formed so as to be inherently stable, adequately drained and suitable for the desired long-term land use and that would allow natural regeneration of vegetation.
36. Minimize the long-term visual impact by creating landforms, which are compatible with the adjacent landscape.
37. Minimize erosion by wind and water both during and after the process of reinstatement.
38. Compacted surfaces shall be deep ripped to relieve compaction unless subsurface conditions dictate otherwise.
39. Revegetate the area with plant species that will control erosion, provide vegetative diversity that will through succession, contribute to a stable and compatible ecosystem. The choice of plant species for rehabilitation shall be done in consultations with local research

institutions, Forestry Services Department and the local people, as they will be long-term beneficiaries.

Water Resources Management

40. The Contractor shall at all costs avoid conflicting with water demands of local communities.

41. Abstraction of both surface and underground water shall only be done with the consultation of the local community and after obtaining a permit from the relevant Water Authority.

42. Abstraction of water from wetlands shall be avoided. Where necessary, permission has to be obtained from relevant authorities.

43. Temporary damming of streams and rivers shall be done in such a way as to prevent the disruption of water supplies to communities down stream and in order to maintain the ecological balance of the river system

44. No construction water containing spoils or site effluent, especially cement and oil, shall be allowed to flow into natural water drainage courses.

45. Wash water from washing out of equipment shall not be discharged into water courses or road drains.

46. Site spoils and temporary stockpiles shall be located away from the drainage system and surface run-off shall be directed away from stockpiles to prevent erosion

Traffic Management

47. Location of access roads/detours shall be done in consultation with the local community especially where access road shall traverse important ecosystem component. Access roads shall not traverse wetland areas.

48. Upon the completion of civil works, all access roads shall be ripped and rehabilitated.

49. Access roads shall be sprinkled with water at least five times a day in settled areas and three times in unsettled areas to suppress dust emissions.

Blasting

50. Blasting activities shall not take place in the vicinity of settlement areas, cultural sites, or wetlands without the permission of the Engineer.

51. Blasting activities shall be done during working hours and local communities shall be consulted on the proposed blasting times.

52. Noise levels reaching the communities from blasting activities shall not exceed 90 decibels.

Disposal of unusable materials

53. Unusable materials and construction elements such as electro-mechanical equipment, pipes, accessories and demolished structures will be disposed of in a manner approved by the Engineer. The Contractor has to agree with the Engineer which elements are to be surrendered to the Client's premises, which will be recycled or reused, and which will be disposed of at approved landfill sites.

54. As far as possible, unused pipelines shall remain at their current position. Where for any reason no alternative alignment for the new pipeline is possible, the old pipes have to be stored at a safe place to be agreed upon with the Engineer and the local authorities concerned.

55. AC-pipes as well as broken parts thereof have to be treated as hazardous material and deposited subsequently as indicated before.

56. Unsuitable and demolished elements shall be dismantled to size fitting on ordinary trucks for transport.

Health and Safety

57. The Contractor in advance of the construction work shall mount an awareness and hygiene campaign. Workers and local residents shall be sensitized on health risks particularly of AIDS.

58. Adequate road signs to warn pedestrians and motorists of construction activities, diversions, etc. shall be provided at appropriate points.

59. Construction vehicles shall not exceed maximum speed limit of 40km per hour.

Repair of Private Property

60. Wherever the Contractor, whether deliberately or incidentally damages private property, it has to be repaired at the Contractor's cost. For each repair, the Contractor has to obtain from the owner a certificate that the damage has been made good satisfactorily in order to indemnify the Client from subsequent claims.

61. In case where compensation for inconveniences, damage of crops etc. are claimed by the owner, the Client has to be informed by the Contractor through the Engineer. This compensation is in general settled under the responsibility of the Client before signing the Contract.

8.0 INSTITUTIONAL ARRANGEMENTS AND TRAINING

The ESMP details active remedial measures and monitoring activities to be continuously carried out to prevent or minimize impacts on the physical, biological and socio-economic/socio-cultural environments as well as to promote occupational safety and health of employees.

8.1 Policy on Environment, Safety and Health

“VRA and its employees are committed to minimising the impact of its operations on the environment. VRA will accordingly adhere to the principles of sustainable energy development and contribute to the welfare of people (or communities) adversely affected by its operations.

VRA will:

1. Comply with all relevant and existing legal obligations on environment, particularly:
 - Promote open communication and dialogue in addressing environmental issues.
 - Establish an environmental management system (EMS) with a view to ensuring continuous improvement, through:
 - Collaboration with other agencies in pursuit of its environmental management objectives and programmes.
 - Support for research, development and technology applications to enhance efficiency of resource management.
 - Contribution to the formulation of public policy and programmes that promote sustainable development especially in areas affecting its core business and those of its subsidiaries.

And also:

2. Educate, train and motivate its employees about environment.
3. Assist in improving the standard of living of communities adversely impacted by its operations.

Specific Objectives

1. Establish an environmental management system (EMS), which ensures integration of environmental concerns in all areas of planning and decision-making, due diligence, risk minimisation, monitoring and continuous improvement of the environment.
2. Comply with both national and international conventions of the environment.
3. Actively promote environmental awareness and individual sense of responsibility through education, training, and motivation.
4. Promote open communication on environmental issues.
5. Support research, development and technology applications to enhance efficiency of resource management.
6. Contribute actively to the formulation of public policy and programmes that promote sustainable development in the energy sector.
7. Protect the Volta Lake.
8. Assist in improving the standard of living of communities in the Authority's areas of operation.

8.2 Environmental management system

In order to maintain control over the implementation of the project and also ensure that commitments to be made in the EIS are acted upon in a comprehensive and acceptable manner, an Environmental Management System and Training Programme is developed in this section. This programme will help to identify personnel, responsibilities and training requirements for the Project Environmental Management Team to be constituted.

The Project Environmental Management Team will be responsible for the following:

- Ensuring project's compliance with all relevant environmental, social, health and safety regulations
- Liaising with all relevant regulatory bodies and organisations- EPA, Factories Inspectorate Department, Energy Commission (Inspectorate Unit), etc.
- Formulation and review of environmental and social policies and practices associated with projects
- Liaising with relevant VRA Departments on all health, environmental, safety and social matters connected to projects
- Assist in the education and training of project staff in environmental, social and safety awareness
- Make budgetary provisions for projects' environmental programmes

- Undertaking environmental and social monitoring activities for projects

The estimated budget for environmental management is as provided below.

8.3 Environmental management structure

The Environment and Sustainable Development Department (ESD) of the Volta River Authority is responsible, among others, for pre-project development as well as the post project implementation of all environment-related activities of the VRA. The ESD is made up of, among others, environmental specialists, sociologists, aquatic biologists, natural resource officers and engineers. The Department is headed by a Director.

In pursuance of the objective of ensuring compliance with environmental regulations, an Environmental Coordinator who is a staff of the ESD will be appointed to coordinate the activities of the Project Implementation Unit (PIU) to be constituted for the proposed project. Membership of the PIU will include a Project Valuation Officer. The Project Environmental Coordinator reports through the Project Engineer.

The Project Environmental Coordinator obtains direction and technical support from the ESD in order to ensure quality input.

The PIU will be responsible directly for all environmental and occupational safety and health matters arising from the project. The post-construction or operational phase environmental management will be incorporated into VRA's Corporate Environmental Management Plan and implemented by the Environment and Sustainable Development Department.

8.4 Qualifications of the Project Implementation Unit

The most relevant specialists, who will be associated with the management of the proposed project, are a Project Engineer, Office Engineer, Environmental Coordinator, Valuation Officers and Field Technicians. Suitable personnel with the appropriate backgrounds will be engaged for the PIU. The PIU will be headed by the Project Director who is also the Director, Engineering, Design and Construction.

To ensure that the environment is managed efficiently, requisite training shall be provided for the members of the Project Implementation Unit.

8.5 Project Environmental Coordinator (PEC)

The Environmental Coordinator for the project will be responsible for all environmental issues in connection with the project. He will report directly to the Project Director. He will work closely with the other members of the Project Implementation Unit.

The PEC should have experience in environmental and social impact assessment, health, safety and environmental (HSE) management.

