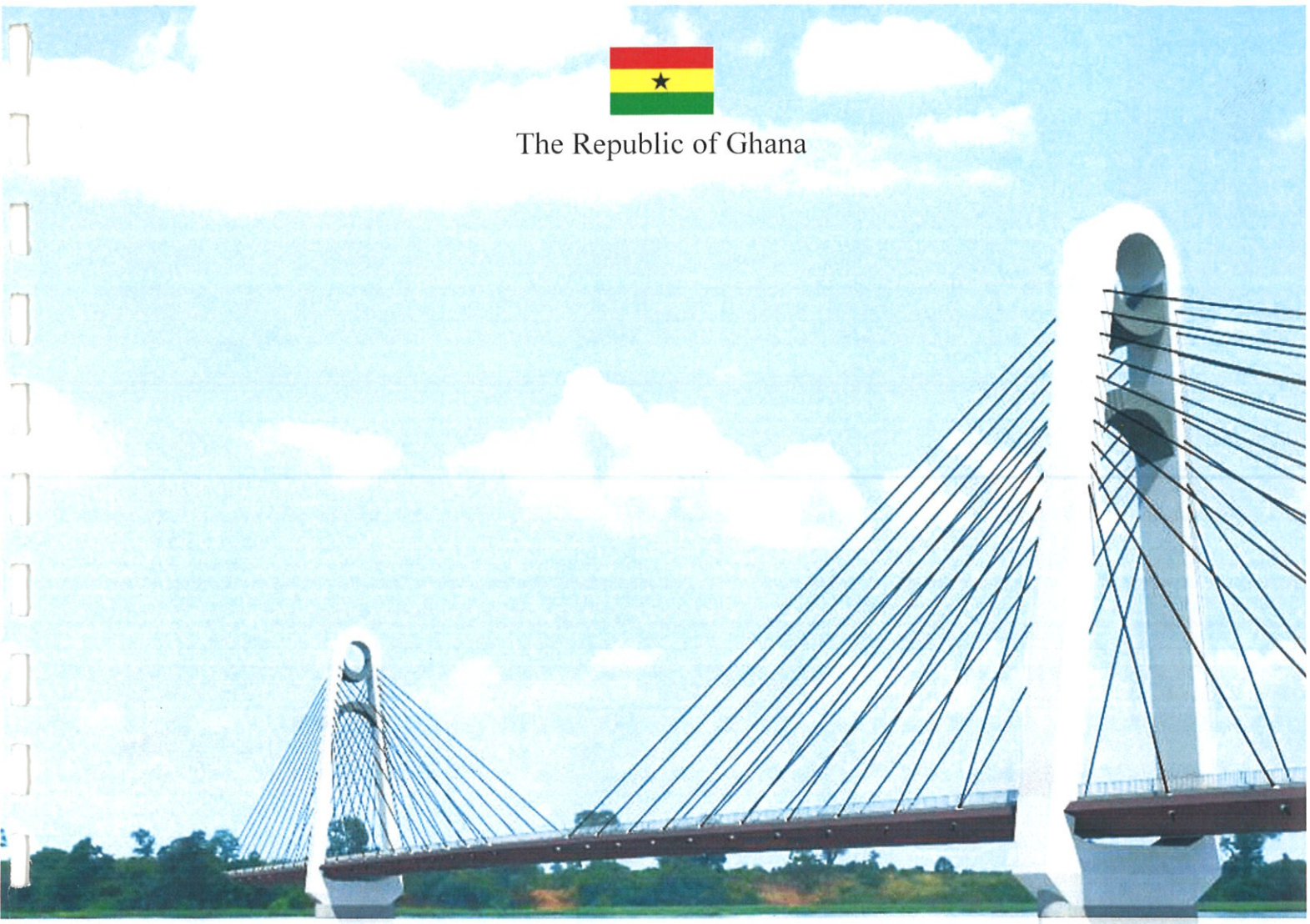
The Republic of Ghana



ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT (ESIA)

FOR
CONSULTING SERVICES FOR DESIGN REVIEW AND CONSTRUCTION SUPERVISION FOR CONSTRUCTION OF A NEW BRIDGE ACROSS THE VOLTA RIVER ON THE EASTERN CORRIDOR PROJECT

March 2020

Joint venture of :

CENTRAL CONSULTANT INC.,

ORIENTAL CONSULTANTS GLOBAL CO., LTD.

In Association with

HAG Consult Ltd. and Associated Consultants Ltd.

Loan No.: GH-P13

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LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ABC	Accelerated Bridge Constructions Technique
AfDB	African Development Bank
CO_2	Carbon Dioxide
DANIDA	Danish International Development Agency
DFR	Department of Feeder Roads
DUR	Department of Urban Roads
EA	Environmental Assessment
ECG	Electricity Company of Ghana
EMU	Environmental Management Unit
ESO	Environmental and Safety Officer
EPA	Environmental Protection Agency
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
FC	Forestry Commission
GHA	Ghana Highway Authority
GoG	Government of Ghana
GRIDCo	Ghana Grid Company Limited
GSS	Ghana Statistical Services
GWCL	Ghana Water Company Limited
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
LVD	Land Valuation Division
MRH	Ministry of Roads and Highway
NGOs	Non-Governmental Organisations
ODA	Official Development Assistants
OHS	Occupational Health and Safety
P_M	Particulate Matter
PAPs	Project Affected Persons
ROW	Right of Way
RPF	Resettlement Policy Framework
STEP	Special Terms for Economic Partnership
STI	Sexually Transmitted Infections
TSP	Total Suspended Particles
WHO	World Health Organisation
WRC	Water Resource Commission

EXECUTIVE SUMMARY

The Government of the Republic of Ghana (hereinafter referred to as "GoG") has received the Japanese ODA loan from the Japan International Cooperation Agency (hereinafter referred to as "JICA") to finance the Construction of a New Bridge across the Volta River on the Eastern Corridor Project (hereinafter referred to as "the Project") which is to strengthen and secure the transport capacity of the Eastern Corridor in Ghana through construction of a new bridge across the Volta river, thereby contributes to economic revitalization and poverty reduction in the area along the corridor and neighbouring countries.

The project scope includes the following:

1) Construction of a new bridge across the Volta River approximately 540m
2) Construction of approach roads on both sides of the new bridge; approximately 1000m in total. The approach roads in the project consists of two parts;
   a) bridge approach roads on both sides of the Volta River, and b) roundabouts connecting to:
      i. The south section of the Eastern Corridor between Asutsuare Junction and Volivo, and Asutsuare .Aveyime Road
      ii. The northern section of the Eastern Corridor between Dufor Adidome and Ashikuma Junction, and the feeder road between Juapong and Volo.
3) Construction of toll plazas
4) Design and installation of lighting system

The GoG acting through the Ghana Highway Authority (GHA) awarded a contract to Messrs Central Consultant Inc. in Joint Venture with Oriental Consultants Global Co., Limited and in association with HAG Consult Limited and Associated Consultants Limited in Accra, Ghana to undertake ***Consulting Services for Design Review and Construction Supervision for the Construction of a New Bridge across the Volta River on the Eastern Corridor Project (GH-P13).*** The project zone is the Volta River bounded to the south by Volivo and to the north by Dufor Adidome.

The Consulting Services include but are not limited to the following:

Review of Detailed Design, Assistance in the bidding process and contract negotiation, Construction supervision, Environmental and social management/monitoring, Transfer Technology, Assistance and supervision on construction safety, Assistance on public promotion, and Coordination with other related works.

Under Ghana's environmental law, construction of roads and highways is classified as environmentally critical and consequently subject to an Environmental and Social Impact Assessment, an Environmental and Social Impact Statement has been prepared, which is presented hereunder.

The objective of the ESIA is to:

- Establish baseline information on both natural and built environment including the socio economic activities within the corridors of the project road.
- Assess and possibly quantify positive and negative impacts.
- Propose effective measures to mitigate the negative impacts.
- Outline management clauses and enforcement of the mechanisms to be included in the contract document regarding the implementation of the mitigation measures, and
- Prepare a monitoring and management plan indicating parameters to be monitored, responsibilities and outputs.

Methodology

The initial EIA Study covered a review of relevant literature followed by field work in the form of scoping and gathering of environmental baseline data. During scoping, consultations were held with various stakeholders whose concerns were incorporated into the EIA Terms of Reference. Baseline data were assembled through field study. On the basis of information obtained from the above activities, potential positive and negative impacts of the project were identified.

Baseline Conditions

Baseline studies enabled the gathering of information on the existing biophysical and socio economic information. The project site is located approximately 75 km north-east of Accra on the Eastern Corridor across two districts (i.e. Shai Osudoku District) on the south side of the river bank and North Tongu District on the northern side). The project corridor falls within the southeast coastal plain(the Shai Osudoku part) one of the hottest and driest areas in the country with maximum temperature of 40°C and tropical region North Tongu District)characterised by double maxima rainfall and average humidity of 80%.In the project zone are located two spiritual baobab trees on the centre alignment of the approach road in the Dufor Adidome side and the approach road on the Volivo side will cross the existing Asutsuare-Aveyime road at just west of the Volivo Basic School.

Consideration of Alternatives

Alternatives to the project were considered and a conclusion was reached that the net benefits could only be achieved if the construction went ahead. The construction of the bridge would considerably contribute to the economic revitalisation of the surrounding areas.

Potential Impacts and Mitigation Measures

The impacts that may be expected are dealt with and are common to most road construction projects. Negative impacts such as noise, dust, disruption in road use etc., may be expected for limited duration during the construction period. Considerable increases in traffic flows and danger to pedestrians and livestock in the communities are also anticipated during the operational phase. However, the positive impacts will include significant reduction in travel time, increased travel comfort of travel and increases in economic activities among others.

Mitigation measures have been proposed to address the negative impacts and to enhance the positive ones. These include operation and maintenance of equipment in accordance to manufacturer's specifications to minimise emission of particulates and noise; appropriate disposal or reuse of excavated material; implementation of management practices to eliminate breeding sites of disease vectors and prevent the creation of new ones; implementing appropriate traffic management measures; and ensuring strict Occupational Safety and Health (OSH) standards at the base camp.

Expected Residual Effects and Environmental Hazard Management

With the implementation and strict adherence to mitigation measures it is expected that residual impacts will be of low significance. There are however some positive residual impacts that can be realised such as improvement in economic standard and increased awareness of health and safety issues. Construction of a road involves occupational health and safety risks to road workers, primarily in the areas of storage and handling of materials, and operation of heavy machinery. The failure of environmental mitigation can result in serious impacts such as erosion, increased road accidents and disruption of the community lifestyles. In view of this, an emergency response plan is proposed to be put in place to deal with environmental /public health emergencies associated with accidents.

Stakeholder and Public Consultation

Stakeholder and public consultations is an essential part of the ESIA process. Public forums are a means to disseminate information about the Project to the local and interested public, to obtain support and cooperation from them, as well as to give them a platform to address their opinions and concerns directly to the Project Proponent. Both EPA (Ghana) and JICA require that stakeholders are consulted to seek their views and opinions regarding the project before they are implemented. The GHA conducted initial public consultations during the feasibility studies at Asutsuare on the 10th of September, 2012 and at Juapong on the 11th of September, 2012, in which bridge construction across the Volta River was explained and discussed. Notably, a focus group discussion was held at Dufor Adidome with the opinion leaders including the Fetish priest and the assemblyman on the 18th of October, 2014 in which, the people provided suggestions and advices to the GHA as to how to deal with sensitive matters such as the removal of the sacred baobab trees and the cemetery. Through this process, stakeholders and the public have an opportunity to contribute to the overall project design by making recommendations and raising concerns. In addition, the process creates a sense of responsibility, commitment and local ownership for smooth implementation of the project. This was the objective of these consultation forums. Because it has been six years since the last public consultation for the Project, another public consultation/forum for the Project will be held to remind the public of the Project and regain their support. Individual consultations have also been done to seek views of the Project affected persons.

Monitoring

An Environmental Management and Monitoring Programme have been developed. The programme comprises elements to be incorporated as requirements specified in the Contract Documents. The responsibilities of the concerned parties are stated. Environmental monitoring and enforcement requirements are presented along with their outputs.

Environmental and Social Management Plan

This section documents a set of guidelines for implementing and incorporating environmental management practices to minimise adverse environmental impacts associated with the construction of the new bridge and its approach roads. Its aim is to establish environmental management standard guidelines for all parties involved in undertaking their various tasks and responsibilities for the project.

Conclusion

Extensive consultations were held with a number of stakeholders and generally, they were of the view that even though the construction phase of the project will inconvenience them in deferent ways, the benefit of the new bridge will outweigh the inconveniences, most of which is temporary. The project is therefore generally accepted and recommended for implementation assuming the designing and implementation of appropriate environmental management measures.

1.0 INTRODUCTION

1.1 Background

The trunk highway network in Ghana consists of three international corridors i.e. Central, Western and Eastern. The Eastern Corridor is the shortest route connecting the most important port of Ghana, Tema Port, and Burkina Faso, and development of this corridor will contribute to the development of less-developed areas along this corridor. Hence, development of the Eastern Corridor has a high priority, and development plans have been carried out with financial assistance from some development partners, including Japan. The Japan International Cooperation Agency (JICA) has identified the importance of the Eastern Corridor in the cooperation policy for Ghana "Development of infrastructure to support economic growth", and conducted the "Preparatory Survey on the Eastern Corridor Development Project (Master plan and feasibility study: Field Studies) to assist the development of the Eastern Corridor, and proposed construction of 67 km of new road, including a new bridge across the Volta River, after comparing various alternatives.

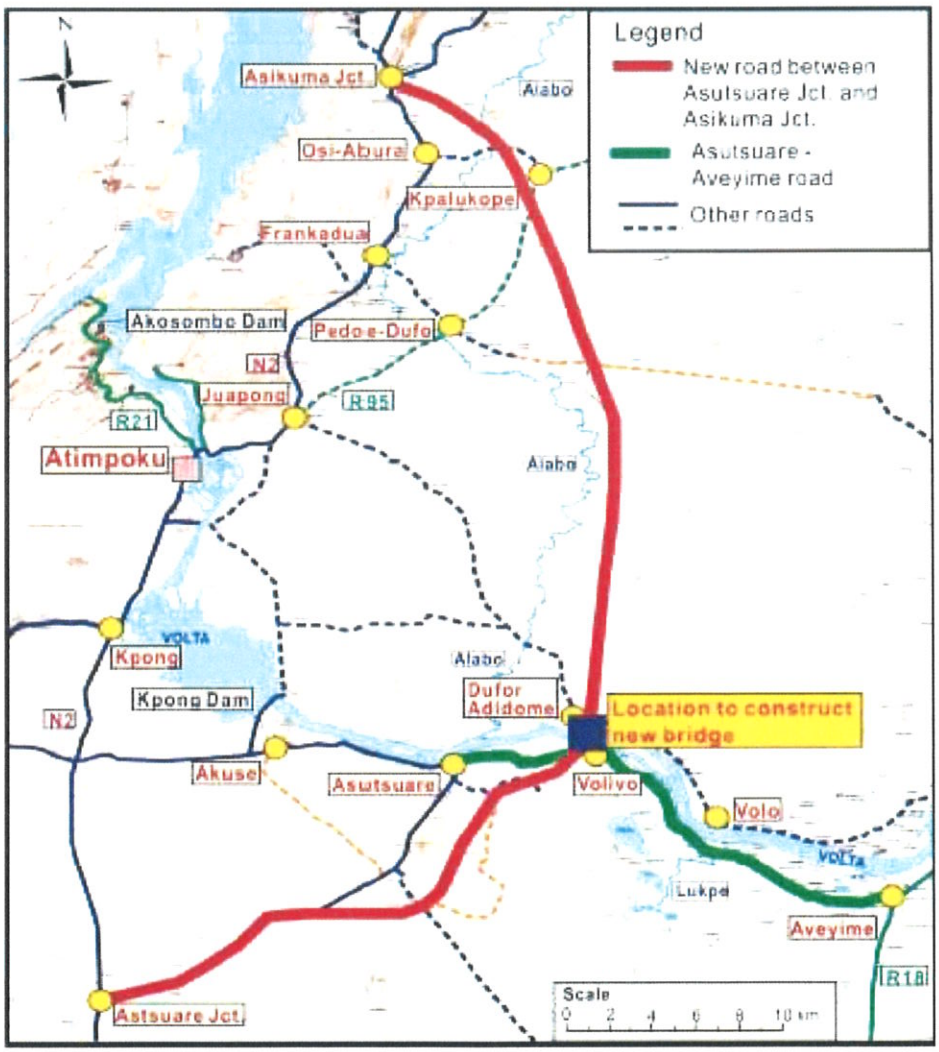


Figure 1: Location of the Project Site

Based on this proposal, the GoG has decided to develop this road section with financial assistance from the African Development Bank (AfDB). And the GoG requested the Government of Japan to execute a Yen Loan project to construct a new bridge across the Volta River by applying the Special Terms for Economic Partnership (STEP) scheme, in order to construct a high-quality, durable, and economically viable bridge by applying various Japanese technologies.

1.2 Project Objectives

The objective of the Study is to carry out detailed design and prepare draft bidding documents for the project to construct a new bridge across the Volta River and its approach road by using a Yen Loan and applying the STEP scheme.

1.3 ESIA Study Objectives

The objective of the ESIA is to:

- Establish baseline information on both natural and built environment including the socio economic activities within the corridors of the project road.
- Assess both positive and negative impacts.
- Propose effective measures to mitigate the negative impacts.
- Outline management clauses and enforcement of the mechanisms to be included in the contract document regarding the implementation of the mitigation measures, and
- Prepare a monitoring and management plan indicating parameters to be monitored, responsibilities and outputs.

1.4 ESIA Study Scope

The scope of the ESIA Environmental Social Impart Assessment (ESIA) Study follows the requirements of both the Environmental Protection Agency and JICA. Geographically the study is limited to the immediate environs of the project bridge. It will consider but not be limited to the following:

- The socio economic effects that the actual works will have on the communities along the road.
- Consulting with government agencies, traditional rulers, community leaders and other interested members of the public.
- Establishing an environmental baseline for the project area.
- Assessing environmental and social impacts resulting from the project and their significance;
- Recommending appropriate measures to mitigate potential negative impacts and enhance positive ones.
- Preparing management clauses to be included in the contract document; and

- Outlining a monitoring plan, including parameters to be monitored, timelines and responsibilities for implementation.