The PEC is responsible for:

- Monitoring all environmental and social programmes for pre-construction, construction and operational phases of the project, including those related to bio-physical and socio-economic/cultural components
- Working closely with project contractors to ensure that all monitoring and mitigation guidelines, recommendations for the project are strictly adhered to. This includes compliance with all health, social and safety guidelines outlined and following strictly the authorities environmental policy guidelines
- Working closely and coordinating efforts with the EPA and other enforcement bodies to ensure full compliance with all legal and regulatory requirements
- Organising activities to motivate and maintain the interest of the project staff in environmental and social issues and assisting to increase project staff awareness of environmental issues through training programmes and review meetings
- Coordinating investigations into/of all types of accidents
- Conducting environmental and social audits in accordance with project monitoring guidelines
- Serving as liaison between project contractors, the Authority and relevant regulatory agencies
- Developing a work plan for the implementation of the ESMP
- Establishing and running a reporting system on progress (or otherwise) in implementing mitigation measures (including contractors' obligations), training, etc
- Production of reports

8.6 Project Environmental Assistant

The Environmental Assistant will assist the project Environmental Coordinator. The suitable person for this position should have some experience in transmission line systems and a

working knowledge in environmental issues. Environmental training will be given to any selected person who will be without the appropriate requisite environmental background.

8.7 General health and safety procedures

Procedures relating to occupational safety and health will be guided by the VRA “Corporate Safety Rules” (1993) and the Factories, Offices and Shops Act, 328, (1970) which are buttressed by the occupational safety and health recommendations in the EIS.

The relevant environmental and occupational safety and health issues covered in the VRA “Corporate Safety Rules” (1993) include:

- Manual lifting
- Hearing protection
- Protective equipment
- Good housekeeping
- Fire prevention
- Prevention of falls from heights
- Electrical hazards
- Machinery safety
- Welding safety
- Head protection
- Feet protection
- Provision of first aid items

All occupational safety and health provisions in the Factories, Offices and Shops Act 328, (1970) shall be complied with during the implementation of the project.

The mitigation measures recommended in the ESMP will also be fully implemented. The areas covered include:

- Hearing loss protection
- Protection against falling/swinging objects
- Snakebites
- Electrical protection
- Accidental falls from height

- Manual lifting
- Fire hazards
- Protection against dangerous machinery
- Provision of sanitary/welfare facilities

8.8 Fire prevention system

The general fire precautions to be taken include:

- The posting of “no smoking” signs at fire sensitive areas (e.g. fuel storage areas at the work camp, etc)
- Provision of appropriate and adequate number of fire extinguishers
- Proper storage of rags used in cleaning hands and containing flammable liquids (e.g. in metal containers for safe disposal)
- Handling of flammable materials by competent persons only
- Provision of emergency fire alarm systems

In addition, fire prevention training would be carried out for selected project employees. At the end of the training, the personnel would have adequate knowledge of all fire prevention systems recommended in the EIS.

8.9 Pollution prevention

Proper management of waste oils/lubricants, excavated earth materials and paint as recommended in the ESMP will be enforced. Measures to be adopted will include:

- Collection, storage and disposal of waste oils and lubricants
- Proper management of excavated materials
- Prevention and management of oil, fuel and paint spills

To ensure the success of pollution prevention, the environmental team will be trained to identify and appreciate what hazards there are in relation to improper storage and disposal of polluting substances.

8.10 Vegetation management plan

In the construction of the transmission system, vegetation clearing is done within the right-of-way, access tracks, tower spots and campsites. These activities result in loss of vegetation cover. Some effects of vegetation loss are:

- Exposure of some streams thus increasing the rate of evaporation.
- Clearing of vegetation and compaction of soils could lead to death and displacement of some faunal species.
- Soils within the project area would be prone to erosion when cleared at high spots and when subjected to the weight of heavy plants and machinery
- Loss of closed canopy and reduction in the number of tree species resulting in increased evaporation particularly of small streams/water bodies.
- Falling trees (especially tall trees beyond the RoW) may cause extensive damage to vegetation/crops in the landing area.
- Excavating for tower foundations may destabilise the soil structure and expose the soils to erosion. In swampy areas, there may be the need to pump out water from the excavations and this would further increase erosion from surface runoff and increase sediment flow into nearby water bodies.

Mitigation measures

Measures to be employed to ensure a reduction of erosion, loss of cover for agricultural purposes, restoration of embankments, re-vegetation:

- Construction of new tracks will be kept to the barest minimum. Track routes will be selected in such a way as to minimise any damage to farms and crops.
- Mechanical control will be used for all vegetation clearing.
- The access tracks will be selected so as to avoid crossing streams and other water bodies.
- Where stream crossings are unavoidable, suitable culverts will be constructed over them. Under no circumstances will water bodies be blocked to provide for construction access.

- Removal of stream bank vegetation (especially bamboo/mangrove) will be avoided as much as possible.
- Compaction of soils along the graded tracks will be reduced by regulating the number of passes of heavy trucks to and from the sites.
- The ground surface at each tower site will be graded to provide drainage away from the tower legs. Where necessary (particularly on hillsides), terracing, cribbing or riprap may be used to provide protection for tower foundations.
- Cutting of trees will be done by a certified timber contractor, and strictly in line with the prescribed safety guidelines. The landing area of falling trees will be carefully selected to minimise damage to farms. Adequate warning will be given to ensure that public safety is not compromised.
- The Contractor will place warning notices (“**NO ENTRY**”, “**NO TRESPASSING**” **etc.**) at entry to access roads. In addition, random security patrols shall be carried out. The public in construction active areas shall be continuously educated through the beating of gong-gong to avoid the construction areas as much as possible.

Budget

Budgetary provision for vegetation management during construction will be part of the contractor’s cost.

8.11 Change management

VRA also recognizes that environmental and social issues that are to be covered by the project ESMP and RAP will change as the project proceeds.

VRA shall appoint a Project Environmental Team (PET) as well as a Project Implementation Unit (PIU) to facilitate the change management responsibility. The PET and PIU shall undertake the following:

- Review internal environmental reports
- Discuss significant issues as they arise

- Make decisions about modifications to mitigation and monitoring needs and requirements
- Advice on external reporting on environmental and social issues, as required

8.12 Monitoring

The monitoring parameters and the recommended frequency proposed in the ESMP will be strictly adhered to. The parameters to be monitored will be:

- Noise pollution
- water quality

The relevant parameters that will be considered for analysis are:

- BOD
- pH
- DO
- Turbidity
- Total suspended solids
- Conductivity
- Availability and use of personal protective equipment
- Fire safety and
- Management of solid and liquid wastes

The frequency of monitoring of the abovementioned parameters has been indicated in the addendum to Table 12.

It must be noted that the on-going baseline establishing exercise being carried out by the ESIA team will enable the proponent to indicate the thresholds that will signal the need for corrective actions and the detection limits.

The Environmental Team members will be trained adequately to understand and appreciate the choice of parameters, sampling sites, methods of sampling/measuring and analysis and frequency of monitoring.

Method for water quality analyses

Temperature should be measured in situ with a portable temperature probe. Turbidity, pH and colour determinations may also be measured in situ. Methods of analysis should be

based on those outlined in “**Standard Methods for the Examination of Water and Wastewater**” (APHA-AWWA-WEF 1998). The parameters and the methods normally used for analyses are summarised in Table 13.

Sampling sites shall be the same sites used for the establishment of baseline data on water quality parameters.

Table 13 Methods of analyses of selected parameters

Parameters	Method	APHA Number	Method
Colour	Visual comparison method	2120 B	
pH	Direct measurement with a pH meter	-	
Turbidity	Direct measurement with a turbidity meter	-	
Total Dissolved solids, TDS	Filtration and drying at 180°C in an oven	2540 C	
Suspended solids, SS	Filtration and drying at 105°C in an oven	2540 D	
Dissolved Oxygen, DO	Winkler’s method with Azide modification	4500-O.C	
Biochemical Oxygen Demand (BOD)	Determination of DO before and after 5 days incubation at 20°C	4500-0.C	
Oil/grease	Partition - Gravimetric	5520B	

8.13 Training and development

To ensure the successful implementation of all the environmental management programmes, a training programme is recommended for the project Environmental Management Team and key personnel of the contractor. The programme will cover the creation of environmental awareness and occupational safety and health issues. The main issues of concern will be:

Environmental awareness

The areas earmarked for environmental awareness creation include:

- Proper usage and definitions of basic environmental terminologies
- Ghana EIA procedures, provisions of Act 490 (1994) and LI 1652, (1999)
- Environmental laws, regulations and environmental compliance in Ghana
- General environmental policies
- Introduction to environmental management planning
- Environmental impact assessment
- Mitigation measures

- Monitoring plans
- Environmental audit
- EIA case studies

Occupational safety and health

The relevant areas for consideration are:

- The Factories, Offices and Shops Act 328, (1970). The provisions for safety, health and welfare.
- Fire prevention and fighting methods

8.13.1 Information, Education and Communication (IEC)

In addition to the provision made in 8.13 for continuous public education during the construction phase and subsequent posting of “Warning Signs”, sustained information, education and communication (IEC) programmes to ensure overall community safety shall be implemented on yearly basis. The purpose of the IEC programme is to remind community members about project related risks and activities that will endanger their lives such as uncontrolled bush burning, climbing of towers, especially by children, as well as the need to adhere to warning signs and all rules governing the right of way. The development of IEC materials and implementation strategies shall require the services of a consultant.

4.6 Institutional Strengthening and Training for Implementation

Institutional Strengthening Activity	Institution	Scheduling	Responsibilities	Cost Estimates
Mitigation	1. Volta River Authority	Pre-Construction - Maintenance	Overall supervision of the project involving, EIA, Compensation, Project Works, etc.	Total Project Budget
	2. Contractor	Construction	Undertake physical construction works	Contract Budget
	3. Project Implementation Unit	Pre-Construction - Maintenance	Supervise and monitor project activities to ensure compliance with national and international regulations	Total Project Budget
	4. Environmental Protection Agency	Pre-Construction - Maintenance	Provide and monitor adherence to conditions in environmental permit.	Part of VRA Corporate

Institutional Strengthening Activity	Institution	Scheduling	Responsibilities	Cost Estimates
	5. Land Valuation Board	Pre-Construction - Maintenance	Valuation of affected crops/lands	Budget Part of VRA Corporate Budget
	6. District Assemblies	Pre-Construction - Maintenance	Ensure that interests of communities are taken into consideration in project execution, and involves receipt of adequate compensation for affected properties.	Part of VRA Corporate Budget
	7. Chiefs and Opinion Leaders	Pre-Construction - Maintenance	Ensure that interests of communities are taken into consideration in project execution, and involves receipt of adequate compensation for affected properties.	Part of VRA Corporate Budget
	8. Ministry of Health	Pre-Construction - Maintenance	Provide technical assistance for HIV/AIDS outreach programme for workers and affected communities.	Contract Budget
Monitoring (including compliance)	1. Volta River Authority	Pre-Construction - Maintenance	Monitor supervision of the project involving, EIA, Compensation, Project Works, etc.	Part of VRA Corporate Budget
	2. Environmental Protection Agency	Pre-Construction - Maintenance	Monitor adherence to conditions in environmental permit.	"
	3. District Assemblies	Pre-Construction - /Maintenance	Monitor payment of compensation to ensure receipt of fair and adequate payment to affected persons.	"
	4. Department of Museum		Provide technical assistance in the management of archaeological chance finds	"

Training Activity	Participants	Types of Training	Content	Scheduling	Cost Estimates
EMP Implementation, Redesign, Conflict Resolution,	1. VRA	Desk/ Field	Basic elements of Environmental Management Planning	Pre-Construction	Part of \$346,000 for EIA/Monitoring

Training Activity	Participants	Types of Training	Content	Scheduling	Cost Estimates
etc.	2. Contractor 3. PIU/Supervising Consultants		Impact assessment & identification and prediction techniques Mitigation plans		work
Environmental Policies & Programs	1. VRA 2. PIU/Supervising Consultants	Desk	Environmental laws, regulations and compliance Ghana EIA procedures (including familiarization with provisions of Environmental Assessment Regulations, 1999 (LI 1652). Environmental policies Health and Safety policies	Pre-Construction	Part of \$346,000 for EIA/Monitoring by Independent Review Consultant
Environmental Processes, Methods & Equipment	1. VRA 2. Contractor 3. PIU/Supervising Consultants	Field	Basic elements of Environmental Management Planning Impact assessment – identification and prediction techniques Mitigation plans Monitoring Environmental audit	Construction	Part of VRA Corporate Budget Part of Contract budget

8.14 Proper and adequate records keeping

The Volta River Authority will keep a General Register in the prescribed form as required by the Factories, Offices and Shops Act, 1970 for the duration of the project. Records that will be kept, as prescribed by the abovementioned law will include, inter alia:

- **Accidents and dangerous occurrences**

Particulars to be entered in the Register will include the following:

- i. Date of mishap
- ii. Name(s) of employees involved
- iii. Sex and Age
- iv. Usual Employment
- v. Precise occupation at the time of mishap
- vi. How mishap was caused
- vii. Period of disablement

- **Testing and examination of fire warning systems**

Particulars to be entered in the Register will include the following:

- i. Description of fire warning system
- ii. Date of test or examination
- iii. Particulars of defects found
- iv. Particulars of action taken and date

- **Particulars of Pressure vessels and lifting appliances**

Particulars to be entered in the Register will include the following:

- i. Date of last thorough examination
- ii. Maximum safe working pressure
- iii. Particulars of defects (if any) reported by the certified engineer/surveyor
- iv. Particulars of action taken to remedy defect indicated in iii. (If applicable)
- vi. Name and other particulars of engineer/surveyor including signature

8.15 Independent Review Consultant

An Independent Review Consultant shall be engaged to carry out independent monitoring of all the mitigation measures outlined in the Environmental and Social Impacts Statement, Resettlement Action Plan, Environmental and Social Management Plan and contractors' Environmental Management Plans.

The Environmental Review Consultant shall:

- Oversee all the mitigation plans so as to ensure sound environmental, health, safety and socio-economic practices at the various stages of project implementation.

- Identify and recommend requisite training for building in-house capability of the proponent.

Table 14 Environmental monitoring activities (Addendum to Table 12)

Project Activity	Potential Environmental Impacts	Location	Proposed Mitigation Measures	Institutional Responsibilities [incl. Enforcement & coordination]	Source of funding	Comments
Pre-construction - to - Maintenance Phases	<u>Impacts on Public Health</u>	Areas where workers will be concentrated	Workers will be conveyed to active construction sites each day. No worker camps will be established that might attract sex workers.	VR /Contractor	Part of Project Budget	These activities should be in line with relevant regulatory requirements as outlined under Sections 2.1.2 and 2.2.2
	Spread of HIV/AIDS and other communicable and sexually transmitted diseases (STDs)		HIV/AIDS Education will be given to the workers.	VRA/Contractor	"	
	Effects on EMF levels generated by the transmission system on public health	Entire Transmission Line	Medical care for workers	Contractor	"	
			The electrical transmission line will be designed and constructed to ensure that EMF levels are well below accepted guidelines for occupational and human health exposure limits.	VRA/Contractor/EPA	"	
			Habitations and other permanent structure will be prohibited within the right-of way.	VRA	Part of Project Budget/VRA Corporate Annual Budget	
	<u>Archaeological Chance Finds</u>	Entire Transmission Line	The unearthing of archaeological remains would be monitored during project implementation. Any chance finds would be reported to the Museums & Monuments Board.	VRA/ Contractor / Dept. of Museums	Part of Project Budget/VRA Corporate Annual Budget	
	Construction activities can result in archaeological findings		Procedures for chance finds are outlined in Report.		Part of VRA Corporate Budget	

Project Activity	Potential Environmental Impacts	Location	Proposed Mitigation Measures	Institutional Responsibilities [incl. & Enforcement coordination]	Cost Estimates	Comments
Pre-construction - to - Maintenance Phases	<u>Impacts on Public Health</u>	Areas of concentrated workers	Workers will be conveyed to active construction sites each day. No worker camps will be established that might attract sex workers.	VRA / Contractor	Part of Project Budget	These activities should be in line with relevant regulatory requirements
	Spread of HIV/AIDS and other communicable and sexually transmitted diseases (STDs)		HIV/AIDS Education will be given to the workers.	VRA / Contractor	"	
	Effects on EMF levels generated by the transmission system on public health	Entire Transmission Line	Medical care for workers	Contractor	"	
			The electrical transmission line will be designed and constructed to ensure that EMF levels are well below accepted guidelines for occupational and human health exposure limits.	VRA/ Contractor/EPA	"	
			Habitations and other permanent structure will be prohibited within the right-of way.	VRA	Part of Project Budget/VRA Corporate Annual Budget	
	<u>Archaeological Chance Finds</u>	Entire Transmission Line	The unearthing of archaeological remains would be monitored during project implementation. Any chance finds would be reported to the Museums & Monuments Board.	VRA/Contractor/ Dept. of Museums	Part of Project Budget/VRA Corporate Annual Budget	
	Construction activities can result in archaeological findings		Procedures for chance finds are outlined in Appendix 4.		Part of VRA Corporate Budget	