1.5 ESIA Methodology

The data and information for this study was obtained through field visits, review of literature including legislation related to the project implementation and public consultations.

1.5.1 Review of Relevant Literature

The team reviewed relevant policies and legislations and related documents with regard to the project to ensure that the design of the project is compliant with laws of Ghana and JICA. These included:

- Environmental Assessment Regulations LI 1652,1999
- Ghana Environmental Protection Agency (EPA) Act, 1994 (Act 490)
- JICA Environmental Guidelines (2010)
- Criminal Code (Act 29), Section 296-297
- Water Resource Commission, 1996 (Act 522)
- The 1992 Constitution of the Republic of Ghana
- The Lands (Statutory Wayleaves) Act 1963, Act 186
- Labour Act,2003 (Act 651)

1.5.2 Field Work

The study team conducted field visits to investigate issues of concern. These involved on-site field inspection of the proposed project and its surroundings to establish environmental and socio- economic baseline conditions on which the identification of impacts and their corresponding mitigation measures were based.

On the 5th of November, 2014, the GHA carried out an initial survey/inspection at the project site as part of the basic design in order to identify any residents, land, buildings, crops and other assets that are located within the 90 m right of way (ROW) set by the GHA for the project-affected area along the Eastern Corridor. The result of this inspection confirmed that there would be no involuntary resettlement for the project but that a limited number of non-governmental plots of land would need to be acquired in areas where currently no road exists.

Following the initial survey, a more detailed survey was carried out by the GHA in the detailed design stage on the 3rd of February and on the 26th, 27th and 30th of March, 2015. The objectives of the detailed survey were: to confirm the exact extent of land acquisition by measuring the size of the land and other structures subject to seizure, if not demolition; to identify the scale and types of crops and other assets affected; and to estimate the monetary value of them in order to calculate an appropriate amount of compensation to be made to each of the PAPs.

The central policy of the ESIA is to provide an opportunity for public participation in the project design and implementation throughout the entire ESIA process. In this respect, stakeholders who included Project Affected Persons, Traditional Leaders, Government and Municipal assembly officials who are likely to be affected directly or indirectly by the implementation of the proposed project were consulted. These consultations brought to light people's views, fears and expectations making it easy to identify major environmental and socio-economic concerns. Furthermore, Public consultations provided the study team the opportunity to inform the community members about the proposed project. Further assessment and consultations has also been done in December 2019 and January to March 2020.

1.6 Environmental and Social Impact Statement

All identified significant adverse impacts were considered and specific, practicable mitigation measures proposed. A monitoring programme has been formulated to monitor trends as a result of the project and thus create the opportunity to minimise adverse effects due to uncertainties in the impact assessment. On the basis of the Terms of Reference, this Environmental and Social Impact Statement is prepared with the following major components:

1. Executive Summary,
2. Introduction
3. Policy, legal and administrative framework,
4. Description of Project
5. Description of Project Environment,
6. Analysis of Alternative Approaches,
7. Potential Environmental and Social Impacts
8. Mitigation of Environmental Impacts and Complementary initiatives
9. Expected residual effects and environmental hazard management
10. Environmental Monitoring Plan,
11. Public Consultations,
12. Environmental and Social Management Plan
13. Institutional Capacities and Strengthening plan
14. Conclusion
15. Appendixes

2.0 ENVIRONMENTAL POLICY AND INSTITUTIONAL FRAMEWORK

2.1 Ghana Government Environmental Policy

The ultimate aim of the National Environmental Policy of Ghana is to improve the surroundings, living conditions and the quality of life for all citizens, both present and future.

It seeks to ensure reconciliation between economic development and natural resource conservation, to make high quality environment a key element supporting the country's economic and social development (EPA, 1991). This environmental policy specifically seeks to:

- Maintain ecosystems and ecological processes essential for the functioning of the biosphere;
- Ensure sound management of natural resources and the environment;
- Adequately protect humans animals and plants, their biological communities and habitats against harmful impacts and destructive practices and preservation biological diversity;
- Guide development in accordance with quality requirements to prevent, reduce, and as far as possible, eliminate pollution and nuisances;
- Integrate environmental considerations in sectoral, structural and social-economic planning at the national, regional, district and grassroots levels;
- Seek common solutions to environmental problems in West Africa, Africa and the world at large.

Environmental protection in Ghana is guided by the preventive approach, that is, with the recognition that socio-economic development must be undertaken in such a way as to avoid the creation of environmental problems. Creation of awareness, among all sections of the community, of the environment and its relationship to socio-economic development, and of the necessity for rational resource use among all sectors of the country is vital part of the overall objective. Public participation in the environmental decision-making process is an important element of government policy.

2.2 Legal and Institutional Framework

There are a number of international and local laws and regulations concerned with development, health related matters and the environment in general. The major laws related to this project include:

- Environmental Assessment Regulations LI 1652, 1999- To provide guidance and ensure adequate consideration of biodiversity and related sensitive resources when conducting Environmental Impact Assessments for this project.
- Environmental Protection Agency, Act 490, 1994 - Responsible for advising government on all matters relating to the environment - monitoring sound ecological balance and coordinating environment activities, education and research and the provision of an environmental permit for this project. The Act also specifies requirements for the production of an EIA for the proposed road works.
- Criminal Code (Act 29) Section 296-297, 1960 - Prevents the accumulation and exposure of filth and refuse of all kinds and the prohibition of activities, which may endanger public health or cause damage to lands, crops, cattle or goods. For this

project, the Act places an obligation to the contractor to desist from project activities that will pose danger to health and safety. It seeks to control public nuisance and ensure safety and security from construction activities.

- Water Resources Commission Act 522, (1996)- provides for the preparation of comprehensive plans for the regulation, utilization, conservation, development and improvement of water resources and develops policy framework for water resources management in the country. The contractor is mandated by this act to obtain a permit from the Water Resources Commission to exploit water resources.
- Local Government Act 462, 1994 - District Assemblies will therefore be responsible for the development, improvement and maintenance of human settlements and environment in the district and local levels. The North Tongu and Shai Osudoku District Assemblies will therefore be responsible for the management and maintenance of the roads within their respective jurisdiction.
- Town and Country Planning Cap 84, 1945 - Preparation of district layout plans, and protection and preservation of amenities and public services such as drainage, roads, refuse disposal, sewerage and water supply. Any intervention sub-project is expected to be compatible with the existing physical plans and approved development and land use.
- The Lands Statutory Way Leaves Act 186, 1963-This Land Statutory Way Leaves Instrument is the most relevant Act with regard to Land acquisition for road construction. The Act regulates the acquisition of land for road projects. It also allows for the purposes of construction, installation and maintenance of works of public utility and for the creation of right-of-way and other rights in respect of such works. For this project, It provides compensation for certain types of loss or damage incurred as a result of those activities. And once the property owner is served a copy of the Way leaves, he/she has three months from the date within which to make a compensation claim.
- Labour Act No Act 651, 2003- Part XV, Section 118 (1) and (2a-h) of the Act enjoins the contractor to ensure that every worker employed by him or her works under satisfactory, safe and healthy conditions, and is further obliged to provide necessary information, instructions, training and supervision to ensure the health and safety at work of those other workers engaged in a particular work.
- Japan International Cooperation Agency Environmental Guidelines - Japan International Cooperation Agency being the donor, has established Environmental and social guidelines for a comprehensive project review and ensuring a cross the board perspective of environmental and social linkages. JICA Guidelines for environmental and social considerations (April 2010) (hereinafter referred to as "JICA Environmental Guidelines"). These include specification clearly stipulating the safety requirements in accordance with the laws and regulations in the country of the

Borrower, relevant international standards (including guidelines of international organization), if any, and also in consideration of "the Guidance for the Management of Safety for Construction Works in Japanese ODA Projects of JICA". The requirement to furnish a safety plan to meet the safety requirements. The requirement for the personnel for key positions to include an accident prevention officer, and the requirement to submit method statements of safety to GHA and the Consultant at the construction stage. Mainly, JICA confirms that projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries; it also confirms that projects conform to those governments' policies and plans on the environment and local communities. JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies, and refers as a benchmark to the standards of international financial organizations; to internationally recognized standards, or international standards, treaties, and declarations, etc.; and to the good practices etc. of developed nations including Japan, when appropriate.

2.3 Emission Limit Values

The following national and international emission limit values are applicable to the Project.

2.3.1 Ambient Air Quality

The Ghanaian Ambient Air Quality Standards are provided in Table 1, together with associated World Health Organisation (WHO) (2005) standards. It should be noted that the Ghanaian Standards are applicable at defined locations, classified as 'industrial' or 'residential'. The WHO Guidelines are understood to be applicable to the protection of public health.

Table 1: Ambient Air Quality Standards

	Substance	Maximum Limits	Averaging Time	WHO Guideline
1.	Sulphur Dioxide (SO_2)	520	1hr	-
		50	24hrs	20ug/m^3
2.	Nitrogen Dioxide (NO_2)	250	1hr	200ug/m^3
		50	24hrs	-
3.	Total Suspended Particulate (TSP)	150	24hrs	-
		80	1 yr	-
4.	Particulate Matter (PM_{10})	70	24hrs	50ug/m^3
		70	1 yr	20ug/m^3
5.	Particulate Matter ($PM_{2.5}$)	35	24hrs	25ug/m^3
6.	Carbon Monoxide	100	15 min	-
		60	30 min	-

		30	1 hr	-
		10	8 hr	-

2.3.2 Noise

International guidelines for ambient noise levels are set out by JICA in their Guidelines for Environmental and Social Considerations (2010) as not deviant from World Bank guidelines. In addition, the EPA provides national guidance on maximum permissible noise levels for prescribed areas as shown in Table 2 below.

Table 2: Ghana Standards for Noise

Zone	**Description of Area of Noise Reception**	**Permissible Noise Level dB(A)**	
		Day (0600 – 2200)	**Night (2200 – 0600)**
A	Residential areas	55	48
B	Educational (school), and health (hospital, clinic) facilities, office and law courts	55	50
C	Mixed use (Residential areas with some commercial or light industrial activities)	60	55
D	Areas with some light industry, places of entertainment or public assembly, and places of worship	65	60
E	Commercial areas	75	65
F	Light industrial areas	70	60
G	Heavy industrial areas	70	70

2.3.3 Water Quality

The National standard (GS 175-1) which is the same as WHO guidelines for drinking water is presented in Table 3.

Table 3: Ghanaian and WHO Water Quality Discharge Standards

Characteristics	**Parameter**	**Unit of Measurement**	***Standard**
Physical	Turbidity	NTU	5
	Colour (apparent)	Hz	15
	Total. Suspended Solids	mg/l	-
	Tot. Dissolved	mg/l	1000
	Conductivity	µS/cm	-
	Acidity(PH)	pH units	6.5-8.5
	Potassium	mg/l	30
	Sodium	mg/l	200
	Calcium	mg/l	200

Chemical	Magnesium	mg/l	150
	Chloride	mg/l	250
	Ammonia(NH_4-N)	mg/l	0.00-1.5
	Total Iron	mg/l	0.3
	Sulphate(SO_4)	mg/l	250
	Manganese	mg/l	0.4
	Phosphate(PO_4-P)	mg/l	-
	Nitrate(NO_3-N)	mg/l	10
	Nitrite(NO_2-N)	mg/l	1.0
Biological	*Faecal Coliform	cfu/100ml	0
	*Total Coliform	cfu/100ml	0
	* E.coli	cfu/100ml	0
	Total Hetero. Bacteria	cfu/100ml	500

2.4 Road Policy and Administrative Framework

Government of Ghana (GOG) Roads and Highways policy provides for continued improvements to the nation's rural and urban road network. This objective will be met through an improved road maintenance as well as rehabilitation and construction programme. The Ministry of Roads and Highways (MRH) is responsible for formulating policies and overall strategies on roads and vehicular transport. The Ghana Highway Authority (GHA), Department of Feeder Roads (DFR) and Department of Urban Roads (DUR) are the organizations under MRH which carry out actual implementation of road policies. This project falls within the jurisdiction of the Ghana Highway Authority.

The MRH has prepared an Environmental and Social Management Framework (ESMF) as well as a Resettlement Policy Framework (RPF). The purpose of the ESMF and RPF is to provide corporate environmental, social and resettlement safeguard policy frameworks, institutional arrangements and capacity available to identify and mitigate potential safeguard issues and impacts of each sub-project.

2.5 Institutional Framework

Institutional responsibilities for the co-ordination, planning, administration, management and control of development and environmental issues are fragmented among a number of agencies, ministries and organizations. The major institutions involved include:

1. Environmental Protection Agency
2. Ministry of Roads and Highways
3. Ghana Highway Authority
4. Shai Osudoku District Assembly
5. North Tongu District Assembly
6. Forestry Commission
7. Water resource Commission

During the preparation of the report, these major institutions and/or their documents were consulted for their technical advice, expert knowledge and concerns as related to the project.

2.5.1 Institutional and Implementation Arrangements

2.5.1.1 Ministry of Roads and Highways (MRH)

The MRH has the specific task of coordinating and guiding the activities of the three main executing agencies in the road sector under the Ministry; The Ghana Highway Authority, and Department of Urban and Feeder Roads. The other related organisations namely under the ministry include the Road Fund Secretariat (RFS). The MRH has responsibility for the:

- Formulation and implementation of integrated roads and highways policy and planning;
- Promotion of strategic investment in the sector;
- Development, implementation and monitoring of road projects; and
- Regulation of standards

2.5.1.2 Ghana Highway Authority

Ghana Highway Authority (GHA) is a road agency under the Ministry of Roads and Highways (MRH). The mission of GHA is to provide a safe and reliable trunk road network at optimal cost taking advantage of modern technology in road building and new income-generating methods to facilitate socio-economic development in the country. The GHA is the road agency implementing the construction of the New Bridge across the Volta River.

The GHA has a Road Safety and Environment department which has oversight of the safeguards issues related to the department's activities. The unit shall supervise the implementation of the Environmental and Social Management Plan (ESMP) and the Resettlement Action Plan (RAP) prepared for the project to ensure compliance. The current set up is capable of supervising the safeguards implementation.

2.5.1.3 Environmental Protection Agency (EPA)

The EPA has the mandate to decide on project screening, guide the conduct of any Environmental Assessment (EA) studies and to grant environmental approval for road sector projects to commence. Its mandate also covers monitoring of implementation phase of road projects to ensure compliance with approval conditions, mitigation measures, and other environmental commitments and quality standards.

2.5.1.4 Local Government Act 462, 1994

The Local Government Act 462, 1994 enjoins the District Assemblies to be responsible for the development, improvement and maintenance of human settlements and environment in the district and local levels. The Assemblies will therefore be responsible for the management and maintenance of the Bridge and approach roads within their respective jurisdiction. The new bridge and the complimentary initiatives fall under the jurisdiction of the Shai Osudoku and North Tongu District Assemblies.

2.5.1.5 Land Valuation Division

The Land Valuation Division (LVD) of the Lands Commission is the statutory institution responsible for assessing and approving compensation amount to PAPs. LVD will receive and verify documentation on affected properties. This is to ensure that payments are not made to people who are not adversely affected and also compensations offered affected persons are adequate. The current set up at the LVD will be capable of implementing carrying out its mandate under the project.

2.5.1.6 Attorney General's Department and Ministry of Justice

The Attorney General's Department of the Ministry of Justice per the constitution of Ghana has the mandate to resolve dispute between parties or entities. As part of the redress mechanisms aggrieved persons who may not be satisfies with any issue as part of the project implementation will seek redress in the law court.

2.5.1.7 Resource Management Institutions

The Water Resources Commission (WRC) and the Forest Services Division (FSD) of the Forestry Commission (FC) are the water and forest resources management institutions respectively. These institutions become relevant whenever such resources under their management are likely to be impacted on or implicated in a proposed road project. Such stakeholder institutions would then be consulted in the planning and decision processing to prevent, avoid, reduce or mitigate the likely impact of the project. They may also have to give their consent with respect to the extent to which such resources may be affected or lost as a result of the road development. Water for construction will be abstracted and the need for permit to be obtained from WRC. The protected areas that are closest to the project site are Kalakpa Resource Reserve and Shai Hills Resource Reserve, both of which are nevertheless located more than 25 km from the site. Presently, Shai Hills Resource Reserve, well known for the olive baboons that reside there, is well managed by the Wildlife Division of the Forestry Commission of Ghana and attracts eco-tourists. In contrast, Kalakpa Resource Reserve receives minimal care due to its limited accessibility.

2.5.1.8 Adidome Dufor and Volivo Traditional Authorities

The Adidome Dufor Traditional Authority which includes the fetish priest is custodian of all cultural and sacred edifices and is to protect them from degradation. There are two sacred baobab trees situated within the right of way (ROW) of the planned route of the approach road on the northern side of the Volta River. One of the trees is considered to be male and the other female and rituals are performed annually in front of them by the religious leader or the Fetish priest and Fetish devotees. According to the Fetish priest, the trees were there before 1875 where a conflict took place involving the people.