Proposed Measure	Mitigation	Parameters to be Monitored	Location	Measurements	Frequency of Measurement	Responsibilities [incl. Review and reporting]	Cost (equipment & individuals)
Pre-construction		<p>Line Route Survey</p> <p>Clearing of vegetation cover during line route survey.</p> <ul style="list-style-type: none"> Clearing of farms lands Tree felling (forest reserves) <p>Public Information</p> <p>Disclosure of Environmental Impact Statement Document</p>	Entire proposed route of the Transmission Line	<p>Hectares (area cleared in project area)</p> <p>Disclosure in the National Dailies</p>	<p>Throughout line route survey</p> <p>One Disclosure</p>	<p>VRA/Surveyors/FSD (Report on survey by Contracted surveyors)</p> <p>VRA/EPA</p>	<p>Part of Project Budget</p> <p>Part of VRA Corporate Budget</p>
Construction		<p>Transportation</p> <p>Guidelines provided under section IV of the VRA corporate safety rules 1993 concerning equipment, motor vehicles and transportation of personnel and materials should be applied and closely monitored and recorded. These should include monitoring the following activities:</p> <ul style="list-style-type: none"> Speed Limits of vehicles, traffic congestion on main roads (near project sites) Trucks conditions and maintenance Vehicle accident records Vehicle safety signals (flares, warning lights, reflectors etc) Vehicle fuelling procedures Vehicle loading/off loading procedures Vehicle daily check outs Driving licenses and permit to drive First Aid and Fire Extinguishing kit 	Entire Project location	<p>Km/hr</p> <p>No. of Preventive Maintenance.</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Quantity</p>	<p>Daily</p> <p>Monthly</p> <p>Daily</p> <p>Daily</p> <p>Daily</p> <p>Monthly</p> <p>Daily</p>	<p>Contractor / VRA</p> <p>(Project Progress Report)</p>	<p>Part of Project Budget</p> <p>Part of VRA Corporate Budget</p>
		<p>Civil Works</p> <p>Activities to be monitored under civil works should cover safe working practices in accordance with VRA Corporate Safety Rules 1963 and Factories, Offices and Shops Act 1970 (Act 328). Monitoring criteria would include:</p> <ul style="list-style-type: none"> Protective clothing and working gear Plant and equipment maintenance Safety Test - lifting plant gears (wires, hoisting blocks etc.) Dewatering operations Concrete works Fire patrols (site camps) Dust levels (settlements/watercourses) Waste Management and Disposal 	Entire Project location	<p>Quantity</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>mg/l</p> <p>Kg.</p>	<p>Daily</p> <p>Weekly</p> <p>Daily</p> <p>Daily</p> <p>Weekly</p> <p>Weekly</p> <p>Weekly</p> <p>Daily</p>	<p>Contractor / VRA</p> <p>(Project Progress Report)</p>	<p>Part of Project Budget</p> <p>Part of VRA Corporate Budget</p>

Proposed Measure	Mitigation	Parameters to be Monitored	Location	Measurements	Frequency of Measurement	Responsibilities [incl. Review and reporting]	Cost (equipment & individuals)
Construction Phase		<p>Vegetation Clearing Clearing of vegetation cover at tower tracks, construction accesses, and right-of-way should be monitored under the following activities:</p> <ul style="list-style-type: none"> • Tree felling • Clearing of farms lands • Clearing of right of way (vegetation cut only to 1.25m height) • Clearing of tower track (graded width 2.5m-3m) • Clearing access tracks (graded width 3.5m) 	Entire Project location	<p>No. of trees</p> <p>Hectares</p> <p>Hectares</p> <p>Hectares</p> <p>Hectares</p>	Daily	Contractor / VRA (Project Progress Report)	<p>Part of Project Budget</p> <p>Part of VRA Corporate Budget</p>
Construction Phase		<p>Water quality Selected rivers, streams, and other water bodies in the project areas of environmental influence shall be sampled and analysed for establishment of baseline water quality conditions. These same water bodies shall be monitored during construction phase to ensure compliance with anti-pollution legislation. The following parameters shall be monitored:</p> <ul style="list-style-type: none"> • Biological oxygen demand (BOD₅) • pH • Oil and grease • Total suspended solids • Conductivity • Total coliform • Turbidity <p>Noise Noise levels shall be measured at the same positions as those for the ESIA in communities close to the proposed line.</p>	<p>Relevant water bodies in the way of the proposed RoW</p> <p>Communities close to the line route and having been identified as likely to undergo noise disturbance</p>	<p>mg/l</p> <p>Number</p> <p>mg/l</p> <p>mg/l</p> <p>µS/cm</p> <p>MPN/100ml</p> <p>N.T.U</p> <p>dB_(A)</p>	<p>Every month during construction phase and once a year during operational phase after maintenance operations</p>	<p>An independent Environmental Review Consultant should be contracted carry out monitoring activities on behalf of the VRA</p>	<p>Sourced from project Budget.</p> <p>Part of VRA Corporate Budget</p>

Proposed Measure	Mitigation	Parameters to be Monitored	Location	Measurements	Frequency of Measurement	Responsibilities [incl. Review and reporting]	Cost (equipment & individuals)
Construction Phase		<p><u>Waste Management</u></p> <ul style="list-style-type: none"> Burning of waste bush Waste water handling Waste segregation Waste dump sites Disposal of conductor drums Disposal of metallic waste Disposal of empty chemical containers <p><u>Socio-economic/cultural issues</u></p> <ul style="list-style-type: none"> Shrines Sacred Grove Identifying all affected persons Assessment of compensation Payment of compensation (adequate amounts, timely payments); Archeological Chance finds <p><u>Employment and job creation</u></p> <ul style="list-style-type: none"> HIV/AIDS Education programme 	<p>Entire Project location</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>Entire Project location</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Kgs. Cm³</p> <p>Kgs. Number</p> <p>Number Kgs. Number</p> <p>Number Number Amount Amount</p> <p>Number</p> <p>Number of programmes</p>	<p>Daily</p> <p>Daily</p> <p>Daily</p> <p>Annually</p>	<p>Contractor/ VRA</p> <p>(Project Progress Report)</p> <p>Contractor/ VRA</p> <p>(Project Progress Report)</p> <p>Contractor/ VRA /Museums and Monuments Board</p> <p>(Project Progress Report)</p>	<p>Part of Project Budget</p> <p>Part of VRA Corporate Budget</p> <p>“</p> <p>“</p> <p>“</p>
Operational and Maintenance Phase		<ul style="list-style-type: none"> Routine ground/aerial inspection of lines Towers (vandalism, corrosion) Insulators and accessories (damages, Replacements) Accidents involving lines and structures Occupational hazards and accidents Accidents affecting public safety Substations – oily wastes, transformer oil (PCBs) 	<p>Substations & Entire Project Area</p>	<p>Number Number Number Number Number Cm³</p>	<p>As and when necessary during operational phase of the project cycle</p>	<p>Transmission Systems Dept of VRA (Department Progress Report)</p>	<p>VRA Corporate Annual Budget</p>

8.16 Scheduling & reporting

The monitoring programme shall include a documented monitoring plan, which shall detail all data handling, storage and analyses requirements. VRA shall identify the location where all data is to be held, staff responsibilities for data handling and analysis and appropriate reporting lines for ensuring management are aware of the current status of site operations. This is particularly important with respect to resettlement negotiation, compensation payment and monitoring of implementation of these activities. Compensation schemes can suffer post construction claims from unsatisfied project-affected persons and detailed records keeping of all actions are essential to try to resolve any such issues.

Results of environmental monitoring activities will be reported to allow for identification of mitigation measures that need corrective action. From preconstruction to operation/maintenance phases, VRA will carry the ultimate responsibility of ensuring that environmental reporting procedures are undertaken. The Project Implementation Unit will carry out monthly discussions on the project which will form a forum for discussions on environmental issues, and decision making with regard to further mitigation, monitoring, or changes to construction practices.

The Environmental Coordinator will report directly to the Project Engineer on all environmental activities for inclusion in the project monthly reports. The Environmental Coordinator will use these monthly reports as the basis for the preparation of an annual environmental report (as a requirement of the Environmental Impact Assessment Regulations) to be submitted to the Environmental Protection Agency and relevant international agencies.

All monitoring and reporting documents will be kept on file, as part of VRA documentation procedures. The project reporting schedule is presented in Table 15.