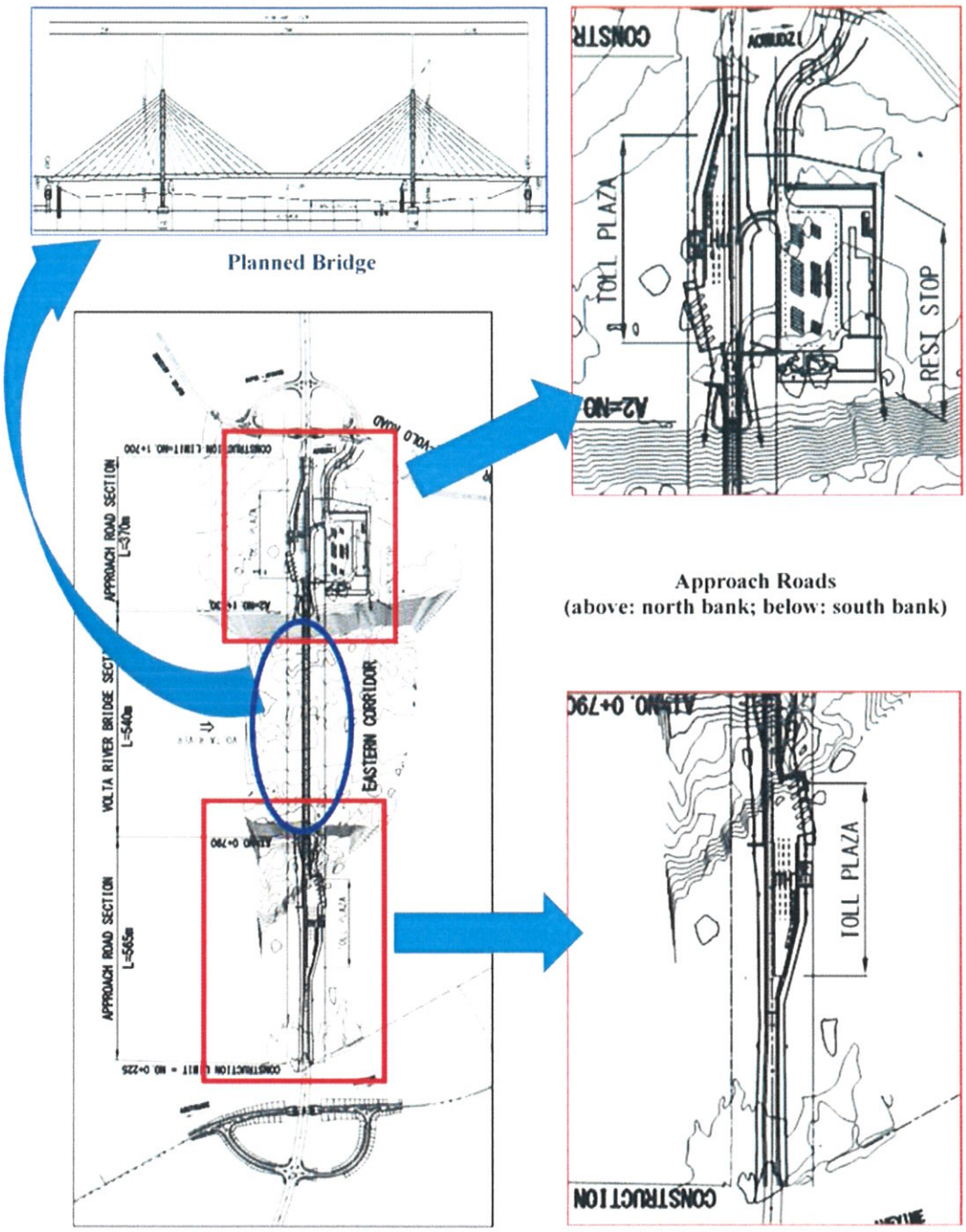
2.5.1.9 Utility Service Providing Institutions

The Electricity Company of Ghana (ECG), Ghana Grid Company (GRIDCo) Ghana Water Company Limited (GWCL) and Telecom Companies are public /private institutions that provide and/ manage utility services including electricity, water, telecommunication and petroleum transmission and storage infrastructure. These are all linear transmission facilities either through underground pipes or overhead lines, often along existing road network corridors (where roads exist). Road construction or reconstruction and other services and interventions tend to affect such transmission lines. These often require relocation, realignment, etc. to make room for the project, which calls for the involvement of the respective utility companies or institutions to be consulted in the road project decision-making processes as appropriate.

3.0 DESCRIPTION OF PROJECT

3.1 Project Location and Description

The Proposed Bridge will be located at Adidome Dufor on the southern bank and Volivo on the northern bank. The village of Adidome Dufor belongs to the North Tongu District Assembly while Volivo is under the Shai Osudoku District Assembly. The project site is located approximately 75 km north-east of Accra on the Eastern Corridor across the two districts. Drawings of the project including bridge and approach roads are shown in Figure 2.



Approach Roads
(above: north bank; below: south bank)

Figure 2: Drawing of Bridge and Approach Roads

3.2 Project Components

3.2.1 Design Standards

The design requirements as outlined in the previous section is achieved by using appropriate design controls and criteria extracted from the design standards prescribed for the jurisdiction. The design under review adopted the following design standards and guides:

- Ghana Highway Authority (GHA) Road Design Guide (RDG) (1991)
- A Policy on Geometric Design of Highways and Streets (AASHTO, 2001) (AASHTO Green Book)
- Ministry of Roads and Highways Standard Details, Road Signs and Markings for Urban and Trunk Roads (1991)

The GHA Road Design Guide served as the primary guide for the final design and the AASHTO Green Book was used to augment the standards prescribed in the primary guide. Thus, the review referenced the same set of guidelines to facilitate the review process. However, other guidelines and literature were referenced to ensure that a comprehensive assessment is done on all the requisite design elements, including:

- Ministry of Roads and Highways Standard Details, Road Signs and Markings for Urban and Trunk Roads (1991) – for road signs and markings
- Design Manual for Roads and Bridges – Geometric Design of Roundabout (CD 116) – for roundabout designs. This document replaces TD 16/07 used for the final design.
- Freeway and Interchange Geometric Design Handbook, Joel P. Leisch (ITE) – for toll plaza approach and exit lanes design.

The following tables provide a summary of the design standards used:

Table 4: Design Standards for New Bridge across the Volta River

Design Speed	**50km/h for the Bridge**
Design Vehicle	Double Axle Articulated Trailer
Maximum Super Elevation	4%
Lane Width	Carriageway: 3.65 m Shoulder: 2.50 m Railing: 0.40 m
Sidewalk	2.00 m
Nominal Cross-Slope	2.5%
Minimum Vertical Clearance	6.0m
Surfacing	Asphalt

Table 5: Design Standards for Approach Roads

Design Speed	**80km/h**
Design Vehicle	Double Axle Articulated Trailer
Camber	3%
Lane Width	Carriageway: 3.65 m Shoulder: 2.50 m Rounding: 1.00 m
Sidewalk	2.5m
Nominal Cross-Slope	2.5%
Drainage	U-drain
Surfacing	Asphalt concrete

3.2.2 Project Works

Major scope of the project is as follows:

- Construction of bridge substructure including double sheet pile cofferdam
- Construction of weathering steel bridge superstructure
- Erection of cable-stayed bridge with high precision
- Construction of approach road (565 m on the southern side of the river bank and 370 m on the northern side)
- Construction of rest/observatory area
- Construction of toll plaza facility
- Installation of axle load scale
- Construction of drainage structures
- Other ancillary works

Table 6: Summary of Project Scope

Work Type	**Work Item**	**Sub Work Item**
Bridge	Foundation for abutments	Piling foundations
	Foundation for piers	Spread foundation, excavation of groundwater rock layer with single steel pipe sheet pile cofferdam
	Abutments	Reverse T-type abutments
	Piers	Pier (main tower): Column type elliptical piers x 2 Pier (approach): Round column piers x 2
	Superstructure (Continuous cable-stayed bridge)	Main girders: Steel-deck edge girder Main towers: Reinforced concrete Bridge length: 540 m (34 m + 96 m + 280 m + 96 m + 34 m)
	Pavement	Asphalt pavement
	Typical cross section	Carriageway: 3.65 m × 2

		Shoulder: 2.50 m × 2 Sidewalk: 2.00 m × 2 Railing: 0.40 m × 2 Total bridge width: 17.10 m
	Ancillary components	Bearings, expansion joints, inspection gondolas and paths, pavement markings, traffic signs, guard fences, road illumination, landscape illumination, navigation aids and aviation obstacle lights
Approach Roads	Length (Main road)	Right bank of Volta River (Volivo side): 565 m Left bank of Volta River (Dufor Adidome side): 370 m
	Earth works	Formation of sub-base
	Pavement	Asphalt concrete pavement
	Road drainage	Side ditches and cross culverts
	Ancillary works	Road illuminations, pavement markings, traffic signs, guard fences and road safety devices
	Typical cross section	Carriageway: 3.65 m × 2 Shoulder: 2.50 m × 2 Rounding: 1.00 m × 2 Total road width: 12.30 m
Other Facilities	Toll plaza	Two toll plazas (Volivo side and Dufor Adidome side) Toll booths and toll gates, administration office, temporary parking space for overloaded vehicles, axle load scale, interlocking pavement and road illumination
	Rest stop	One location (Dufor Adidome side) Commercial building, parking lots, access road, park and observation deck and illumination

3.2.3 Horizontal and Vertical Alignments

The horizontal and vertical alignments of the project have been designed to meet standard requirements and to improve safety.

3.2.4 Pedestrian Facilities

In view of pedestrians in the vicinity of the proposed bridge, facilities for pedestrians have been included in the design to cater for their needs. These facilities include provision of walkways parallel to the various roads.

3.2.5 Traffic Control Devices

Traffic control and road safety devices will be put in place in addition to other necessary road furniture when implementing the project.

3.2.6 Construction Materials

Within the Shai Osudoku and North Tongu areas and the adjoining municipalities, there are both new and existing borrow and quarry pits that can be sourced for the construction materials for this project.

3.2.7 Construction Camp Establishment

Appropriate land for construction camp sites will be sought for by the Contractor(s) to house the following:

I. Main Camp Sites
   a) Consultants' offices,
   b) Contractors' offices,
   c) Fuel farms
   d) Truck parking yards

II. Materials Holding and Batching plants

III. Pre-cast yards

3.2.8 Site Preparation

Construction process begins with the alignment surveying, pegging and clearing. This involves bush clearing, top soil stripping to be followed with earthworks. Bush clearing removes vegetation cover including grass, shrubs and trees. Tress will also be removed and the Contractor is expected to maintain a record of the number, species and characteristics of the trees removed for compensation through planting.

3.2.9 Earthworks

Earth moving is the removal of the overburden along the alignment to give way for filling with appropriate materials. This generates significant spoil earth materials to be disposed off or reused elsewhere. The activities will involve moving fill materials (gravel) to fill and development of the base on which the road surface will be formed.

3.2.10 Materials Sourcing and Extraction

Mobilisation of materials will be the main activities such as to include aggregate from the quarry sites, gravel from borrow areas and water from sources. Materials haulage, storage, batching and applications are major project activities.

3.2.11 Piling Activities

A deep foundation is required to support the bridge; therefore, piling for the foundation will also be major activity.

3.2.12 Road Surface Materials

The surface materials would be asphaltic concrete. The proposed project route is expected to be durable, having the capacity to bear substantial and diverse volumes of load with the

expected increase in vehicular volume, a better, smoother riding ability, and a low noise generation characteristic.

3.2.12 Project Implementation Schedule

The following briefly summaries the project profile:

Table 7: Project Timelines

Year of Completion of Design	2015
Commencement of Construction	2020
Completion of Construction	2025
Project Completion	2026
Project Duration	77 Months including Design Review/Tender (17 months), Construction (48 months), and Defect Notification Period (12 months)
Date of Operation	2025

4.0 DESCRIPTION OF PROJECT ENVIRONMENT

4.1 Project Area of Influence

The project will be located across two district assemblies in the Greater Accra and Volta Regions. The specific project location is from Volivo (Shai Osudoku district) which is at the northern bank across the Volta River to Adidome Dufor (North Tongu District) which is the Southern bank.

Below are summaries of natural and social characteristics of the project area.

4.2 Project Area Characteristics

4.2.1 Climate

The Volivo part of the southeast coastal plain is one of the hottest and driest areas in the country whiles the climate Adidome is more tropical, influenced by the south-west monsoons from the south Atlantic and the dry harmattan winds from the Sahara. The mean temperature for the area is approximately 27°C, with a maximum temperature of around 33°C and minimum of 22°C. Though, it can reach peaks as high as 40°C in Volivo. Precipitation is generally low and erratic, normally receiving rainfall between September and November. The mean annual rainfall ranges from762.5 mm in the coastal area to 1,220 mm in other parts. Temperature and humidity vary little throughout the year. Average humidity is high at around 80%.

4.2.2 Topography

In the central part of Accra plain, the relief is gentle and undulating with altitude not exceeding 70 m above sea level. The plains are punctuated by a few prominent inselbergs, isolated hills, outliers and knolls scattered across the area. Prominent relief features include the Yongua inselberg (427 m) which has a conical shape with a number of outliers around the Asutsuare and Osuwem areas, the Krabote inselberg also to the North, and the Shai Hills (289m) towards the western part of the area. There are conspicuous large rock outcrops and boulders in the vicinity.

4.2.3 Geology and Soil Type

The project area forms part of the lower Volta flood plain. The repeated process of flooding and receding of the Volta River over the years has created fertile alluvial soil in the Volivo area and a coarser textured sample in the Adidome region. There is also the presence of a vast sedimentary stratum of oyster shells deposits and a number of inland lakes. Soils in the area are poorly drained pale-coloured sandy silt and underlying clay formed recently or in the contemporary Volta Alluvium making cultivation difficult. Nevertheless, they are suitable for rice and sugarcane cultivation under irrigation as they appear to be moderately well-supplied

with nutrients in their natural condition, and are easily workable even with simple implements. They also provide raw materials for the pottery, brick and tile industries. The main mineral deposits in the area are clay, oyster shells, feldspar, nepheline gneiss, sand and granite.

4.2.4 Vegetation

The Project area lies in the Coastal Savanna Grassland/ Thicket Scrub vegetation zone. As part of the Accra Plains, it is an open tree savanna where the trees and shrubs occur in clumps formed on termite mounds that are scattered in the area. Some of the tree and shrub species that characterize the vegetation of the study area are *Securinega Virosa, Abutilon mauritianum, Grewia carpinifolia, Adansonia digitata* and *Zanthoxylum xanthoxyloides*. *Azadirachta indica*, an introduction, has spread widely in the area. *Leucaena leucocephala*, an Alien Invasive Species, is very abundant in the thickets in the Dorfor-Adidome section of the project area. The Dorfor-Adidome thicket Scrub is also abundant in the Gold Star climber species *Ritchiea reflexa*. The Gold Star rating implies the species is rear in the project area. Conservation action is required for this species to ensure that it is not completely removed and wiped from the area by the project. A large portion of the vegetation remains dry for most of the year particularly in the southern area with the exception of the short rainy season. In the Volta floodplain, tall swampy grass and tall savannah grass with isolated thickets and trees are the prevalent type of vegetation as well as farms and farm-regrowth. Some common grasses include *Andropogon gayanus, Hyparrhenia rufa, Chloris pilosa, heteropogon contortus* and *Sporobolus pyramidalis*. Along the Volta River, the vegetation is dense and the stream basins where mainly mango, oil palm, baobab, silk cotton, acacia and others are grown. Farther from the river, the vegetation is sparse, dominated by grassland interspersed with neem trees and guinea grass, digitaria decumbent and fan palms.

4.2.5 Animal Species

Generally, the species diversity and abundance of mammals within the proposed project site was very low with the giant rat (*Cricetomys gambianus)* being the dominant fauna. Though all species are partly protected under the Wildlife Conservation Regulations of Ghana, only four of the species encountered are categorized as Least Concern on the IUCN Red List of Threatened Species. Of the 39 species of birds recorded, none was of international conservation importance while 2 are of national conservation importance. These are namely the Cattle Egret (*Bubulcus ibis*) and the Yellow billed Kite (*Milvus aegyptius*). The two species are however widely spread throughout the project area and have wide range of habitat distribution in Ghana hence are not expected to be impacted significantly by the project.
The table below shows the fishes found the Volta Lake.

Table 8: Fishes found in the Volta Lake

	English Name	Scientific Name	Local Name
1	Nile Tilapia	Oreochromis niloticus	Koobi
2	Catfishes	*Clarias gariepinus*	Adwene
		Heterobrancus bidorsalis	
3	Bagrid catfish	*Chrysichthys nigrodigitatus*	Gblovi
4	African Bony tongue	Heterotis niloticus	Superku
5	West African Pygmy herrings	Sierrathrissa spp	One Mouth Thousand
6	Snakehead	Parachanna obscura	Koboo
7	Tiger fish	Hydrocynnus foskahlii	Akao/ Akawo
8	Electric fish, Africa knife	*Gymnarchus niloticus*	Aprukusu/ Eyor
9	Nile Perch	*Lates niloticus*	Akwaabi
10	*Puffer Fish*	*Tetraodontidae*	

Source: Fisheries Commission

4.2.6 Water Resources

Flowing over a fairly low terrain, streams have carved wide valleys yet they are dry for most of the year in the Volivo region. A number of artificial dams and ponds of varying size have been constructed in the district and are used for irrigation and watering of livestock. A total of 18 towns in Volivo have access to piped water with the remaining towns depending on wells, boreholes and other sources. Most of the people living in the villages, on the other hand, depend on borehole water, hand-dug well water, streams and rivers. An estimated 34% of the inhabitants in the 231 settlements in Volivo have no access to potable water. Ground water in the area is saline.

The Adidome area is however drained by the Alabo, Kolo, Aklakpa, Gblor, and Nyifla Rivers and their numerous tributaries into the Volta River. During the rainy season, these streams overflow their banks, causing damage to roads and farms. There are several ponds and dugouts/dams in the area, which serve as the main source of water for the inhabitants and livestock. Sources of water for domestic use and for those in the villages are pipe-borne, boreholes, streams, hand dug wells, streams and rivers with towns being the exception. Until 1994, most communities in Adidome had no access to potable water. But the Danish Government (Danish International Development Agency/DANIDA)-led water supply project provided piped water to Tedeafenui and other communities in the Adidome area. In addition, 26 communities have been provided with a total number of 89 shallow wells fitted with hand pumps. The Volta River offers an important source of water to the towns and villages nearby.

4.2.7 Water Quality

Water and air quality as well as noise levels in or near the project site were examined during the F/S. The results of the tests generally show values that are environmentally favourable

than the EPA guideline values. The results of the water quality, air quality and noise level tests are presented in Tables below.