Table 15 Project reporting schedule

Activity	2007				2008		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Mitigation Measures							
Pre-construction							
Line route survey							
Acquisition of right of way							
Line Route Survey Report/ EIA Report							
Construction							
Access tracks				x	x	x	
Transportation of Machinery				x	x	x	

Activity	2007				2008		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Full grading of tower tracks				x	x	x	
Clearing of RoW				x	x	x	
Erection of towers				x	x	x	
Erection of conductors, Shield wires and accessories				x	x	x	
Modification works at substations				x	x	x	
Acquisition of right of way				x	x	x	
Compensation				x	x	x	
<i>Project Monthly Progress Reports</i>				x	x	x	
Operation							
Dropping of conductor							x
Shattering of insulator units							x
<i>Project Monthly Progress Reports</i>							x
Maintenance Phase							
Control of vegetation re-growth							x
Rust treatment							x
<i>Quarterly Reports</i>							x
Construction – Maintenance Phases							
Management of liquid and solid waste				x	x		x
HIV/AIDS Outreach programme				x	x		x
<i>Project Monthly Progress Reports</i>				x	x		x
Environmental Monitoring Activities							
Pre-construction							
Line route survey							
Public information							
<i>Project Monthly Progress Reports</i>	x	x	x	x	x	x	x
Construction							
Transportation of Machinery				x	x	x	x
Civil Works				x	x	x	x
Vegetation clearing				x	x	x	x
Waste Management				x	x	x	x
Socio-economic/Cultural issues				x	x	x	x
Compensation				x	x	x	x
<i>Project Monthly Progress Reports</i>				x	x	x	x
Operation - Maintenance							
Dropping of conductor				x	x	x	x
EMF Levels				x	x	x	x
<i>Quarterly Reports</i>				x	x	x	x
Institutional strengthening							
Volta River Authority	x	x	x	x	x	x	x
Contractor	x	x	x	x	x	x	x
PIU/Supervising Consultants	x	x	x	x	x	x	x
Environmental Protection Agency	x	x	x	x	x	x	x
Land Valuation Board	x	x	x	x	x	x	x
District Assemblies	x	x	x	x	x	x	x
<i>Project Monthly Progress Reports</i>	x	x	x	x	x	x	x
Training							
EMP Implementation, Redesign, Conflict Resolution, etc.				x	x	x	x
Environmental Processes, Methods & Equipment				x	x	x	x
Environmental Policies & Programs				x	x	x	x
Training Reports				x	x	x	x

8.17 Cost of environmental management

The proponent will make human resources available for environmental management and enhancement. In addition, financial provision shall be made to ensure that mitigation measures (including compensation), monitoring and training programmes are effectively implemented. The proponent will make the necessary budgetary provisions to cover all commitments for the Transmission Line Project.

The estimated total budget for environmental and compensation management, as shown in Table 16 below, shall be US \$3,823,446.00.

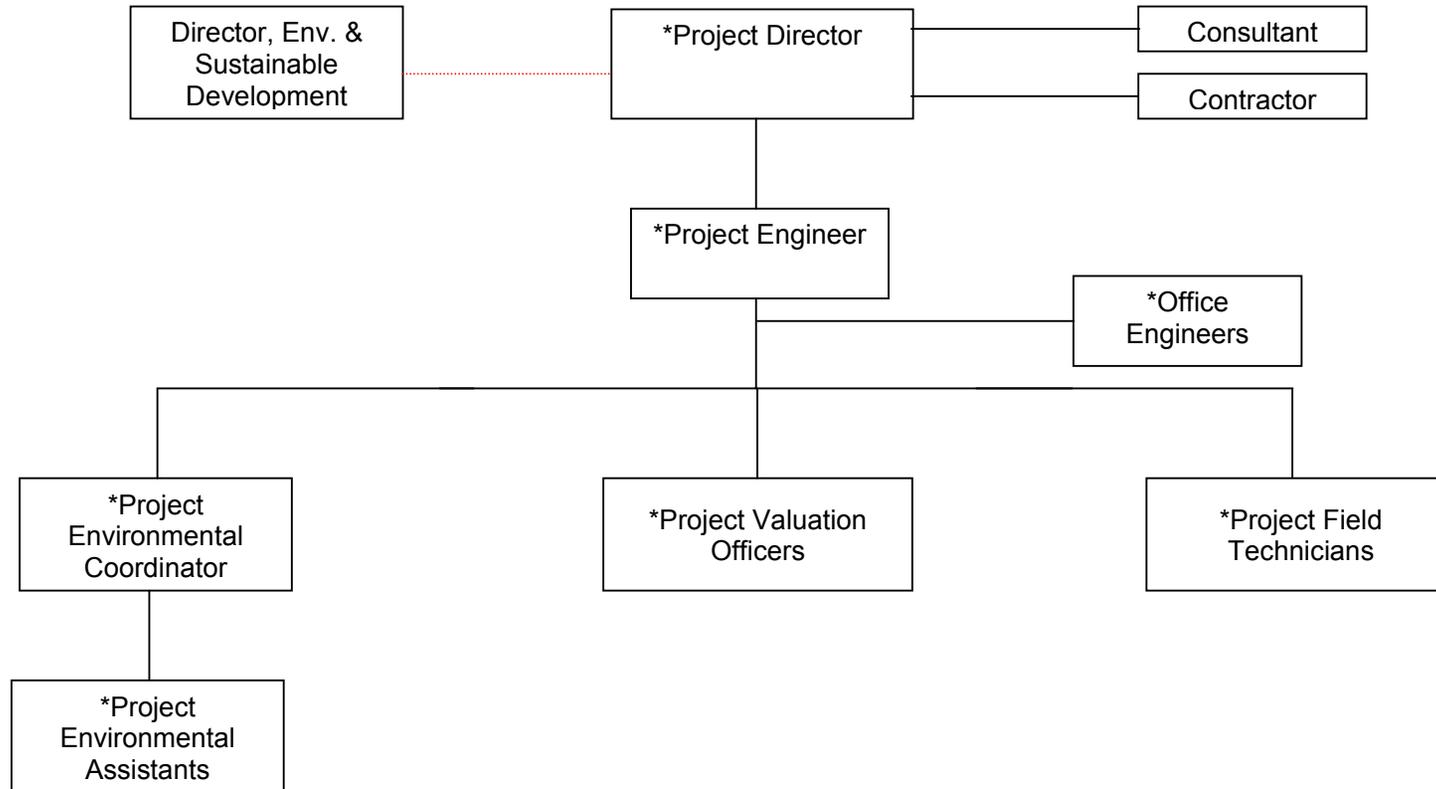
Table 16 Environmental & Compensation Budget

N°	ITEM	US \$
1	Environmental Impact Assessment study	80,000
edit	Review & Disclosure of Environmental Impact Assessment Report	6,000
3	Cost of preparing RAP and ESMP	30,000
4	Environmental Monitoring	110,000
5	Training of environmental management team in-house	20,000
6	IEC (including HIV/AIDS Programmes ¹)	100,000
7	TOTAL ESTIMATES FOR ENVIRONMENTAL WORKS	346,000
9	CROPS COMPENSATION	72,786
	Estimated constructional damages @ 10%	7,280
	Permanent land for towers	173,378
	Add-on amounts for vulnerable project-affected persons	12,000
10	BUILDINGS/STRUCTURES	2,393,513
11	UNDEVELOPED PLOTS FOR RESIDENTIAL PURPOSES	43,478
12	ACCESS TRACKS	87,000
13	PURIFICATION RITES	14,700
14	Contingency allowance of 20% to cater for the effect of probable increases in property values.	507,738
15	Professional fees, reimbursement for permits, etc	165,573

¹Cost of IEC services for the constructional phase of the project cycle. This cost reduces to about US\$30,000 per year for all subsequent years as discussed in Section 8.13.1.

16	TOTAL ESTIMATES FOR COMPENSATION WORKS	3,477,446.00
17	GRAND TOTAL FOR ENVIRONMENTAL AND COMPENSATION WORKS	3,823,446.00

Figure 4 Organisational chart- Project Environmental Management



* **Members of VRA Project Implementation Unit that would coordinate with the contractor/consultant**

9.0 CONSULTATIONS

Some consultations were made with some regulatory agencies, District Assemblies and local communities prior to the preparation of the ESMP. The methodology of the consultations has been discussed below

9.1 Methodology

The communities predicted to be affected by the proposed project were identified with the help of the relevant District Assemblies, the chiefs and people of the project area, survey reports and Topographic maps produced by Survey Department and the environmental and socioeconomic impact consultants. The survey instruments used were questionnaires prepared prior to the survey. A summary of the survey methodology is discussed below.

The survey team moved from community to community and consulted with chiefs, elders, opinion leaders and assemblymen. At the end of each consultation, the names and directions to the nearest villages/communities were elicited from the community that had just been consulted. This was compared with the list that had already been drawn up to ensure that the survey covered all the affected communities. It should be noted that some of the communities are so small that they are not represented on maps.