As the only water body within the immediate project zone, the physical, chemical and biological parameter of the Volta River was analyzed. Table 9 and 10 shows the results for the water samples taken from the two landing sites of the proposed bridge.

Table 9: Surface Water Quality of Volta River (Dufor Adidome landing site)

Parameter	EPA Method No.	Unit	Value	GS 175-1	WHO Guideline
Turbidity	3	NTU	<1.00		5
Colour (Apparent)	2	Hz	2.50-		15
Odour		-	-	Inoffensive	Inoffensive
pH	4	pH Units	6.42	6.5-8.5	6.5-8.5
Conductivity	1	µs/cm	68.4	-	-
Tot. Susp. Solids (SS)	5	mg/l	<1.00	0	-
Tot. Dis. Solids (TDS)	6	mg/l	41.0	1000	1000
Sodium	30	mg/l	5.10	200	200
Potassium	29	mg/l	3.00	30	30
Calcium	23	mg/l	7.29	200	200
Magnesium	26	mg/l	0.817	150	150
Total Iron	31	mg/l	<0.010	0.3	0.3
Ammonia	13	mg/l	<0.001	0.00-1.5	0.00-1.5
Chloride	24	mg/l	2.28	250	250
Sulphate	19	mg/l	2.24	250	250
Phosphate	17	mg/l	0.048	-	-
Manganese	26	mg/l	0.012	0.4	0.4
Nitrite	14	mg/l	0.370	1.0	1.0
Nitrate	15	mg/l	<0.001	10	10
Total Hardness (CaCo3)	25	mg/l	21.0	500	500
Total Alkalinity (CaCo3)	22	mg/l	24.0	-	-
Calcium Hardness (as CaCo3)	23	mg/l	20.2	-	-
Mg Hardness (as CaCo3)	26	mg/l	0.760	-	-
Fluoride	20	mg/l	<0.005	1.5	1.5
Bicarbonate as CaCo3)	22	mg/l	29.2	-	-
Carbonate	22	mg/l	0.00	-	-

Table 10: Surface Water Quality of Volta River (Volivo landing site)

Parameter	EPA Method No.	Unit	Value	GS 175-1	WHO Guideline
Turbidity	**3**	**NTU**	**1.41**		**5**
Colour (Apparent)	**2**	**Hz**	**2.50**		**15**
Odour		**-**	**-**	**Inoffensive**	**Inoffensive**
pH	**4**	**pH Units**	**6.66**	**6.5-8.5**	**6.5-8.5**

Conductivity	**1**	**µs/cm**	**66.3**	**-**	**-**
Tot. Suspended Solids (SS)	**5**	**mg/l**	**<1.00**	**0**	**-**
Tot. Dissolved Solids (TDS)	**6**	**mg/l**	**39.8**	**1000**	**1000**
Sodium	**30**	**mg/l**	**4.40**	**200**	**200**
Potassium	**29**	**mg/l**	**2.00**	**30**	**30**
Calcium	**23**	**mg/l**	**8.09**	**200**	**200**
Magnesium	**26**	**mg/l**	**0.185**	**150**	**150**
Total Iron	**31**	**mg/l**	**<0.010**	**0.3**	**0.3**
Ammonia	**13**	**mg/l**	**0.050**	**0.00-1.5**	**0.00-1.5**
Chloride	**24**	**mg/l**	**2.48**	**250**	**250**
Sulphate	**19**	**mg/l**	**2.51**	**250**	**250**
Phosphate	**17**	**mg/l**	**0.022**	**-**	**-**
Manganese	**26**	**mg/l**	**0.006**	**0.4**	**0.4**
Nitrite	**14**	**mg/l**	**0.382**	**1.0**	**1.0**
Nitrate	**15**	**mg/l**	**<0.001**	**10**	**10**
Total Hardness (CaCo3)	**25**	**mg/l**	**21.6**	**500**	**500**
Total Alkalinity (CaCo3)	**22**	**mg/l**	**30.0**	**-**	**-**
Calcium Hardness (as CaCo3)	**23**	**mg/l**	**18.2**	**-**	**-**
Mg Hardness (as CaCo3)	**26**	**mg/l**	**3.36**	**-**	**-**
Fluoride	**20**	**mg/l**	**<0.005**	**1.5**	**1.5**
Bicarbonate as CaCo3)	**22**	**mg/l**	**36.6**	**-**	**-**
Carbonate	**22**	**mg/l**	**0.00**	**-**	**-**

4.2.8 Air Quality

Information on baseline air quality gives an indication of existing levels of ambient air quality parameters in order to evaluate the impact of additional emissions from the constructional and operational phases of the project on the environment. The levels will also be the reference for the continuous assessment of possible impacts of the project on the air quality of the receiving environment.

Particulate matter was sampled using MiniVol samplers set to a flow rate of 5 L/min. Samplers were placed at a minimum height of 5 meters above ground level to prevent the collection of ground level dust temporarily made airborne by gusting winds. Pumped air was siphoned through a quartz filter paper, mounted in the sampling unit and sampling undertaken for 24 hours at each sampling location. The quartz filter paper was stabilised for a minimum of 24 hours before and after sampling in a desiccator. The fresh quartz filter paper was weighed before sampling. After the 24-hour sampling period, post sampling filters were weighed and the difference in weight (W2-W1) was used to calculate the concentration of the particulate matter in µg/m^3 using the formula below.

$$(PM2.5, PM10, TSP)\mu g/m^3 = \frac{Net\ dust\ weight * 10^6}{Flow\ rate\ (L/Min) * Sampling\ time\ (Min)}$$

Sulphur dioxide, Nitrogen dioxide and Carbon monoxide were sampled using the detector tube method. The detector tubes (dragger tubes) contain chemical agents that change colour in the presence of the pollutant gas of interest. The dragger tubes were opened at both ends and hanged for a period of 24 hours to allow the diffusion of ambient air through the chemical resins in the tube (passive method). After the sampling period the length of the coloured zone was read in parts per million (ppm) and the concentration of the gas calculated in $\mu g/m^3$ using the relation below:

$$\mu g/m^3 = \frac{Concentration\ of\ gas\ (ppmh) * molecular\ weight\ of\ gas}{22.4}$$

Table 11 shows ambient Particulate matter (PM) and Total Suspended Particles (TSP) within the project area while Table 12 shows the Nitrogen dioxide, Sulphur dioxide and Carbon Monoxide levels measured.

Table 11: Ambient PM10 and PM2.5 Measured on 17/12/2019

LOCATION	$PM_{2.5}(\mu g/m^3)$	$PM_{10}(\mu g/m^3)$	$TSP(\mu g/m^3)$
Volivo	13.8	21.8	37.7
Dufor Adidome	14.4	22.0	36.9
Ghana Standards for 24-hour Ambient air Quality for PM_{10} and $PM_{2.5}$	35	70	150

Table 12: Nitrogen Dioxide, Sulphur Dioxide, Carbon Monoxide levels measured on 17/12/2019

LOCATION	NO_2 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)
Volivo	0.3	<0.1	<2
Dufor Adidome	0.2	<0.1	<2
Ghana Standards for NO2, S02, CO	150	50	10

4.2.9 Noise

A decibel (dB) is the unit for the measurement of noise. The zero on a decibel scale is at the threshold of hearing, the lowest sound pressure that can be heard on the scale according to smith: 20 dB is whisper, 40 dB the noise in a quiet office, 60 dB is normal conversation, 80 dB is the level at which sound becomes physically painful.

Noise measurements/recordings were taken with a High Precision 3M Sound Level Meter, Model Type 1. The sound level meter has an inbuilt calibrator, and was calibrated before measurement/recordings were taken. The noise meter was calibrated at 114 dB (A) prior to the measurement. To obtain representative noise levels, measurements were recorded at a rate of 3dB at ten-minute (10) intervals for daytime and night time.

Ambient noise levels recorded were below the Ghana standards (Day) which is consistent with the residential area.

Table 13: Daytime Ambient Noise levels (dBA) recorded on 17/12/2019

LOCATION	L_{AEQ}	L_{10}	L_{50}	L_{90}	L_{MAX}
Volivo	39.5	41.3	37.6	34.0	52.1
Dufor Adidome	36.1	38.7	33.9	31.4	50.4
Ghana Standard for Residential Daytime noise	55				

Table 14: Night time Ambient Noise levels (dBA) recorded on 17/12/2019

LOCATION	L_{AEQ}	L_{10}	L_{50}	L_{90}	L_{MAX}
Volivo	34.5	37.1	33.5	32.0	50.8
Dufor Adidome	32.1	35.8	31.9	30.6	46.9
Ghana Standard for Residential Daytime noise	48				

4.4 Population and Settlement

4.4.1 Population

The project catchment area falls within two main Districts: Shai Osudoku and North Tongu District. The total population for the two main districts is estimated at 151,909. This is made up of 62,131 people from Shai Osudoku and 89,777 from North Tongu district. Males form the majority (51.3%) in Shai Osudoku whiles females form the majority (52.7%) in the North Tongu district.

Population Sizes of Project Districts Area

Districts	Male	Female	Total
Shai Osudoku District *(2017 Projection)*	31,873 (51.3%)	30,253 (49.7%)	**62,131**
North Tongu *(2010 Population)*	42,492 (47.3%)	47,285 (52.7%)	**89,777**
Total			**151,909**

(Source: GSS)

On the other hand, the total population of the two communities is also estimated at 8,809 made up of 3000 people from Volivo and 5,809 from Dorfor Adidome. A detail of gender disaggregation distribution is shown in the table below:

Estimated Population Size of the Project Communities

Community	Male	Female	Total
Volivo	1659 (55.3%)	1341 (44.7%)	**3000**
Dorfor Adidome	2986 (51.4%)	2823 (48.6%)	**5809**
Total			**8809**

General Community Structure / Settlement

- **Volivo**

Volivo is surrounded by nine (9) main communities under the Dofor electoral area. These communities are Kewu, Atrobinya, Avakpo, Volivo-Lanor, Mafikoper, Chiefkoper, Amegbolor, Atabui and Duffor. Traditionally, the community is headed by the community chief and his elders whiles an elected Assembly member supported by a unit committee runs the political day-to-day administration of the community. The people of Volivo are mainly Dangmes with a few of the populace being Ewes. There are about 700 households with an average household size of 5 people per house in the community. Culturally, the person of Volivo celebrates "Jehayem" every May. Jahayem is celebrated to shame hunger.

- **Dorfor Adidome**

Dorfor Adidome is the largest among 12 communities under the electoral area. Unlike Volivo, Dorfor Adidome is made up of seven (7) main clans and the heads of these clans form the elders of the community. However, the clans are presided over by the main chief who controls the affairs traditionally in the community. All clans have their unique symbol but the community has the Baobab Tree as the universal symbol for the community. Politically, the Assembly member together with the unit committee members runs the political administration of the community. According to the community elders, the estimated average household size is five (5) people per house. The people of Dorfor Adidome are mainly Ewes with few Fulanis. The people culturally celebrate the "Ayimagonu" and "Dzrafedu-Za" festivals in November and March / April respectively. The festival is celebrated to remind community members of how their forefathers became victorious in the 1870 Global war.

4.6 Economic Activities

The economy is of the two communities is dominated by agriculture activities on subsistence basis in a labor-intensive manner. The most dominant crop under cultivation is Rice and this cultivated district wide. At Volivo, the rice farming is mainly done on irrigation basis. Water is usually drawn from irrigation facilities from Akuse and Asutsuare. Again, Volivo is also known for the production of fruits such as banana, mangoes, pineapple. Other major crops cultivated in both communities are cassava, maize, pepper, oil palm etc.

The agricultural land is farmed by its owners and there are no tenant farmers. This was confirmed by the assembly man of Dufor Adidome. Golden Exotic Estate has a plan of extending its 800 ha banana plantation to 3,000 ha and Tropo Farms has a 5 ha fish farm.
Another considerable farming activity undertaken in both communities is the fishing activity which is mainly done on the Volta river. The river is mainly known for the production of tilapia. Other traditional fishing communities include Bakpa, Mafi, Mepe, Battor and Volo in the catchment area. Also, livestock farming forms part of the farming activities undertaken by the communities. The Fulanis at Adidome are mainly noted for the rearing of cattle in the area.

Another area of interest that has gainfully engaged the youth and women in the area is Oyster Shell mining and processing. Oyster shells are naturally found on the grounds in both communities. The shells are processed by way of crushing by machine used for poultry feed. They are also processed for paints such as white wash paints, emulsion paints. There are also few artisans such as masons, welders, seamstress/tailors, electrician etc.

Oyster shell mining activities ongoing at Dorfor Adidome

4.7 Community Facilities

The two communities have a basic school each covering from Nursery to the JHS level. Every Monday is a market day in Dofor-Adidome. Volivo does not have a market. However, trading activities is usually carried out every Sunday at Asutsuare.
With respect to health, there are two health facilities in Adidome one of which is a privately owned clinic and the other a health centre. On the other hand, Volivo has a CHPS Compound that serves the needs of the people in terms of health.
The main source of water for drinking and domestic use is the Volta river for both communities. However, both communities apparently had two borehole facilities each, but are currently broken down.

Although, there are few household pit latrines made of mud structures in the communities, majority of the community members do not have toilet facilities. The main place for defecation is the bush.

The communities are connected to the national grid with majority having access to electricity. Again, the main telephone networks; MTN, airtel/tigo and Vodafone are available in the communities but needs some more improvements as certain areas within the communities do not have adequate network coverage.

Approach roads are planned to cross existing electricity lines. Limited but additional social services may be introduced during the construction stage, possibly improving the situation.

A household toilet facility at Volivo

A broken down borehole at Volivo

4.7 Public Utilities

Approach roads are planned to cross existing electricity lines. Limited but additional social services may be introduced during the construction stage, possibly improving the situation.

5.0 ALTERNATIVES CONSIDERED

5.1 Introduction

Projects such as road and bridge construction that may have effects on the built and natural environment always raise issues of concern and alternatives of such projects are always necessary. The reason is to assess the effects of these alternatives on the environment against expected benefits. Two main project alternatives have been considered and they are:

- No Project Development Option; and
- Project Development Option.

The environmental and social impacts of each option, particularly the scale of involuntary resettlement and required, the response of the land owners, and the impact on watercourses, were given due consideration. The bridge types were also presented and explained at the public forum held at two different locations and the inputs provided by the participants at the forum were taken into account in selecting the bridge type.

5.2 No Project Development Option

This alternative implies that the bridge connecting the two Districts will not be constructed and that the accessing the Volta region from greater Accra and vice versa would be left in their present state which is travelling through the Adomi Bridge with its related impacts.
Development opportunities may not be realized. The negative environmental and social impacts during construction and operation of the proposed scheme would be avoided with this option, but the long-term commercial and social development advantages offered to the region by the Option 2 proposal would be entirely lost.

5.3 Project Development Option

This option of construction of the bridge will improve the safety, health and social conditions of all commuters. The most important benefits that can be derived from the transport infrastructure improvement, as proposed in this project, include the following among others:

- Savings in travel time for both passengers and freight shipments
- Reduced operating expenses for the users of the new bridge and also for those who continue to use the existing facilities, which may become less congested
- Savings in road maintenance expenditure
- Stimulation of economic development
- Increased comfort and convenience
- Improved access to social facilities or amenities

5.4 The Preferred Alternative

The advantages to be derived from the construction of the new bridge alternative outweigh the disadvantages of the "No Project Development Option". Although there are

environmental implications associated with the improvement alternative, appropriate mitigation measures would be implemented to control them, thus justifying the case for implementing the project. The preferred option is to implement the New Bridge across the Volta River.

The most important benefits that can be derived from the construction of the bridge include the following among others:

- Anticipated traffic volumes will be reduced considerably.
- Safety of pedestrians will be enhanced due to the creation of pedestrian walkways
- Increased comfort and convenience
- Health of residents is enhanced

6.0 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

From baseline information gathered at the fieldwork phase and issues that transpired during the consultation with stakeholders, the impacts of the project particularly during the construction phase are assessed.

6.1 Potential Positive Impacts – Constructional Phase

6.1.1 Employment and Income

The project is expected to create opportunities for both skilled and unskilled labour. These may include engineers, masons, block layers, carpenters, food vendors, etc. Security persons will be needed to safeguard contractor's equipment, construction materials, and supplies. Other activities such as surveying, road marking, and traffic regulation will also create jobs. Labourers may be hired from the project environs and will be beneficial to the communities. The presence of a labour force will also increase economic and employment opportunities for residents through the sale of goods (such as food/drink, crafts, wood etc.) and other services. Expansion of business activities as well as trading of agricultural crops is also expected. Upon completion of bridge construction, river-crossing canoe operators will no longer be able to earn transportation fees. However, since their main occupation is to be fishing, the level of impact is considered to be low.

6.1.2 Enhance skills for Local Artisans

New job opportunities/skilled and unskilled labour jobs will be required during construction. Capacity development/skill training for such opportunities for the local artisans will also expand the opportunities for locals to obtain new jobs.

6.1.3 Increase revenue for the Municipal Assemblies

During the construction phase trucks carting materials to the site will be required to pay toll which will bring some revenue to the assembly. Revenue can also be generated by the North Tongu and Shai Osudoku Municipal Assemblies from traders who sell or trade around the project site to workers through ticketing. The new bridge could serve as a new land mark/tourist spot in the area.

6.2 Potential Positive Impacts – Operational Phase

6.2.1 Improved Regional Economy

The project would lead to an overall upgrading of the socioeconomic setting of the area. It is expected that the construction of the bridge will provide socio-economic benefits to the

project area since, apart from the Greater Accra region; the project road forms a major link to Ashanti and Eastern Regions. The project would thus impact positively on the regional economy, as accessibility and commercial activities would be enhanced thereby facilitating regional economic integration.

Although construction activities will cause temporary delays in public and private transport, access to services and facilities should be improved in the long-term through greater reliability and, possibly increased availability of public transport. Public and private transport opportunities should improve because of faster travel speeds, reduced frequency of breakdown, and lower maintenance costs.

The new bridge also has a potential to enhance appreciation of land and property values in the road section and the immediate neighbourhoods. Among the appreciation will include value addition to commercial and economic investments, potential for institutional development and attraction for tourists.