The consultations start with the normal traditional greetings and exchanges. During these exchanges an interpreter is designated, who usually is a representative of the District Assembly, a Unit Committee member, an Assemblyman, a survey team member, or a teacher in the community.

After the exchanges and greetings the team informs the gatherings about the proposed project and its objectives. All the details that are likely to inform their reactions are explained to the gatherings. The reasons for carrying out the project are also explained.

The Chiefs, invariably, are the first to react to the information. Thereafter with the permission of the Chiefs, the meetings are thrown open for the various reactions of the elders and opinion leaders and the youth.

The survey team then take the gathering through the details of potential environmental impacts that had not been covered by the people. Proposed mitigation measures are then

put forward and explained. Alternate mitigation measures are discussed and the opinions of the communities sought on the appropriateness of such mitigation.

All the findings and decisions are documented in questionnaires and minutes.

9.1.1 Communities in the project's area of influence

Thirty-five communities living close to the proposed pipeline route stretching from Tema in the Greater Accra Region to communities close to Dzodze in the Volta Region were consulted to discuss the implications of the project to their safety, health and welfare. The issues and concerns raised as a result of the consultations have been discussed below.

Some chiefs, opinion leaders, assembly men/women took the view that once government had decided on a project, the project is likely to be pushed through whatever their objections or opinions were. The consultants explained the importance of their opinions and objections, if any, to the project and encouraged them to make the opinions available for discussion.

It will be counter productive to discuss all the results of the various consultations held with all the communities during the field survey since this would be a repetition of the same issues raised at the meetings with the communities. Indeed almost all the issues raised run through almost all the communities consulted. We therefore discuss below only, negative and sensitive (impacts on culture, farms and dwelling places, etc) impacts and concerns expressed by some of the communities consulted.

The main concerns expressed by the communities have been summarised below:

A VISIT TO THREE COMMUNITIES AND A FARM AT BUNDASE BY A TEAM FROM CARDS, ONE OFFICIAL FROM AFRICAN DEVELOPMENT BANK (ADB) AND ONE OFFICIAL FROM VOLTA RIVER AUTHORITY (VRA) ON THE 27TH JULY 2006.

TIME: 12:45pm – 3:20pm

Team from CARDS Official from ADB

Official from VRA

Alex Obuobi.

Mr. Jungan

Ben Sackey

Kwame Sarfo.

Betty Akumatey.

Eric Klobah.
Bortier Rexford.
Frank Dadza.

FARM AT BUNDASE.

INTERPRETER: ERIC KLOBAH

1. The team arrived at the farm at Bundanse at about 12:45 pm.
2. The farmer whose name is Osa Nyemetei was present and he took members through the farm which he said belonged to his brother, next to which was his. Both farms are in the right of way so the pylons would pass through. In his brother's farm was only pepper but in his farm were pepper and maize.
3. Mr. Jungan explained that he was from ADB located in Tunisia and they were one of the financiers of the project.

ISSUES:

1. Mr. Nyemetei expressed happiness about the project, since it was going to contribute to the development of the country. He however wanted to know if he could continue farming when the pylons are put in place.

HELD:

1. Mr. Jungan assured him, he could continue his farming as only 40metres of their farm would be taken. He also told him that the bank would make sure that they are compensated, for any crops that are destroyed or that are found in the right of way.

LAPLELKU VILLAGE

Interpreter: ERIC KLOBA

1. At about 1.15 pm the team arrived at Laplelku village.
2. Most of the elders in the village were absent except for four men who were present.
3. They however, expressed the fact they knew about the visit and the project because the various teams had been to their village and also their family head had called from Tema to inform them of the teams visit that day even though he could not be present.
4. The contact person therefore called the family head in Tema so that Mr. Jungan could talk to him.
5. After talking to the family head in Tema, Mr. Jungan told the members present that he was from ADB, headquarters located in Tunisia. He said that ADB were one of the financiers of the project. He also said that before the bank could release funds for the project, two reports had to be prepared namely (I) Environmental study report and (II) Expropriation study report and that was why he was in the country.
6. He assured them that this wasn't the last time they were seeing the team as other teams would also be visiting them soon.
7. He also said that after this reports had been prepared, there would be a series of public fora in each of the affected communist, for people to talk about their fears and problems, for each one to be addressed before the project could start.
8. He promised them that without their consent or approval and then compensation paid in full, the project would not start.
9. One of the members expressed the fact that unemployment was a problem in the village and so they should be employed when work begins on their land.
10. Mr. Ben Sackey said that he couldn't guarantee ready employment for members of the community, since part of the job requires technical expertise, but then if they made themselves available to the contractor, when the need arises for lay hands to be employed, he was sure they would be recruited as opposed to carrying laborers from afar.
11. The inmates wanted to know if they would have access to the electricity when the project is completed.
12. Mr. Ben Sackey once again assured them that since the project was for the whole country they would also be able to access it.

Community: **Nyigbenya**

Interpreter: **James Kugblenu** (Assembly Man)

1. At about 1:55 the team arrived at Nyigbenya.
2. About 15 towns men were present and as soon as we arrived they all came to meet us at the place scheduled.
3. The natives of this village all attested to the fact that they knew about the project.
4. Some of the natives said they had seen the pegs on their farms and they were also ready to take us to their farms.
5. Mr. Jungan once again talked about the fact that he was from ADB who were one of the financiers of the project. He also explained the nature and process of documents that had to be prepared before the project is approved. He talked about the Environmental study and Expropriation study.
6. Mr. Jungan also said that there was going to be a public forum for each one to come and ask questions and have them resolved. He promised the people that this wasn't the last time they were seeing such a team, but then, there would be more visits.

ISSUES

- (a) Natives wanted to know if government was going to pay for the land or for crops that was on the land and to whom compensation would be paid.
- (b) Natives also wanted to know if government was going to pay for the whole farm or just of the farm
- (c) Natives shared the view that since this was a high voltage what would happen if the cables should fall.
- (d) Natives also wanted to know how soon project would start.
- (e) The natives also shared the views that the value of the land would go down since no one would want to go close to such high tensions cables.
- (f) They also asked about the possibility of them been employed on the project, since unemployment was an issue.

HELD

- (a) Mr. Jungan made them to understand through the translation/assemblyman that they would be paid both for crops and land. He even went further to say that if an

orange tree for example is destroyed; they were going to be compensated for all the number of years the tree would bear fruit.

- (b) They were told that only affect part of the farm affected would be paid for. Mr. Jungan used his own personal experience to explain.
- (c) They were also assured that this was a remote possibility officials cited thunder as an example.
- (d) Natives were told once we were there meant that project had started but then it was a step by step process.
- (e) They were made to know that value of land would not be affected as only part of land (40m) was what would be taken, and that they could use the land as any other place.
- (f) Natives were not given assurance of employment but they were told that it was a possibility that contractor would recruit from town.

Inhabitants of Nyigbenya present

1. Kadili Agoki
2. Samuel Akwetei
3. Joseph Narh Akotei
4. Ofoli Kumodji
5. John Kumodji
6. Ebenezer Akotei
7. Shaibu Shodji
8. Daniel Koblah Akutei
9. Benni Agama
10. Dugbatey Ayila
11. Jacob Ofori
12. Gideon Ofori
13. Joseph Ofori
14. John T. Bedae
15. John Kublenu Tetteh – Assemblyman

Contact through Wisdom Kublenu – (Contact tel: 0243-941212)

Community: **Dawa**

Interpreter: A Vanguard (Assemblyman)

- The team arrived at Dawa at about 2:40pm.
- The team had already contacted the people of Dawa so they were all seated and ready for us when we go there.
- The meeting was held at ASAFOATSE KWETHEY ADELA IV's house.
- Mr. Ben Sackey was the main speaker at Dawa, as he gave a general overview of the project.
- Mr. Ben Sackey introduced Mr. Jungan and explained why he was in the country.
- The people through their spokesperson/assemblyman acknowledged the fact that they knew and had been contacted about the project. Some of them had even seen the pegs on their lands.

ISSUES

1. Natives wanted to know if the project won't pose any danger to any village around, even when the village wasn't in the corridor.
2. Natives wanted to know what would happen if some people try to take advantage of the project, by planting so that a lot would have to be destroyed so they earn more.
3. Natives also wanted to know what to do if one has bought a land but it happens that the land is in the right of way. But the land bought was intended for building purposes.
4. Natives wanted to know what will happen when there is a different land owner and a separate farmer.
5. The issue of unemployment was raised over there too by the assemblyman. They pleaded to be involved in the project, when it gets to their town.

HELD.

1. Mr. Ben Sackey reacted by telling them that there won't be any problem. All the project needed was the 40m width which they had already talked about.
2. Mr. Ben Sackey once again told the people that as the survey team moves along they take note of any things that are present or which they have destroyed and so if any one tries to take advantage that person would be found out, since data is

collected for every move the team make and after words date would be collected once for confirmation purposes.

3. He said that compensation would be paid to owners of the land if they can prove ownership by showing the documents that cover it. He however, also stressed the need for individuals to hold on such projects if they are in the right of way.
4. Mr. Sackey said that where there was a conflict of ownership, no compensation would be paid, till that issued is resolved. However where there were different people ploughing a land to the owner of the land, compensation would be paid to both the farmer for his crops and owner for his land.
5. Once again Mr. Sackey said that employment could not be guaranteed, but then it was possible that the contractor might want to recruit from the localities where they were working, so they might be employed, but that he couldn't promise.
6. Ms. Akumatey also urged the people to spread the news to their other colleagues or friends, so that everyone would be in the know. She pleaded with them to bear with the surveyors since there had been reports that some of the surveyors had been harassed, the day before.
7. Mr. Ben Sackey also stressed the fact that compensation would be fully paid for once and not in bits, so he pleaded with them to allow the necessary documentation to be done before payment. He also said that the compensation would leave them in a better position.
8. Mr. Jungan reminded them that there was going to be a public forum that everyone could come and have their problems addressed before the project starts.
9. At about 3:20pm Asafoatse moved for the meeting to come to an end which was recorded by the assemblyman, so at about 3:25 the meeting was brought to an end, with the team retiring to Ada.

Presents at the meeting

1. Moro Akwetey
2. Adela-Ti Ibrahim
3. Teye-Wayo Tetteh
4. Tei Mensah Kwao
5. Akwetey Narteh
6. Ineqauw Adela
7. Mensah Tetteh

8. Mensah Kofi
9. Kwei Narh Kwao
10. Mensah Seidu
11. Asafoatse Kwetey Adela IV (Contact tel: 0243-682-739)
12. Issah A. Vanguard

Community: **Ahorlikope, Akatsi District.**

Concerns raised:

The concerns raised by the community members included:

- The loss of properties such as houses, farmlands, crops, etc within the project corridor. The affected persons should be paid prompt and appropriate compensation.
- The community will expect a feed back from the SEST as well as any other consultants connected with the project especially concerning properties that will fall within the project corridor.
- They emphasized that sensitization on the proposed project should be carried out through the political leadership in the communities-assembly members, MP, DCE, etc. (people who have the trust of the communities) in order that the people are convinced to dispel doubts.

Present at the meeting:

Name	Designation
Togbui Adonor III	Community chief
Ahorli Awuleshie	Farmer
Kwaku Ekpor	Farmer
Manonyikpo Afi Ahorli	Farmer
Stephen Sefordzi	Farmer
Dashie Ahorli	Farmer
Papa Ahiabli	Farmer
Ahorli Awuleshie	Farmer
Patience Edo	Farmer
Ahorli Huanyawor	Farmer
Albert Ahorli	Farmer
Emmanuel Ahorli	Farmer

Wilson Ahorli

Chief fetish priest

Community: **Yorkutikpo**, North Tongu District**Concerns raised**

The major concerns of the authorities are:

- All persons whose properties would be affected should be paid the appropriate compensation.
- Should there be the need for resettlement this should be done properly with the provision of appropriate housing infrastructure and basic social facilities such as health, water and sanitation, education, etc.

Land for any resettlement scheme will be available.

Present at the meeting:

Name	Designation
	Opinion
John Dzobo	leader/Teacher
Aku Ayikpa	Farmer
Awo Amediku	Farmer
Veronica Afetor	Farmer
Isaac Sogah	Farmer
Mama Norkuawu	Farmer
Dzinadoa Beble	Farmer
Vida Ahorlu	Farmer
Eugene Tsilenya	Farmer
Clifford Vidza	Farmer
Patience Klukpui	Farmer
Gabriel Adjei	Farmer
Adzo Akpalu	Farmer
Francis Avor	Farmer
Mansah Afetor	Community elder
Americana Amediku	Farmer

Victoria Tamakloe	Farmer
Dodzi Hoggar	Farmer
Wisdom Gadasu	Farmer
Samuel Gadasu	Farmer

Community: **Adetsewui, Akatsi District**

Concerns raised:

Despite the perceived advantages, the following concerns were raised;

- Loss of peoples' livelihoods through the loss of farmlands within the project corridor
- Possible loss of dwelling places
- Poor resettlement and compensation packages as experienced in some past projects.

Present at the meeting:

Name	Designation
Togbui Dzatah II	Village Chief
Hufordzi Ahelegbe	Farmer
Husunu Amenyo	Farmer
Adzo Amenyo	Farmer
Madam Tagbu Adorkawo	Farmer
Hushiyor Gbewordi	Farmer
Samuel Aurleme	Farmer
Togbui Adorkanu	Community elder
Moses Sonyaglo	Farmer
Awuleshi Togbale	Farmer
Fashi Nomenyo	Farmer
Mawunya Ahamah	Farmer
Mawunya Ahamah	Farmer
Shitor Adzodenya	Farmer
Amewomuna Dashiah	Farmer
Adzodeha Husunoo	Farmer
Sodzinushi Akaglo	Farmer

Hudzenugor Agbeviade	Farmer
Lulie Avu	Farmer
Vicent Akagla	Farmer
Senyo Awleme	Farmer
Samuel Akaglo	Farmer

Community: **Tadzewu-Akpadzrakope, Ketu District**

Concerns raised:

- The main concern raised by the gathering was that land in the district has a very high premium due the serious sea erosion affecting the district. Therefore any project that affects peoples' land is critically appraised.
- Any land or property that is affected by the project should be promptly and adequately compensated.
- The community should directly benefit from the project by way of provision of electricity to the community when the project is implemented.

Present at the meeting:

Name	Designation
John Sogah	Farmer
Nani Amenyadzi	Farmer
Nanewortor Amuzu	Farmer
Mamavi Ezi	Farmer
Torgbui Kutu Agbozo	Village chief
Godwin A. Kunake	Farmer
Torgbui Agbozo	Community elder
Kwashi Gana	Farmer
Cephas Akpadzra	Farmer
Dogbey Afortude	Farmer
Dameshie Kpofo	Farmer
O. Vovomeli	Farmer
Kofi Gavor	Farmer
Cephas Akpadzra	Farmer

Raphel Nanewortor

Distiller

Abla Noshri

Farmer

Table 17 List of persons consulted at the District Assemblies

DISTRICT ASSEMBLY	NAME	POSITION
Tema Municipal (TMA)	1. Mr. David Annan 2. Mr. G.K. Scott 3. Mr. Henry Owusu 4. Mr. Francis Esandoh	MCE MCD MDPO Asst. MDPO
Dangme West	1. Mr. M.T.A. Nerterey 2. Mr. A.K. Agblewornu 3. Mr. Ali Amadu 4. Ms Adelaide Adu 5. Mr. Douglas Animley	DCE DCD Asst. DDPO CDO CDO
Dangme East	1. Mr. Israel Baaku 2. Mr. G.H. Dari 3. Mr. Mohamed Yakubu 4. Mr. Francis Abofra 5. Mr. Patrick Nyonator 6. Mr. F. Abaka-Quansah	DCE DCD DDCD DDPO DBO Dist. Engineer
South Tongu	1. Mr. James Martey 2. Mr. Samuel Kitah	DCD DDPO
North Tongu	1. Mr. Peter Thompson 2. Mr. Adadevor	DCD DDPO
Akatsi	1. Mr. Eli Tsikata 2. Mr. Elom Tibu	DDCD (Ag. DCD) DBO (Ag. DDPO)
Ketu	1. Mr. Akpe Afenyo	DDPO

Annexure

Table 18 Sensitization Programme and List of Persons consulted

Date	District	Name	Position	Contact Tel.
26/5/06	Tema Municipal Assembly (TMA)	1. Mr. F. Esandoh 2. Hon. J. Nortey 3. Hon. J. Akpeng	Asst. DDPO AM, Kpone AM, Kpone	0208524068 0277535396 0243272919
26/5/06	Dangme West DA	1. Mr. Ali Amadu 2. Nene Gyebi II 3. Hon. E.A. Vanguard 4. Hon. J. Kugblenu	Asst. DDPO AM, Dawhenya AM, Dawa AM, Nyigbenya	0244270344 0244159132 0243465673 c/o 0243180244
26/5/06	Dangme East DA	1. Mr. G.H. Dari 2. Mr. Y. Mohamed 3. Hon. S. Quaye 4. Hon. D. Hormeku	DCD DDCD AM, Sege AM, North Kasse	0244961736 0244771711 - -
27/5/06				
27/5/06				
29/5/06	Ketu DA	1. Mr. Akpe Afenyo 2. Mr. J. Kudjo 3. Hon. AMs	DDPO DCD Executive C'ttee	0208187288 - -
29/5/06	Akatsi DA	1. Mr. Elom Tibu	DBO/Ag. DDPO	0244587111
29/5/06	South Tongu DA	1. Mr. Samuel Kitah 2. Hon. Isaac Akpabi	DDPO AM, Yorkitikpo	0243078845 021-662731
29/5/06	North Tongu DA	1. Mr. Alfred Adadevor 2. Mr. C. Kporvi	DDPO Opinion Leader, Kpedzeglo	0246225329 -