6.2.2 Vehicle Operating and Transportation Costs

The road will provide an alternative route for vehicular traffic currently using the Adomi Bridge route to access the western parts of Accra and beyond, and vice versa. This will make tremendous savings on general fuel consumption and reduction in vehicular emission pollution, by providing an alternate bridge route.

The project has potential to benefit road users through reduced vehicle maintenance costs and delays. The effect on overall vehicle operational costs is positive and significant for the local and regional users in the operation phase.

6.3 Potential Negative Impacts – Construction Phase

6.3.1 Water Resources

The largest impact on water quality is expected to be on the Volta River. Construction activities generate spills and other waste which when improperly disposed may pollute the river. Surface run-off from construction sites and camps may include but not necessarily be limited to hydrocarbons such as waste oil and lubricants. In addition, discharge of wastewater from construction camps will also contribute to polluting the river. Camps should be sited at least 100m from the Volta River.

Dredging operation, disposal of dredged materials during piling activities, materials from superstructure formworks and other activities, and solid waste will deteriorate water quality in the river especially local turbidity. The indiscriminate disposal of dredged material in the river water will increase turbidity in the downstream water, which might cause significant damage to breeding and spawning of fish and may pose threat to other aquatic species.

6.3.2 Soil Erosion and Sedimentation

Road construction will intensify the effects of natural soil erosion due to vegetation removal, soil disturbance, and exposure of bare soil surface. If appropriate measures are not taken, the increased erosion loss could be significant over the construction period.

6.3.3 Air Quality

The major air quality issue during road construction is the production of dust during earthworks, storage and transportation of soil or other fine-grained materials (cement, sand,), and vehicles moving across unpaved or dusty surfaces. Dust is also emitted during the production of concrete, especially if good production practice for dust emissions mitigation is not followed. Major air pollutants (dust, gaseous emissions and particulate matter) produce air pollution and impact adversely on human health, flora and fauna and on the built environment.

These impacts are considered negative and significant, especially to receptors located close to project during the construction phase. Mitigation measures are required to reduce the impacts on air quality within the project area. Dust pollution from construction activities will however cease in the operation phase.

6.3.4 Noise and Vibration

Noise quality during the main bridge construction will deteriorate due to the mobilization of equipments, construction materials/ vehicles, batch mixing, erection and casting, and welding. The overall impact of noise to the receptors will depend on the position of equipments and their cumulative actions. Construction activities are anticipated to produce noise levels in the range of 80 - 95 dB (A). The noise likely to be generated during excavation, loading and transportation of material will be in the range of 90 to 105 dB (A) and this will occur only when all the equipment operate together and simultaneously. This however is a remote possibility. The workers in general are likely to be exposed to an equivalent noise level of 80 to 90 dB (A) in an 8-hour shift.

However, the surrounding communities will remain far (1-7km) from the main bridge construction sites and due to the extensive vegetation coverage in the communities; the noise impact from construction equipments is thus expected within the standard level. However, construction workers and others will directly be exposed to these noise levels.

6.3.5 Landscape Modification

Excavations quarry and borrow materials stockpiling as well as the parking of construction equipment are also expected to take place during the construction phase. The impact of such on the aesthetic and visual quality and value of the landscape is thus considered negative. However, the bridge itself will add some aesthetic value to the area when completed.

6.3.6 Construction Camps

Temporary construction camps will be required for storing construction vehicles, equipment, fuel and road-building materials. Establishing new construction camps may involve the bulldozing and levelling of a piece of ground, and erection of temporary housing units. This could destroy an area, leading to obvious consequences on soil erosion and water quality, if the camp is poorly sited and or constructed. Indiscriminate dumping of engine oils, fuel, lubricants or other solvents can contaminate soil and leach into subsoil water. Construction workers may live on site therefore it would be necessary to provide them with housing facilities.

6.3.7 Construction Wastes

Non-hazardous solid wastes (excavated materials, domestic solid waste), and liquid wastes would be generated whilst rehabilitating the road. Poor sanitation and solid waste disposal in construction camps and work sites are likely to have negative impacts on human health. The improper handling and disposal of construction wastes would have a negative impact on the environment.

6.3.8 Public Utilities

Public utilities along the project road include water pipelines, telecommunication lines and electricity cables. Overhead high-tension lines run along the road at sections of the project area. Construction of the bridge is likely to result in the temporary disruption in utility supply to areas along the project road as well as others serviced by these lines. The impact on provision of service from the public utilities in the construction phase is negative.

6.3.9 Land Acquisitions and Relocations

The Right of Way (ROW) for the project is 90m set by the GHA. Within the Right of Way, a total of ten (10) Project Affected Persons (PAPs) were captured / interviewed on one-on-one basis for the Project. Following an initial and subsequent detailed surveys it was confirmed that there would be no involuntary resettlement for the project but that a limited number of non-governmental plots of land would need to be acquired in areas where currently no road exists.

In addition, there are two baobab trees standing in the middle of the planned approach road that are considered religiously important among the Fetish group in Dufor Adidome village that will be removed or relocated following proper religious and cultural procedures. Some parts of the cemetery situated on the west side of the planned intersection between the Eastern Corridor and Dufor Adidome-Volo road in the north bank are also considered to be affected as they lie within the 55m-ROW of Dufor Adidome-Volo road. With regards to the cemetery, the community is willing for the whole area of the cemetery to be replaced rather

than only the affected areas and the GHA is willing to accept this. Two electricity lines belonging to GRIDCo may also be affected by the project during construction.

6.3.10 Flora and Fauna

Vegetation/Flora

Vegetation/Flora General impacts of clearance for the approach roads on flora include the following:

- Removal of vegetation within the Right of Way (ROW) including two Baobab trees and some Gold star specie (Ritchiea reflexa) of conservation importance ;
- Soil compaction, sealing of soil surface;
- Indirect impact from dust, particles; oil, fuel;
- Impact of covering riverbed on riparian vegetation.
- Spoil material from road cutting can kill vegetation on disposal site

These impacts are considered negative but moderate since the actual areas involved would not be large. Mitigation measures are required to reduce the negative impacts.

Fauna

The impact on fauna expected to be low since most of them will move away from the noisy and generally uncomfortable areas. However, there is the likelihood of poaching by construction workers in the project area.

The proposed project is therefore anticipated to have a trifling impact on wildlife and their habitat in the area.

6.3.11 Aquatic life

Piling and dredging activities will cause suspension of sediments which will increase the turbidity, particulate matter, and suspended solids in the water column, this it can interfere with the feeding of fish since some of the fishes found in the lake are filter feeders. When turbidity is increased, light penetration can reduce and this can affect the photosynthetic ability of phytoplankton hence reduce food production and hence amount of food available for fish. This can affect the distribution of fish in the area because they may migrate from the area reducing their numbers. This will make fish unavailable for fishermen that fish in the area.

6.3.12 Public Health

Stagnant water in excavated places near the road is a health hazard to nearby residents since they serve as breeding sites for vectors of disease such as mosquitoes which transmit malaria.

Labour would be required for construction phase. Unskilled labour would be required for civil works and would be preferably sourced from local areas. However skilled labour will be

required for certain activities. The skilled workers would likely be primarily migrants from places outside the project areas. The basic issues related with migrant labour may include:

- Conflict amongst workers, and between workers and local community, based on cultural, religious or behavioural practices.
- Discontent amongst local community on engagement of outsiders.
- Mild outbreaks of certain infectious diseases due to interactions between the local and migrant populations. The most common of these are vector borne (Malaria), water borne and sexually transmitted diseases (HIV, Syphilis and Hepatitis).
- Security issues to local women from migrant workforce.
- Use of community facilities such as health centres by migrant labour may lead to discontent with local community.

6.3.13 Occupational Health and Safety

Construction workers will be exposed to many occupational hazards including slip, falls from heights (with construction of deck), grazes, cuts, foreign objects in eyes, being pierced with sharp objects and being hit by heavy objects. Accidents caused by the poor handling, misuse or malfunctioning of equipment may increase. Workers will also be exposed to high levels of noise and dust that can be detrimental to their health. Accidents risks would arise from attempts to save haulage time and cost by overloading vehicles and speeding, as well as poorly shaped haul routes.

6.3.14 Cultural Heritage

There is no well-known cultural heritage in or around the project site but two baobab trees considered to be sacred by the Fetish group of the local community need to be removed and unmarked graves relocated as a result of the project. The impact is considered to be insignificant as careful consultation has been carried out to date without any objection from the community leaders and other members concerned.

6.4 Potential Negative Impacts – Operational Phase

6.4.1 Induced Development

During the operational phase, several land use changes may occur which may lead to the loss the main objectives of easing traffic flow. Among the effects include;

- Potential unplanned developments along the corridors attracted by easy transportation.
- Increased demand for residential, schools, recreation facilities and health facilities effects on public resources.
- Potential increase in traffic flow and categories into the areas.

6.4.2 Health, Safety and Security

The construction of the bridge will allow higher traffic volumes which may have subsequent impacts such as;

- Elevated noise levels to the residential, commercial and institutional facilities
- Potential increased road accidents as the road users adapt to new road use trends
- Potential immigration of business, institutions and residential facilities
- Potential increased demand on available sanitation and hygiene facilities along the corridors
- Increased chances of higher infections and spread of HIV/AIDS and other communicable diseases

6.5 Cumulative impacts

The overall objective of the project is to enhance mobility, promote efficient, affordable transport services along the project area and improve livelihoods of people in the project area of influence.

Some positive cumulative impacts are stated below;

- An improvement in travel will be observed as travel time will be reduced. This will especially be beneficial in terms of enhancement of accessibility and commercial activities thereby facilitating regional economic integration
- Efficient vehicular movement arising from an improvement in travel may also lead to a reduction in emissions, especially CO_2. Cumulatively, this will contribute to Climate Change mitigation,
- Safety of the road users also stands to be improved. With the provision of NMT facilities, additional routes, enhanced signage and information, cases of road accidents will be significantly reduced.
- The new bridge also has a potential to enhance appreciation of land and property values in the road section and the immediate neighbourhoods. Among the appreciation will include value addition to commercial and economic investments, potential for institutional development and attraction for residential housing development.

The on-going project will have negative cumulative impact as well:

- Running projects may pose increased social risks with respect to among others HIV/AIDS, drug trafficking security and other social challenges unless strategic and appropriate mitigation strategies are formulated to guide all the projects.

6.6 Summary of Impacts

Table 17 summarizes the impacts by providing a description and an assessment of identified impacts.

The methodology developed to assess and evaluate the significance of the impact is based on the following criteria:

- The type of effect i.e. positive or negative
- Duration and or frequency of occurrence i.e. short term, long term
- Sensitivity of the impact under consideration in a geographical context i.e. whether it is international, national, regional or local as defined in Table 17
- The magnitude of the impact; whether it is high, medium or low. (Table 18)

Effects are considered to be major, minor or negligible and can be negative or positive. Where positive impacts are identified mitigation is not required

Table 15: Geographical Context and Policy Importance

Geographical Context	Topic Definition
International	Important at global, African or trans-boundary levels
National	Important in the context of Ghana
Regional	Important in the context of Volta Region
District	Important in the context of the Shai Osudoku and North Tongu Districts
Local	Important in Volivo and Adidome Dufor

Table 16: Magnitude Criteria

Magnitude of effect	Negative effects	Positive effects
High	• Widespread community concern. • Failure to meet legal compliance requirements. • Fatality or serious health disability. • Severe or possibly irreversible damage to an important ecosystem or resource.	• Widespread community benefit. • High contribution to safety or prevention of fatalities. • High level of technology transfer. • Prevents serious damage to an important ecosystem or resource.
Medium	• Local community opposition and levels of complaint. • Regulatory concerns. • Lost time injury or short term health effects. • Medium term damage to an ecosystem or resource.	• Contributes to local development and economy. • Provides confidence to regulators. • Prevents medium term damage to an ecosystem or resource.
Low	• Minor community opposition or complaints.	• Low level of community support. • Economic benefits not distributed

	• Able to comply with legal requirements. • Local/minor health effects requiring short-term treatment. • Short-term, minor damage to an ecosystem or resource.	locally.

As a guide Table 19 presents a significance evaluation tool which calculates the significance of the effect by a combination of importance/ sensitivity and magnitude.

Table 17 : Evaluation of Significance of Effect

Sensitivity of Impact	**Magnitude of Impact**		
	Low	**Medium**	**High**
International	Minor / Major	Major	Major
National	Minor / Major	Major	Major
Regional	Minor / Major	Minor / Major	Major
District	Negligible / Minor	Minor / Major	Minor / Major
Local	Negligible	Minor	Minor / Major

The table below give a summary of the Environmental and Social Impacts and its assessments.

Table 18: Summary of Environmental and Social Impacts

IMPACT	**DESCRIPTION**	**ASSESSMENT**
POSITIVE IMPACTS- CONSTRUCTION PHASE		
Employment and Income	Job opportunities will be created for both skilled and unskilled labour	**Extent**: Local, District ,regional **Duration**: Temporary and Short term **Magnitude**: High **Evaluation:** Major
Enhance skills for Local Artisans	The local artisans will have the opportunity to be trained by the contractor enhancing their skills on the job and pushing them to a higher level in their field or career.	**Extent**: Local, District, regional **Duration**: Long Term **Magnitude**: Medium **Evaluation:** Minor

Increase revenue for the Municipal Assemblies	Revenue can be generated by the North Tongu and Shai Osudoku Municipal assemblies from traders who sell or trade around the project site to workers through ticketing.	**Extent**: District **Duration**: Short Term **Magnitude**: Medium **Evaluation:** Minor
POSITIVE IMPACTS- OPERATIONAL PHASE		
Regional Economy	The Project would lead to an overall upgrading of the socio-economic setting in the area. Appreciation of land and property values in the road section and the immediate neighbourhoods will be enhanced	**Extent**: Regional **Duration**: Long term **Magnitude**: High **Evaluation:** Major
Vehicle Operating and Transportation Costs	The road will provide an alternative route for vehicular traffic currently using the Adomi Bridge route to access Accra and beyond, and vice versa. Tremendous savings on general fuel consumption and reduction in vehicular emission pollution.	**Extent**: Local, District and Regional **Duration**: Long term **Magnitude**: High **Evaluation:** Major
NEGATIVE IMPACTS- CONSTRUCTION PHASE		
Water Quality	Spills of potential contaminating materials during construction could impact on Volta River	**Extent**: Local, District and Regional **Duration**: Temporary and Short term **Magnitude**: High **Evaluation:** Major
Soil Erosion	Road construction will intensify the effects of natural soil erosion due to vegetation removal, soil disturbance, and exposure of bare soil surface	**Extent**: Local **Duration**: Temporary and Short term **Magnitude**: Medium **Evaluation:** Major
Air Quality	Dust will be generated during the construction activities. Emissions from construction	**Extent**: Local, District and Regional **Duration**: Temporary and Short term **Magnitude**: High **Evaluation:** Major

	vehicles and equipment.	
Noise and Vibration	Construction activities involving heavy duty machinery, vehicular movement, vehicle horns , piling etc, will increase ambient noise levels and vibration beyond the immediate project corridor	**Extent**: Local **Duration**: Short Term **Magnitude**: Medium **Evaluation:** Major
Landscape Modification	Aesthetic and visual quality deteriorate due to excavations, stockpiling of materials, etc.	**Extent**: Local **Duration**: Temporary and Short term **Magnitude**: low **Evaluation:** Negligible
Construction Camps	Improper construction of camps may destroy an area, leading to obvious consequences on soil erosion and water quality.	**Extent**: Local **Duration**: Short Term **Magnitude**: Medium **Evaluation:** Minor
Construction Waste	Large quantities of construction wastes would be generated whilst constructing the bridge, approach roads and other facilities. Poor sanitation and solid waste disposal in construction camps and work sites are likely to have negative impacts on human health.	**Extent**: Local **Duration**: Short Term **Magnitude**: High **Evaluation:** Minor
Public Utilities	Electricity cables will be relocated resulting in disruption of utility services	**Extent**: Local **Duration**: Short Term **Magnitude**: Medium **Evaluation:** Major
Land Acquisition and Relocation	The construction of approach road and facilities will cause farmlands to be taken.	**Extent**: Local **Duration**: Long term **Magnitude**: High **Evaluation:** Major
Flora and Fauna	Vegetation must be cleared and tress felled for the approach roads as well as the bridge site. The noise and vibration from the construction works will frighten them and probably drive from their habitat.	**Extent**: Local **Duration**: Long Term **Magnitude**: High **Evaluation:** Major

Aquatic Life	Piling and dredging activities will cause suspension of sediments which will increase the turbidity, particulate matter, and suspended solids in the water column, this it can interfere with the feeding of fish since some of the fishes found in the lake are filter feeders.	**Extent**: Local **Duration**: Short Term **Magnitude**: High **Evaluation:** Major
Public Health	Stagnant water in pools near the road is a health hazard to nearby residents since they serve as breeding sites for vectors of disease. Increase risk of spreading sexually transmitted infections (STIs) and AIDS to rural inhabitants.	**Extent**: Local, District and Regional **Duration**: Long Term **Magnitude**: High **Evaluation:** Major
Occupational Health and Safety	Accidents caused by the poor handling, misuse or malfunctioning of equipment may increase as well as slips and falls etc	**Extent**: Local **Duration**: Medium Term **Magnitude**: High **Evaluation:** Major
Cultural Heritage	There are two baobab trees considered to be sacred by the Fetish group of the local community that need to be removed and unmarked graves relocated as a result of the project.	**Extent**: Local, **Duration**: Long Term **Magnitude**: High **Evaluation:** Major
NEGATIVE IMPACTS- OPERATIONAL PHASE		
Land Use Changes	During the operational phase, several land use changes may occur which may lead to the loss the main objectives of easing traffic flow	**Extent**: Local **Duration**: Intermittent **Magnitude**: Medium **Evaluation:**Minor
Health, Safety and Security	The construction of the bridge will allow higher traffic speed	**Extent**: Local, District and Regional **Duration**: Long Term

	which may have subsequent impacts on health safety and security	**Magnitude**: High **Evaluation:** Major

6.7 Mitigation Measures

The following mitigation measures have been considered as the most suitable to reduce the negative impacts that the project may result in.