Figure 5 Map of Tema District

Source: District Planning Office

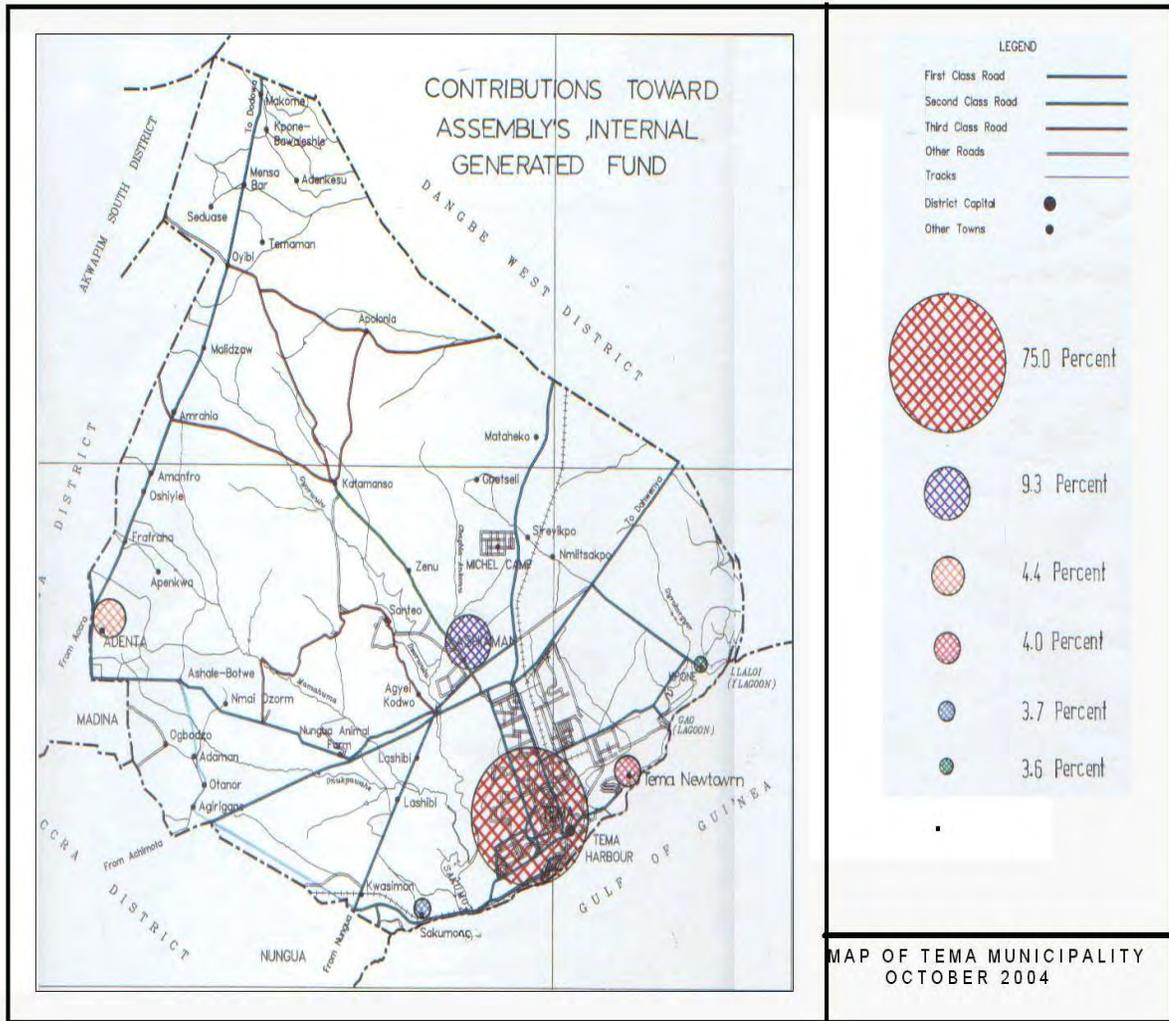
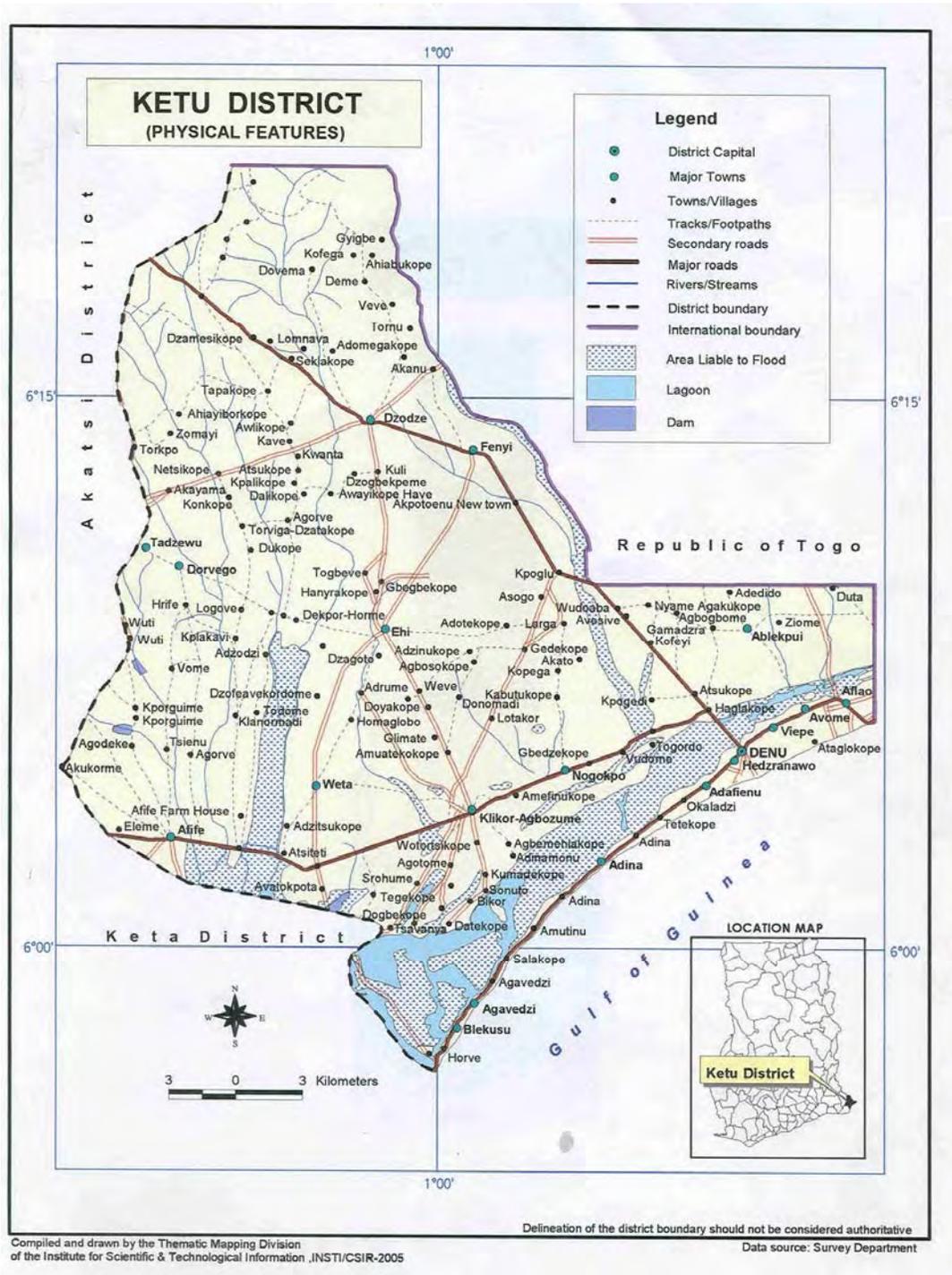


Figure 7 Map of Ketu District



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