Pre-construction requirements

- **Selection and recruitment of contractors**: environmental and social clauses will be included in the bidding documents (BDs). A rating system will also be defined in the BDs to give preference to firms with the necessary resources and approach to management environmental and social impacts during the works.
- **Fair, equitable and prior compensation** of persons affected by the project for property identified in the Resettlement Action Plan (RAP). This amount shall be paid by the Government of Ghana prior to start-up of the works.
- **Contractor's undertaking**: the works contractor shall prepare a Contractor's Environmental and Social Management Plan, including environmental compliance clauses, that it undertakes to comply with. It will be recommended that each contractor submit for approval by the supervising engineer's environmentalist a Site-Specific Environmental Protection and Management Plan (SEPP) no later than 60 days after contract notification. These documents shall contain as a minimum: (i) the organization chart of personnel assigned to environmental and social management, indicating the project's environmental and social officer; (ii) a description of the biophysical and socio-economic environmental impact mitigation methods; (iii) the management and restoration plan for borrow areas and where applicable quarries, including the necessary authorizations for existing queries and pits ; (iv) the water resources management plan; (v) erosion, drainage and sedimentation management plan; (vi) location of storage and equipment areas; (vii) liquid and solid waste management plan; (vii) all the site protection measures and implementation programme; (vi) the general site and location plan drawn to scale; (vii) a description of methods for the prevention and reduction of pollution, fires and road-related accidents; (viii) an emergency response plan including health facilities and access to them in emergency situations; (ix) site regulation regarding environmental protection and security; and (x) the interim site rehabilitation plan upon completion of the works and handing over of equipment, where applicable to local authorities and communities.
- **Capacity building of the key actors**: in light of the project's scope, training sessions on the environmental and social management of the project will be organized for the

main local stakeholders prior to works start-up. In particular, this will entail 3-days training sessions for the administrations staff to better understand JICA environmental guidelines, their roles and responsibilities prior and during the works, etc.

6.8 Mitigation Measures – Construction Phase

6.8.1 Water Quality

The contractor must ensure that waste chemical substances that can potentially contaminate the Volta River are disposed of properly and away from the river. Fuel trucks servicing equipment and vehicles on site will be obliged to carry at all times, anti-spill trays and a supply of suitable material, such as sawdust, for absorption of minor spills. Where possible, buffer zones of vegetation should be provided between work sites and water bodies. Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers. Use environment friendly and non-toxic slurry during construction of piles to discharge into the lake.

6.8.2 Soil Erosion and Sedimentation

In order to prevent soil erosion, the following should be followed:

- Earthworks should be planned and executed with due diligence to prevent soil erosion.
- The removal of the natural vegetation cover should be minimised or avoided.
- Create cut off drains in areas above cut slopes.

6.8.3 Air Quality

Dust generated during construction can be reduced by periodic watering of exposed surfaces, and/or by enforcing lower speed limits within the work zone. Trucks carrying and transporting sand and other construction materials must be well covered. The contractor must also make sure that the equipment and vehicles used are in good condition to ensure minimal emissions. Regular monitoring of PM, TSP, CO_x, NO_x, etc should be done during construction.

6.8.4 Noise and Vibration

The project implementation agency, the Ghana Highway Authority must educate and ensure that the contractor controls pollution and maintain construction equipment regularly in accordance with the manufacturer's specifications with particular regard to control of noise. The contractor is expected to plan and execute the works so that it does not become a nuisance to the general public where possible. Mixing plants would be located at least 500m from any community along the project roads. Contractor will be prevented from working in settlement areas between 2200hrs and 0600hours as stipulated by Ghana Standard. Construction workers should be provided with relevant safety gear including ear plugs at all times while at work and enforces usage.

6.8.5 Landscape Modification

The contractor must endeavour to avoid cutting down of trees where possible. The bridge and all other facilities will be landscaped to add some aesthetic value to the areas around it. Some shrubs and grass will be planted in the median whilst trees are planted along the sides of the approach roads. Borrow pits will be rehabilitated by re-vegetation of the site. Any borrows and quarry that will be established in the project vicinity will be operated and closed in the context of contract agreement established prior to construction

6.8.6 Construction Camps

Sites for camps shall be done in consultation with the local authority and local community; this will help to deal with social upheavals. The camp sites should be located away from residential areas. The contractor shall provide adequate office accommodation for his own staff and those of the Engineer's representative, workshops for his own use and those of his workers. Facilities to be provided should be maintained up to adequate standards. This facility is to be sited about 500m from the river.

6.8.7 Construction Wastes

The Contractor should ensure that:

- Waste disposal facilities including waste holding receptacles construction and domestic wastes, toilet facilities and septic tanks for sewage are provided on site.
- Construction and domestic waste as well as sewage should be disposed of into approved locations e.g. landfill sites
- Workshops have proper oil interceptors to collect surface water runoff from areas around refuelling points and service bays. The contractor will be expected to transport waste oil to the nearest commercially run oil disposal operator.
- Reusable waste from construction activities are used where necessary.

6.8.8 Public Utilities

Affected utility providers will be consulted to plan and realign displaced utility services, as well as discuss possible means of providing services in the interim to reduce inconveniences as much as possible. Public notices will be issued in advance to inform the general public about possible disruptions. The assessment of possible relocation zones and relocation of utilities will be undertaken by the following:

Table 19: Organisations responsible for utility relocation

UTILITY	ORGANIZATION RESPONSIBLE
High Tension Lines	GRIDCo
Water Lines	Ghana Water Company Limited (GWCL)

Telecommunication Lines	Telecommunication companies

6.8.9 Land Acquisitions and Relocations

All those who are found within the ROW of the project should be given three months to vacate after compensation due them has been fully paid. A full Resettlement Action Plan has been done which will include a comprehensive compensation process. Persons whose properties and land found in the project's right of way that will be relocated or destroyed will be adequately compensated accordingly.

6.8.10 Flora and Fauna

Conservation action is required for this species to ensure that it is not completely removed the area by and wiped from the project.

6.8.11 Aquatic Life

Dredging and piling works shall be planned to occur outside the known spawning and breeding season/period of the commonest fish species in the water body. This will ensure that the construction activity does not destroy any spawning females or their eggs, or any spawning areas.

The Accelerated Bridge Constructions (ABC) Technique will be employed to reduce the duration of impact on the water system and its associated species. Reduction technique is to be employed that is increasing the rate of construction will be hastened, while ensuring that all standard protocols are observed. This will ensure that the construction is completed at the possible shortest time. To achieve this, means that all the needed materials to complete the works shall be acquired and be ready before commencement if construction. That way when the system starts to repair its self after a period, and when species that migrated away start to come back, there will be no disturbance from suspended construction work.

Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary.

Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers. Use environment friendly and non-toxic slurry during construction of piles to discharge into the lake.

6.8.12 Public and Health

Pools of stagnant water around the construction site must be filled to prevent mosquitoes from breeding in them. GHA will be responsible for organising AIDS and STI's awareness campaign at construction camp and settlements along the road corridor.

This impact is considered significant since it affects human lives and would therefore require adequate mitigation measures.

6.8.13 Occupational Health and Safety

Injuries resulting from falling from heights and falling objects, as well as from the (mis) use of equipment and tools, cuts from stepping on sharp objects such as nails and other metal off-cuts and injuries resulting from clashes between vehicles and the workers as they both operate within the same space are likely to occur during the implementation of the project.
The Contractor must also implement a comprehensive Occupational Health and Safety (OHS) policy. The contractor must provide and enforce the use of personal protective equipment (PPEs)

6.9 Mitigation measures – Operational Phase

Land Use Changes

The successful mitigation of this impact rests greatly on the Shai Osudoku and North Tongu district assemblies. They should enforce land use zoning regulations in their respective district assemblies.

Health, Safety and Security

The GHA will among other things conduct:

- Road safety awareness campaigns should be organized to sensitize people on road safety and protection of the road signage and information.
- Ensure improvement and protection of signage, guard rails and other features that contribute to road safety
- Strict monitoring compliance with traffic use and speed limits
- Enhanced Information and awareness of HIV/AIDS

6.10 Cost of Mitigation Measures

Table 20: Mitigation measures and Cost

IMPACT	PROPOSED MITIGATION	COST OF MITIGATION
NEGATIVE IMPACTS- CONSTRUCTION PHASE		
Water Quality	Preventing contamination of surface water bodies and ground water.	For Contractor, no separate cost item for clauses in contract documents.
Air Quality	Periodic watering of exposed surfaces.	For Contractor No separate cost item for clauses in contract documents.
	Enforcing lower speed limits within the work zone	
	Cover all trucks hauling materials	

	Equipment and vehicles used are in good condition to ensure minimal emissions.	
	Regular monitoring of PM, TSP, CO_X, NO_X, SO_X etc should be done during construction.	
Soil Erosion	Plan and execute earth works with due diligence to prevent soil erosion	No separate cost item for clauses in contract documents
Landscape Modification	Shrubs and grass will be planted in the median whilst trees are planted along the sides of the road.	Cost to be included in contract documents.
Land Acquisition and Relocation	Proper and adequate compensation promptly paid to the land and property owners. Payment should take place before lands are taken over by the project.	An amount is estimated for the compensation of lands based on Consultant's Property Impact assessment.
Noise and Vibration	Maintain construction equipment regularly to control of noise.	For Contractor No separate cost item for clauses in contract documents.
	Plan and execute the works so that it does not become a nuisance to the general public where possible.	
	Provision of appropriate gear for workers.	
Construction Camps	Ensure that the construction camp are carefully sited and arranged to minimise their impact.	For Contractor No separate cost item for clauses in contract documents.
Construction Waste	Ensure proper disposal of construction waste	For Contractor No separate cost item for clauses in contract documents.
	Provide toilet facilities for workers	
Public Health	Eliminating breeding sites of disease vectors.	For Contractor, No separate cost item for clauses in contract documents.

	Occupational Health & Safety Plan	For Contractor No separate cost item for clauses in contract documents
	HIV/AIDS Awareness programme/ Community Outreaches	Cost included in contract for sensitisation
Public Utilities	Consult utility providers to plan and realign displaced utility services	Cost to be included in contract documents.
NEGATIVE IMPACTS- OPERATIONAL PHASE		
Vehicle Operating and Transportation Costs	Vehicle Operating and Transportation Costs	Vehicle Operating and Transportation Costs
Land Use Changes	The District Assemblies should enforce land use zoning regulations in their jurisdiction.	Cost to be included in contract documents
Health, Safety and Security	Road safety awareness campaigns should be organized to sensitize people on road safety and protection of the road signage and information. Enhanced Information and awareness of HIV/AIDS Ensure improvement and protection of signage, guard rails and other features that contribute to road safety Strict monitoring compliance with traffic use and speed limits	Cost to be included in contract documents Cost to be included in contract documents

6.11 Prevention of the Spread of Diseases

The spread of HIV/AIDS among project workers and communities during construction is one of the main health risks. The project design shall include sensitization programs of the dangers of HIV/AIDS through prevention and awareness campaigns; and through linkages with local NGOs and Health Authorities in the project area as well as creating the capacity for continuous prevention and awareness campaigns for road users.

6.12 Tree Planting

Trees are likely to be felled during the construction phase and as a compensatory measure the contractor is expected to plant four trees for every tree that will be felled.

7.0 EXPECTED RESIDUAL EFFECTS AND ENVIRONMENTAL HAZARD MANAGEMENT

7.1 Residual Impacts

With the implementation and strict adherence to mitigation measures it is expected that residual impacts will be of low significance.

There are however some positive residual impacts that can be realised:

- Economy is expected to grow with the influx of people and the provision of goods and services.
- There will be increased awareness of health and safety issues.

7.2 Environmental hazard management

The failure of environmental mitigation can result in serious impacts such as erosion, contamination/increased turbidity of the Volta River, and disruption of the community lifestyles. Construction of a road also involves occupational health and safety risks to road workers, primarily in the areas of storage and handling of materials, and operation of heavy machinery. The anticipated risks in this project include:

1. Exposure to excessive dust particles or toxic fumes from bitumen, cement and other chemicals used in road works;
2. Potential collapse of trenches;
3. Risk of fuel spills and therefore contaminating the Volta River.

The risks can be mitigated to a large extent through:

1. Strengthening staff skills and training in environmental management;
2. Monitoring environmental actions and responsibilities and making provision for remedial actions;
3. Planning for remedial measures in case initial planned actions are not successful;
4. Limiting time of exposure to dust particles, chemicals and noise;
5. Provision of Personal Protective Equipment (PPE)
6. Establishing safety and inspection procedures in materials handling, operating heavy equipment and constructing trenches; and
7. Safe handling of chemicals.

7.3 Environmental Emergency Response Plan

An emergency response plan should be put in place to deal with environmental /public health emergencies associated with accidents. An area will be designated as assembly point in the event of emergencies where all activities will be halted and workers move to the assembly points in an orderly manner. Whiles the emergency services are contacted. Where first aid must be administered, a trained first aider will carry it out whilst arrangements are made with the health facility for the injured to be taken to.

The best way to avert any emergency is through prevention. However, there are emergencies which are beyond prevention such as natural disasters. All workers will be given environmental and safety inductions to enable go about their respective duties in a safe and environmental sound manner. Appropriate PPEs must be provided to assist in dealing with environmental, health and safety issues. Individual responsibilities will call for everyone to be alert when going their duties.

Further training will be given to workers working for instance at a height. Personnel from fire service will be contacted to give some fire drills, rescue and containment. Specialist first aider will be contacted to train foremen on administering first aid in the event of emergencies. All incidents will be recorded and investigated for corrective actions to be put in place to avert/ prevent future occurrence.

When accidents occur, the person who caused it or finds it will take the following environmental, Health & Safety Incident Recording Procedure presented below:

Table 21: Health and Safety Incident Recording Procedure

Action	Responsibilities	Comments
Assess the incident	Person causing/ finding incident	Refer to incident response plan. If incident is significant or major call the Project Manger
Identify materials and obtain appropriate PPE	Person causing/ finding incident	PPE can include gloves, safety boots, goggles, nose musk and vest
Contain the incident or put mitigation in place	Person causing/ finding incident	If pipe; close valve, if leak from oil drum; roll drum to produce leaks, if fire; raise alarm, if accident; inform health personnel, request for back up from supervisor
Inform foreman/supervisor	Supervisor	Isolate area and stop pedestrian and vehicular traffic till further instruction
Foreman/supervisor notifies site manger notifies E&S team	Foreman/ Supervisor/ Site Manger/ ESO	Foreman/ supervisor will follow standard incident response by contacting traffic controller. Notify key contacts and emergency authorities as required
Determine cause of Incident	ESO	For major incident call for assistance and notify relevant supervisors
Protect adjacent areas from impact	Foreman/site manger	Seal drain grates by putting sand bags or other works to mitigate the incident
Clean up or repair as required	Foreman/site manger	Use appropriate absorbents on spills and repair damaged environmental controls
Dispose of wastes as	Foreman/site	Arrange for offsite disposal in accordance with EPA

required	manger	requirement
Inform environmental, health and safety and fill incident log form	ESO	Record incident and review procedures. Report to emergency response/EPA/Police/Fire Service

Emergency phone numbers

Environmental Protection Agency	0302 664697-8
Ghana Police Service	191
Ghana National Fire Service	192
Ghana National Ambulance Service	112

8.0 STAKEHOLDER AND PUBLIC CONSULTATIONS

8.1 Overview

Various engagements and consultations have been held with relevant stakeholders and the project affected communities over the years since the inception of this project from 2014. As part of the requirements by EPA and JICA, engagements were held to seek the views, perspectives and concerns of the stakeholders into the project.

As part of the review for the ESIA process on the bridge project over the Volta river, community and stakeholder consultations have been held to effectively provide some concerns and opinions regarding the project before its implementation. PAPs as well as community members had the opportunity to make meaningful contribution to the project. In addition, the consultations provided participants the urge to point out major concerns regarding the previous consultations held in 2014 and now.

8.2 Meetings Held

The initial stakeholder consultations involved meetings with concerned individuals. The objective was to inform them of the project as well as discuss the environmental and social issues of the proposed bridge as well as the mitigation measures that would be necessary.

As part of the review exercise for the construction of the bridge, further consultations have been carried out with stakeholders, community members and PAPs. The consultations were held to point out to them on the need for a review of the exercise carried out in 2016. Again, the consultations seek to incorporate their perspective and concerns into the project. The discussions were held on the 14th and 15th of January 2020 at Volivo and Dorfor Adidome respectively. In addition, consultations with the PAPs were also done within the same period. The PAPs census survey was also carried out within four (4) days from the 14th January 2020 to 17th January 2020.

8.2.1 Overview of Meetings

It has been confirmed by the survey that no residential land, permanent house or building will be affected by the project on neither the Volivo nor the Adidome side of the bridge. There are, however, some crop farms that would be impacted. On Dufor Adidome side of the bridge, two Sacred Baobab trees that were initially in the right of way are still affected by the revised design. In addition, there are electric power poles in the ROW that belong to GRIDCo, a state institution in charge of electric power distribution. On the other hand, the Adidome Cemetery which use to be in the ROW, is no longer affected due to the revised design.

No objections to the proposed projects were made. In general, the attendants agreed with the proposed projects and were looking forward to seeing them actually be implemented. Details of affected persons can be found in table 22 below.

8.2.2 Issues and Concerns Raised

Below are some of the concerns raised by the people during the meeting

- The people raised concerns that there are no documents for some of their lands because they inherited it directly from their forefathers. They therefore suggested that other alternative measures be used to identify the rightful owners. This includes confirmation by community elders and neighbouring farmers who share common boundaries.
- PAPs are of the view that ever since the first visit from about six years ago, pictures were taken for PAPs farmland and they were asked to stop farming on that particular land because of the project. They have advised some considerations to be given in terms compensation for the period loss over the pass years.
- The people also demanded that since the project is taking away their lands which has been their only source of livelihood, they wish to be engaged as workers during the project implementation.
- They also advice GHA to be diligent in selecting the right contractors for the construction of the bridge. A contractor who is devoid of corruption is the one they opt for.
- Land may be destroyed by all the constructional activities that will take place; rendering some completely unusable in the process which may not be restored. It was however suggested that some environmental measures should be put in place to restore some of the land after construction.
- Accident rates may be on the rise on the approach roads. Community members suggested that traffic regulations such as pedestrian walkways and flagmen should be put in place to control the incidence of road accidents.
- Burrow pits dug during the construction of the road should be recreated into dugouts to provide water for livestock.
- Construction materials, especially toxic chemicals that may be used for the project should be properly disposed of in order to cause any damage to the water bodies.
- Community members asserted that every proposed project is anticipated to lead to increased rates of child trafficking and child labour. Again, cyber-crime may be on the rise. It was suggested that security measures should be enhanced within the communities. The number of police should be increased in the districts.
- The police should follow up on reported cases of rape and defilement that may arise during the proposed project. Some pictures from the various consultations are shown below:

Community Consultations at Volivo

Community Consultations at Dorfor Addome

Summary of Project Affected Persons

Table 22: The Profile of PAPs in Volivo

#	Full Name of PAP or Representative	Sex	Age	Tel. No.	Marital Status	Household Size
1	Amanor Darkey	Male	78	242466341	Widow/er	12
2	Joseph Amanor Odonkor	Male	68	241934165	Married	11
3	Tetteh Peter Kwao	Male	52	244206359	Married	8
4	Kwaku Amediavor (Farmer on Amanor Kwame Isaac's land)	Male	58	248627107	Consensual Union	3
5	Philip Kwablah Amanor	Male	62	243950173	Divorced	6
6	Appiah Narteh	Male	60	241934165	Widow/er	9
7	Tetteh Raphael (Land owner)	Male	61	548160171	Married	7
8	Tetteh Henry for Blessed Nartey (Raphael Tetteh- Land owner)	Male	25	241930485	Single	6
9	Regina Ayorkor Mensah (Land Owner)	Female	51	276942208	Married	6
10	Kwabena Kwao	Male	37	249629502	Consensual Union	8
11	Odonkor Kwasi for Honyadzi Tetteh	Male	40	248357864	Married	8
12	Atterh Kofi	Male	71	246224976	Married	17

13	Amanor Kwame Isaac (Land owner/farmer)	Male	52	242859995	Married	26
14	Nicholas Teye Young	Male	43	247958757	Married	6
15	Emmanuel Kwao	Male	27	556542757	Married	7
16	Narkortu Bernice Maku	Female	52	C/o 0241810809	Divorced	15
17	Adjo Kwao (Amanor Darker-Owner)	Female	30	None	Divorced	13

Table 23:The Profile of PAPs in Dorfor Adidome

#	Full Name of PAP	Sex	Age	Tel. No.	Marital Status	Household Size
1	Mary Kwao	Female	70	247629621	Widow/er	4
2	Azietor Wisdom for Azietor Family	Male	64	506708069	Married	3
3	Nukpedu Tsorme Jacob Tornyeli	Male	73	249693050	Married	8
4	Agbohla Francis for Agbohla Mawuena	Male	34	550317686	Consensual Union	3
5	Dzetorme Kwasi (Kosi)	Male	75	244727902	Consensual Union	7
6	Peter Zigi	Male	32	592904142	Consensual Union	6
7	Ben Azietor	Male	70	249391872	Married	2
8	Nukpedu Tsorme Jacob Tornyeli	Male	73	249693050	Married	8
9	Christiana Nukpedu	Female	83	557638755	Widow/er	8
10	Dzetorme Kwasi (Kosi)	Male	75	244727902	Consensual Union	7
11	Azietor Wisdom for Azietor Family	Male	64	506708069	Married	3
12	Moses Kabutey	Male	45	547562250	Married	6

STAKEHOLDERS CONSULTED

Table 24: Other Stakeholders consulted

Name and Contact	Community / Agency	Designation	Issues / Concerns Raised
1. Nicholas Owen – 0542446925/0549815463	Volivo	Assembly Member	❖ Burrow pits dug during the construction of the road should be recreated into dugouts to provide water for livestock. ❖ Construction materials, especially toxic chemicals

2. Philip Ayertey - 0247537023		Former Assembly Member	that may be used for the project should be properly disposed of in order to cause any damage to the water bodies ❖ Community members asserted that every proposed project is anticipated to lead to increased rates of child trafficking and child labour. Again, cyber-crime may be on the rise. It was suggested that security measures should be enhanced within the communities. The number of police should be increased in the districts.
3. AzietorTse Kofi – 0248579999 **4. Prince Zao - 0243174493**	Dorfor Adidome	Assembly Member Former Assembly Member	• The police should follow up on reported cases of rape and defilement that may arise during the proposed project • Land may be destroyed by all the constructional activities that will take place; rendering some completely unusable in the process which may not be restored. It was however suggested that some environmental measures should be put in place to restore some of the land after construction • Contractors must work with due diligence in order not to pollute the river since it is the only source of water for the community. They proposed that boreholes be dug in the community augment the situation.
4. Dr Bob Alpha	Water Resources Commission	Project Manager	• Major concern to them are the two toll booths: They are concerned with people littering the water through buying and selling brought on by visitors in traffic. o They proposed that tolls should be collected 100m minimum from the River/bridge on level ground and 130m minimum if it is a sloped land in order to reduce waste impact. o They also proposed one toll (situated in the centre of the road) for collection instead of two to reduce waste and litter produced. o Measures should be put in place to control littering as well as other sanitary controls. • Construction concerns: o Drilling and cofferdams- mitigation measures o Permits are needed from the WRC for both works before detailed recommendations would be given. Project brief and detailed designs will be required for permit application. o Supervision of both drilling and cofferdams

			would be done by officials of the WRC. o Extra drainage works need to be included for River and water diversion etc. aside those mentioned for road works. o Observatory area, axle load weighting area, parking bay as well as other facilities should be located a minimum of 100-130m away from the water to reduce impact. • Regular water quality monitoring to reduce project impact

8.3 Grievance Procedures

8.3.1 Grievance Redress Procedures

The objective of the Grievance Redress Procedure is to address and resolve grievances or complaints from affected persons promptly, fairly, and in a manner that is, to the extent possible, acceptable to all parties. The following principles will be applied:

- Provide straightforward and accessible ways for affected persons to voice complaints or resolve any disputes that might arise related to Project implementation;
- Seek solutions to any tensions and conflicts early on, to avoid the use of a 'fire fighting' approach
- Identify and implement appropriate and mutually acceptable actions to address complaints;
- Respond in a timely manner, and with sensitivity to the needs of complainants
- Ensure that claimants are satisfied with outcomes of the corrective actions, and maintain a dialogue with them to the extent possible; and
- Avoid resorting to higher levels of adjudication, such as judicial proceedings, as much as possible.

8.3.2 Types of Grievances

All grievances will be received by the Grievance Committee (GC), through Director of Survey and Design, the Principal Valuation Expert, the Manager of Environmental Management Unit (EMU), and the Principal Legal Officer all from GHA, an EPA officer, a representative from the relevant municipal/district assembly, and a representative of the PAPs. The GC will respond to any grievances that the PAPs may have during the RAP implementation.

There will be two contact people from the GC to attend to all complaints as the first step by recording all complaints. The record will include name and contact of complainant, issue of complaint, date and time and receiving officer. The complainant will verify that the

complaint lodged has been appropriately captured on the complaints sheet (to be designed and provided by GHA/Environmental Management Unit).

The grievances most likely to occur during the implementation of the RAP may include the following:

- Disagreement over compensation amount assigned
- Delays in receiving compensation
- Disagreement over asset ownership
- Disagreement over proportionate sharing of assets with joint ownership
- How PAPs with lost identity documents can receive their compensations

8.3.3 Institutional Arrangements for Redressing Grievances

It is expected that all grievances would be addressed amicably at the committee level. However, in the unlikely case that a particular issue proves difficult to address, the complainant has the option of seeking redress at a higher level i.e. court of law and the committee members will co-operate.

8.3.4 Grievance Procedures

The details of each grievance will be recorded on a Grievance Form, along with name and address of the applicant, the application date, type of application, and the name of the officer receiving the grievance. A database of recording grievances along the lines described above will also be developed. In receiving the grievances of vulnerable affected persons (e.g., women, those above 65, the illiterate, or the physically challenged), the GHA Environmental Management Unit shall pay particular attention to any special needs, difficulties or concerns that they may have.

The steps for grievance redress are as follows:

(1) Designated PAP representatives already serving on the GC shall receive grievances/complaints for the attention of the Grievance Committee. The GC shall inform the complainants on the status of their grievances within 7 days after the application.

(2) If the grievance can be resolved by the GC (i.e., if it necessitates no consultation with other organizations), possible corrective actions will be determined within 10 days. If resolution of grievance is seen to require commitment beyond the Grievance Committee, the members shall coordinate and consult with the relevant officials. In such cases, the time frame for the determination of possible corrective actions shall be 15 days.

(3) A complainant is allowed to procure the services of a private valuer at no cost to the PAP who would help that person determine an acceptable compensation. This can be presented to the committee as a grievance. The GC will investigate the compensation complaints.

(4) The Committee will communicate their proposed solution to the complainant.

(5) PAPs that are entitled to compensation or additional compensation will receive their entitlements from GHA Environmental Management Unit upon the recommendation of the Grievance Committee.

(6) Complaints that relate to the quantum of compensation will be referred to LVD to validate the compensation rates with the accompanying independent valuation report clearly stating the assumptions and rates used to arrive at compensation claims. The private valuation Expert of the Complainant would be invited to meet the LVD on an agreed date to resolve the issues involved in the disagreement. After negotiations, the LVD would communicate their recommendations to the GHA Environmental Management Unit which would in turn inform the claimant of the outcome.

(7) If the said GC recommends payment of the claim, then the GHA Environmental Management Unit would ensure that it is done before the structure under review is taken over.

(8) Once an agreement has been reached between the applicant and the responsible party on the corrective actions, the applicant will be asked to sign off the grievance closeout form on his/her acceptance of the solution.

(9) If the applicant remains dissatisfied with the outcome, additional corrective action will be agreed on and carried out by the responsible party.

(10) Whenever a complainant's claim cannot be resolved satisfactorily, GHA Monitoring Environmental Unit will procure the services of an arbitrator to mediate between the complainant and said committee. It is only after this mediation has failed that a claimant can then exercise the option of going to Court, as provided under Section 20 under Chapter 5 of the Constitution of the Republic of Ghana.

8.4 Future Consultations

The initial consultations during the design phase and ESIA study should be followed by more consultations during the construction and operation phases. On the part on the contractor he has to consult with the locals to avoid creating nuisances. The GHA will also consult North Tongu municipal assembly, Shai Osudoku municipal assembly and PAP's to inform and involve them during the implementation of the Resettlement Action Plan (RAP).

9.0 MONITORING

Environmental monitoring ensures that the impacts have been accurately predicted and that mitigation measures are being implemented as planned and has the assumed effects. The monitoring exercise will ensure that the remedial actions recommended in the assessment are incorporated in the project and maintained throughout the operation life where appropriate. It will also identify additional remedial measures and corrective measures or redesign remedial measures if they are not sufficiently effective.

9.1 Construction Phase Monitoring Enforcement

All major stakeholders in the project have a monitoring responsibility of some kind. However, only the Supervising Engineer, the Ghana Highway Authority Environmental Management Unit, The EPA, the Contractor are allocated specific and formal monitoring obligations. Traffic Police, Health Authorities and other public authorities will automatically monitor some of the effects of the project during their daily work.

Periodic interviews with the beneficiaries of the projects will also be undertaken to assess their opinions about the effect of the implementation of the project.

Table 25: Summary of Monitoring Responsibilities and Output

Party Responsible	Parameters to be Monitored	Output
GHA (Environmental Management Unit)	• Overall Environmental Performance of the Project • Community relations • The unit has direct responsibility over operations concerned with the social impact including those caused as a result of resettlement and land acquisition. • The evaluation of properties' value, estimation of the amount of compensation as well as provision of the compensation, however, do not lie under the direct • Responsibility of the EMU. Payment of appropriate compensation	Quarterly Environmental reports
Policy Planning Section and Monitoring and Evaluation Section of the MRH	• Lead and coordinate both internal and external monitoring of A-RAP implementation	Monitoring Reports
Lands Commission/Land Valuation Division	• Identification of permanent and temporary structures • Determining the appropriate level of compensation to be made.	Compensation claims processing
Town and Country Planning Department	• The TCPD ensures that the ROW is Implemented according to the approved planning schemes.	Land use plans

EPA	• Overall Environmental Performance of the Project	Regular monitoring to ensure compliance Instructions to Contractor and the Engineer
The Engineer	• Construction methods and materials • Environmental management of construction sites • Implementation of mitigation measures for air, water, soil, traffic, Occupational Health and Safety, etc. • Environmental management of construction camps • Contractors waste management Staged rehabilitation of impact areas • Community relations • Environmental performance of contractor's equipment • Accidents (traffic, spills etc.) • Environmental performance of mitigation measures	Monthly Environmental reports. Incident Reports as and when required (spills, accidents and the like)
The Contractor	• Environmental performance of equipment and plants • Implementation of interim and permanent mitigation measures • Occupational Health and Safety measures • Base Camp Management • Waste Management Plans • Air and Water quality • Accidents of any kind	Maintenance records Accident Reports Mitigating actions e.g. sprinkling of water, traffic signs, safety barriers
North Tongu and Shai Osudoku district assemblies	• Among other specific duties for various sectors of the district assemblies • Forum for public education and community consultations. • The assembly will coordinate the interest of the PAPs and also serve as an interface between the GHA and the PAPs.	Reports and instruction to Contractor/GHA
Health Authorities	• Change of frequency of diseases • Occurrence of new diseases in the area	Health reports.
Local Communities	• Negative environmental impacts • Social disturbance	Complaints to Contractor and Supervising Engineer
External Consultants	• Carry out periodic monitoring, evaluation and auditing of implementation of the A-RAP	Monthly and Quarterly Progress Reports
Utility Agencies	• GRIDCo will relocate the power lines and power poles	Power relocation and restoration
Water Resource Commission	• Monitor activities of the Project relating to the water body	Regular monitoring to ensure compliance with

		permit conditions Instructions to Contractor and the Engineer
Attorney General's Department	• Represents the government in court proceedings to address the grievances of unsatisfied PAP's. • Drafting the executive instrument for acquiring the land needed for the project.	Redress Mechanisms

10.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 An Overview

The foregoing chapters of this report show that the project poses issues of concern related to social and economic development as well as environmental conservation and for this reason, a comprehensive management plan outline would be necessary on the project implementation. This section documents a set of guidelines for implementing and incorporating environmental management practices to minimise adverse environmental impacts associated with the construction of the new bridge on the Volta River. Its aim is to establish environmental management standard guidelines for all parties involved in undertaking their various tasks and responsibilities for the project.

The ESMP should take into consideration stakeholder's desires and interests and be reviewed continuously for the benefit of acceptability by stakeholders.

10.2 Guiding Objectives of the ESMP

- To clarify the basic policy for environmental management as well as to comply with environmental guidelines in the operational and construction phases;
- To clarify the organizations responsible for environmental management and monitoring;
- To specify measures to mitigate the negative impacts on the natural and social environments and to ensure their implementation;
- To adequately understand the status of the natural and social environment and the effectiveness of the environmental mitigation actions implemented; and
- To ensure that various plans and reports adequately take environmental concerns into consideration.

10.3 Monitoring Environmental Status

It is crucial to monitor the state of the environment during and after construction in order to properly understand its viability and the effectiveness of the mitigation measures applied. This information will form the basis for deciding whether any, and what kind of, additional measures ought to be taken. The roles and responsibilities of the organizations concerned with environmental monitoring, the items to be monitored and expected outputs are presented in Table 38. The specific method of monitoring is described in Table 32.

Table 26: Responsibilities for Environmental Monitoring and Outputs

Responsible Organization	Subject of Monitoring	Output
Environmental Management Unit, GHA	Overall environmental performance of the project (internal monitoring) Community perception State of compensation	Instructions to contractor and consultant Monthly environmental report

EPA	Overall environmental performance of the project (external monitoring)	Instructions to GHA, contractor and consultant
Consultant	Environmental management activities of the contractors at construction sites, construction camps, and borrow pits/quarries Environmental performance/effect of construction methods and materials as well as contractors' equipment and machinery used by the contractors Community perception and state of affected areas Accidents (e.g. traffic and spills) Overall environmental performance of mitigation measures	Monthly environmental report Incident reports as, and when, required (e.g. spills and accidents)
Contractor	Environmental performance of: equipment and machinery; interim and permanent mitigation measures; occupational health and safety measures; and construction camp management Air, water, and soil quality as well as the level of noise and vibration generated as a result of construction Accidents	Maintenance records Accident reports Mitigation actions (e.g. sprinkling of water, installation of traffic signs and safety barriers)
Traffic Police	Traffic nuisance Traffic safety measures Traffic accidents	Police reports and instructions to contractor
Health Authorities	Frequency of diseases Occurrence of new diseases in the area	Health reports
Local Communities	Negative environmental impacts Social disturbance	Complaints to contractor and supervising consultant

Table 27: Methods of Environmental Monitoring

Environmental Item	Frequency	Parameter	Location	Responsibility
Ambient noise	Daily	• Level and frequency of disturbance to nearby settlement • Level of frustration and requirement for sound barrier	• Construction site • Adjacent settlement	Contractor (under Consultant's supervision)
Ambient air quality	Monthly	• Amount of dust generated	• Construction site • Adjacent	Contractor (under Consultant's

		• Level of frustration and requirement for spraying water on roads to control dispersion of dust • Items (SO2, NO2, CO, TSP, PM10)	settlement	supervision)
Effluent water quality	Quarterly	• Water quality of effluents and runoff from construction site • Items (pH, TSS, TDS, BOD, COD, T-N, T-P, mineral oil, oil)	• Work camp drainage • Construction site drainage	Contractor (under Consultant's supervision)
Sedimentation and erosion	Daily, as required	• Condition of erosion and sediments by visual check	• Construction site • Borrow pits • Cleared land • Water channels • Volta River banks	Contractor (under Consultant's supervision)
Waste management	Daily	• Waste generation, transportation, final disposal and onsite treatment by visual check	• Construction site, camp	Contractor (under Consultant's supervision)
Occupational health and safety	Daily	• Assignment of responsible personnel • Visual check of proper use of protective gear • Visual check of signs	• Construction site, camp	Contractor (under Consultant's supervision), GHA as required

10.4 Measures for Impact Mitigation

Based on analyses on the expected impacts, mitigation measures against the major negative impacts have been proposed as shown in Table 34 below.

Table 28: Measures for Impact Mitigation

Category	Environmental Impact	Mitigation Measure
Pollution and Nuisance	Air pollution	Regular watering of exposed surface to prevent dust dispersion during construction • Comprehensive equipment maintenance to prevent undesirable gas emissions from such equipment

		• Well-managed construction supervision to prevent dust dispersion during construction
	Water and soil pollution	A control and management policy for storing construction materials, fuel, sewage and other chemical substances to prevent unexpected leakage • Establishment of appropriate disposal and discharge sites in the construction site • Proper sanitary facilities and an appropriate sanitary management system
	Waste disposal	Establishment of appropriate disposal and discharge sites in the construction site
	Noise and vibration	A well-planned construction schedule to avoid nuisance of noise and vibration particularly during night time • Regular maintenance of construction equipment
Natural Environment	Hydrology	Construction scheme that takes into account the potential impact of construction works on the river
Social Environment	Involuntary resettlement and land acquisition	A system for monitoring the livelihood of people subject to land acquisition and those who have family members buried in the cemetery that are to be replaced • A grievance mechanism in implementing the A-RAP
	Local economy such as employment, livelihood etc.	Preparation in the A-RAP of an income restoration programme and its implementation in case income sources are damaged by the project
	Land use and utilisation of natural resources	Approval of the GHA regarding the location and areal plan for borrow pits and quarry sites as well as the excavation and restoration plans
	Existing social infrastructure and services	Relocation of utilities such as power lines, if necessary, prior to construction by the organisations concerned such as the Electricity Company of Ghana and GRIDCo
	Cultural and religious heritages	Adequate care and due consideration for the ritual and feelings of the Fetish group of the community, those who have family members buried in the cemetery, and other community members with regard to removal of the two baobab trees and relocation of the cemetery
	Working condition	Development and maintenance of a proper work camp with due respect to the construction workers' working conditions • A programme for monitoring working conditions • Trainings and regular safe checks during construction in order to ensure safety of the construction workers
	Water use/rights	Obtaining authorizations from relevant organizations including the Municipal Assembly with regard to the management plan on water intake for construction works
	Transmitted diseases such as HIV/AIDS	An infectious disease awareness campaign covering HIV/AIDS targeting construction workers. As it is common in Ghana, implementing an educational safety programme should not be difficult for the project. NGOs are also available to provide support for both Shai Osudoku and North Tongu Districts for such purpose. • Implementation of local communities' awareness programme that lasts preferably even after the construction stage
Others	Accidents	Implementation of a campaign to increase drivers' awareness for reducing traffic accidents

10.5 Cost for Impact Mitigation and Monitoring

An estimate of the costs required to carrying out major mitigation measures and monitoring is presented in Table 41 below.

Table 41: Cost for Impact Mitigation and Monitoring

Mitigation measure	Unit Price	Quantity	Total
Environmental Officer			
Costs of environmental and Social monitoring by officers of the GHA and EPA	USD 12,000/month	20 months	USD 240,000
Consultant and Contractor			
HIV/AIDS prevention and awareness campaign	USD 3,000/campaign	1 campaign/yr x 3 yrs	USD 9,000
Road safety campaign	USD 1,000/campaign	1 campaign/yr x 3 yrs	USD 3,000
Monitoring tool (water quality testing kit)	USD 3,000/set	1 set	USD 3,000
Total Cost for Implementing Major Mitigation Measures and Monitoring			USD 255,000

11.0 CONCLUSION

The findings from the Environmental and Social Impact Assessment show that although the proposed bridge project is expected to have a number of negative impacts most of these are anticipated to occur during the construction phases and are mitigated in the overall bridge design.

However there are sensitive areas in the project area, which if not properly taken care of could be destroyed. The mitigation measures will require constant information flow and consultation with the stakeholders to ensure the least adverse social-economic impact from the project.

The project is therefore being recommended for implementation assuming the incorporation of the recommended mitigating measures and implementation of the Impact Mitigation Measures.

APPENDICES

APPENDIX A: TERRESTRIAL FLORA AND FAUNA SURVEY REPORT

TERRESTRIAL FLORA AND FAUNA SURVEY AT THE PROJECT SITE FOR

THE CONSTRUCTION OF A NEW BRIDGE ACROSS THE VOLTA RIVER ON THE EASTERN CORRIDOR PROJECT

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Submitted To:
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EXECUTIVE SUMMARY

This study was conducted as a component of an Environmental and Social Impact Assessment (ESIA) by VOLIVO Project. The project includes the construction of a bridge over the River Volta to link the Volivo and Dorfor-Adidome communities in the Eastern and Volta Regions respectively. The project will also construct a 90 m wide road that covers a distance of 1.2 km (600 m at Volivo and 600 m at Dorfor-Adidome.

The surveys were conducted to determine the ecological significance of flora and fauna that currently exist around the proposed project site. The main methods used in data collection for this study was direct field assessment/observations.

The project area supports small population and species of wildlife. This is due to the continuous decline in the ecological integrity of the habitats in the area from decreasing vegetation cover through farming and grazing of wildlife. None of the fauna species encountered within the project site surveyed is of conservation interest. One flora species was rated as Gold Star due to its rarity in the general area.

The proposed project is anticipated to have very little negative impact on both the wildlife in the area and their habitats. A flora management plan is recommended for the Gold start Species identified in the area. Notwithstanding, it is recommended for the project to commence during the dry season and period outside the closed season to further reduce the any potential impacts.

SECTION ONE: GENERAL INTRODUCTION

1.1 Project Background

The Government of the Republic of Ghana has received the Japanese ODA loan from the Japan International Cooperation Agency (JICA) to finance the Construction of a New Bridge across the Volta River on the Eastern Corridor Project which is to strengthen and secure the transport capacity of the Eastern Corridor in Ghana through construction of a new bridge across the Volta river, thereby contributes to economic revitalization and poverty reduction in the area along the corridor and neighbouring countries.

The construction components of the Project include:

- Construction of a new bridge across the Volta river: approximately 540m
- Construction of approach roads on both sides of the new bridge: approximately 1,000m in total
- Construction of toll plazas and
- Design and installation of lighting system

The construction phase of the project is anticipated is anticipated to have impacts on flora and fauna of the area. In compliance with national, the project is required to undertake and Environmental Impact Assessment to identify all potential impacts to help the project develop measures to help address these impacts.

1.2 Objectives of the study

The objective of this survey is to obtain representative information on the terrestrial ecosystems and associated biodiversity and habitat of the area. The relative ecological health of the site and its ability to absorb project impacts was determined. The survey also reports the relative biodiversity assets of the project site to enable the proposed project ascertain potential impacts on the area to allow for full consideration and mitigation of those impacts. The assessment will form part of ecological impact assessment for the project and help avoid or minimize adverse impacts on and to protect environmentally sensitive areas.

Specifically, the objectives of the surveys were to;

- Assess the fauna and flora composition within the proposed project site
- Assess the fauna and flora composition within the project area
- Determine the ecological significance of the flora and fauna within the site
- Assess threats to fauna and flora in the area
- Determine potential impact to flora and fauna in the area from projects activities
- Propose mitigation measure to address the potential impacts

SECTION TWO: METHODOLOGY

The study was undertaken using field surveys to gather information about the flora and fauna in the area. The study was carried out on the early morning through the evening of14th January 2020 by a two-member team.

Field surveys were concentrated within the proposed project site (See Figure 1 for map of project site). Surveys for fauna were conducted in the early morning when most wildlife are still active while flora assessment was carried out in the day time.

2.1 Flora

The flora survey aimed at determining the existing vegetation type within the site and whether any species are rare or endangered according to international classifications.

A rapid walk over assessment of the vegetation of the proposed sites for the road construction project was carried out. All plant species encountered in sample sweeps of 20 m radii were recorded and their conservation statuses determined using the Star Rating System of Hawthorne (1995) as presented below;

Star rating	***Definition of Rating***
Black Star species	Species rare internationally and at least uncommon in Ghana; urgent attention to conservation of populations needed
Gold Star species	Fairly rare internationally and/or locally
Blue star species	Widespread internationally but rare in Ghana or vice-versa
Scarlet star species	Common, but under serious pressure from heavy exploitation
Red Star species	Common, but under pressure from exploitation
Pink Star species	Common and moderately exploited. Also non-abundant species of high potential value
Green Star species	No particular conservation concern, common in Ghana

2.2Fauna

The terrestrial fauna assessment consisted of mammal and avifauna survey. The general survey procedure involved slow attentive walks within the project site during which any fauna seen or heard (in the case of birds) was identified and recorded. All features of ecological interest for fauna observed were also noted and recorded. Areas of dense vegetation or thickets were thoroughly surveyed to identify any wildlife that may be in hiding. Areas identified as possible habitats for certain species were also thoroughly searched. Surveys were targeted at finding any signs of activity that the animals might have left behind. Activities carried out during the survey included (i) direct opportunistic observation (used to identify any living animal encountered in the area), and (ii) spoors (recording any sign left by a living animal such as a constructed burrow or holes, faecal pellets, footprints etc since most mammals almost always leave signs of their activities behind them).

Identity of unfamiliar bird species was confirmed with the help of a field bird guide book (Borrow and Demey, 2004). Observation of birds at distant point was done with the help of pair of Binoculars.

The list of fauna species encountered was compiled and presented in tables for this report. Conservation and protection status of each species of fauna recorded was determined using the IUCN Red List of Threatened Mammals (www.iucnredlist.org), and the Wildlife Conservation Regulation (L.I. 685, 1971) of Ghana. All the wildlife species in Ghana, with the exception of grasscutter, fall under the category of Closed Season Protected (CSP) during the closed season period, August 1st to December 1st each year.

SECTION THREE: RESULTS

3.1 Flora

3.1.1 General Vegetation Zone of the Project Area

The Project area lies in the Coastal Savanna Grassland/ Thicket Scrub vegetation zone (Innes, 1977). Hall and Swaine (1981) included it in the Accra Plains – an open tree savanna where the trees and shrubs occur in clumps formed on termite mounds that are scattered in the area. Some of the tree and shrub species that characterize the vegetation of the study area are *SecurinegaVirosa, Abutilon mauritianum, Grewiacarpinifolia, Adansoniadigitata*and *Zanthoxylumxanthoxyloides*. *Azadirachtaindica*, an introduction, has spread widely in the area. *Leucaena leucocephala*, an Alien Invasive Species, is very abundant in the thickets in the Dorfor-Adidome section of the project area.

Some of the common grasses are *Andropogongayanus, Hyparrheniarufa, Chloris pilosa, heteropogoncontortus* and *Sporobolus pyramidalis*.

3.1.2 Vegetation/habitat types of the roads right -of way

Two main types of vegetation were encountered on the sites earmarked for the construction of the roads at Volivo and Dorfor-Adidome viz., (1) Thicket/Scrub and Grassland and (2) Farms and farm-regrowth. Appendix 1 gives the samples locations and their descriptions while Appendix 2 gives the general floristic composition of the project sites.

Thicket/Scrub and Grassland (1.5-5 m high in most places):
The Thicket/scrub and grassland vegetation has isolated trees. Some of the tree species present are *Azadirachtaindica* and *Diospyros abyssinica*. It is poor in plant species largely due to the persistent farming. The common grasses identified on the site were, *Panicum maximum, Rottboelliacochinchinensis* and *Hyparrheniarufa*.

The Dorfor-Adidome section of the project is predominantly thicket scrub (about 80%) with isolated trees, mainly *Adansoniadigitata*. *Azadirachtaindica*, *Leucaena leucocephala*, *Grewiacarpinifolia* and *Zanthoxylumxanthoxyloides* are some of abundant flora. *Leucaena leucocephala* grows in almost pure stands in this section. The Dorfor-Adidome thicket Scrub is abundant in the Gold Star climber species *Ritchiereflexa*. Conservation action is required for this species.

Farms and far re-growths:
The major crops on the farms Cassava (Manihot esculenta) and Maize (Zea mays) and vegetables such as Okra. The farm re-growth is dominated by forbs, notably

Tridaxprocumbens, Vernonia cinerea, Rourea coccinea and *Urariapicta*. The common shrubs include the invasive *Chromolaenaodorata, Sidaacuta*and *Abutilon mauritanum. Paspalumorbiculare*, *Panicum maximum* and *Digitariahorizontalis*dominate the grasses in the farms and farm re-growths.

Farms and farm re-growth dominate the Volivo section of the project site (about 75%).

3.2Fauna

3.2.1 Mammals

A total of five species of mammals were recorded during the survey. All these mammal species were encountered within the proposed project areas (Table 1).

Generally, the species diversity and abundance of mammals within the proposed project site was very low with the giant rat (*Cricetomysgambianus)* being the dominant fauna. Four of the species encountered are categorized as Least Concern on the IUCN Red List of Threatened Species, with one of the species (Togo hare, *Lepus zechi*)not accessed for its conservation status (Table 1). All the species are partly protected under the Wildlife Conservation Regulations of Ghana (Table 1). All the mammal species encountered are close season protected under the Wildlife Conservation Regulation 1971, LI 685. Hunting or capturing of all wildlife species, including those that are partly protected, is prohibited between the months of August 1st to December 1st.

Table 1: Species of mammals encountered in the proposed project areas during field surveys and their conservation importance.

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS					
		IUCN				WCR	
		EN	VU	NT	LC	CP	PP
Cricetomysgambianus	Giant Gambian rat				+		+
Xerus rutilus	Unstriped ground squirrel				+		+
Thryonomysswinderianus	Cane rat				+		
Lepus zechi	Togo Hare						+
Herpestessanguineus	Common Slender mongoose				+		+

(LC- Least Concern; NT- Near Threatened; VU- Vulnerable; EN- Endangered; WCR- Wildlife Conservation Regulation; PP- Partly Protected; CP- Completely Protected; Empty cell- Data Deficient)

3.2.2 Avifauna

A total of 38 bird species were encountered during the survey (Table 2). Of the 39 species of birds recorded, none was of international conservation importance while 2 are of national conservation importance. Thirty-seven (37) of the bird species recorded are designated as Least Concern on the IUCN Red List of endangered species. None of the species were Endangered, Near Threatened or Vulnerable. Thirty-six species are partly protected with 2 being completely protected by the Wildlife Conservation Regulation of Ghana. The two species that are completely protected are however widely spread throughout the project area and have wide range of habitat distribution in Ghana hence are not expected to be impacted significantly by the project.

Table 2: *Species of birds recorded in the project areas during field surveys and their conservation importance.*

		CONSERVATION STATUS						
		IUCN					WCR	
SCIENTIFIC NAME	ENGLISH NAME	CE	EN	VU	NT	LC	CP	PP
Actophilornis africanus	African jacana					+		+
Ardeapurpurea	Purple heron					+		+
Ardeolaralloides	Squacco heron					+		+
Bubulcus ibis	Cattle egret					+	+	
Burhinus senegalensis	Senegal Thick-knee					+		+
Butoridesvirescens	Green backed heron					+		+
Camaroptera brevicaudata	Grey backed cameroptera							+
Campetherapunctuligera	Fine spotted wood percker					+		+
Caprimulgusclimacurus	Long-tailed nightjar					+		+
Centropus senegalensis	Senegal coucal					+		+
Cerylerudis	African pied kingfisher					+		+
Cinnyriscoccinigastrus	Splendid sunbird					+		+
Cisticola erythrops	Red faced cisticola					+		+
Corvinella corvina	Yellow billed shrike					+		+
Cossyphaniveicapilla	Snowy-crowned robbin chat					+		+
Crinifer piscator	Grey plantain eater					+		+
Cypsiurusbalasiensis	Palm swift					+		+

Gypohieraxangolensis	Palm-nut vulture	+		+
Halcyon leucocephala	Grey headed kingfisher	+		+
Hirundo aethiopica	Ethiopian swallow	+		+
Lamprotornispurpureus	Purple glossy starling	+		+
Laniariusbarbarus	Yellow crowned gonolek	+		+
Lonchura bicolor	Black and white mannikin	+		+
Lonchuracucullata	Bronze mannikin	+		+
Meropsalbicollis	White-throated bee eater	+		+
Milvus aegyptius	Yellow billed Kite		+	
Ploceusnigricollis	Black necked weaver	+		+
Poicephalussenegalus	Senegal parrot	+		+
Priniasubflava	Tawny-flanked prinia	+		+
Pternistisahantensis	Ahanta francolin	+		+
Ptilostomusafer	Piapiac	+		+
Pycnonotidae	Common bulbul	+		+
Saxicola rubetra	Whinchat	+		+
Spilopelia senegalensis	Laughing dove	+		+
Streptopeliasemitorquata	Red-eye dove	+		+
Tockusnasutus	African grey hornbill	+		+
Turduspelios	African thrush	+		+
Vanellusspinosus	Spur-winged lapwing	+		+

*(LC- Least Concern; NT- Near Threatened; VU- Vulnerable; EN- Endangered; CE- Critically Endangered; WCR- Wildlife Conservation Regulation; PP- Partly Protected; CP- Completely Protected; Empty cell- Data Deficient; ** - Birds recorded in project site)*

3.3 Anticipated Impacts of the project on Flora and Fauna in the area

Infrastructure development have been reported to have negative impact on the flora of an area through clearing which destroys available habitats for fauna/wildlife that may exist in the area. Wildlife species have been known to respond to disturbance and changes in their environment (habitat destruction or conversion, pollution, noise, etc) by migrating, adapting or dying. Destruction of vegetation and disturbance from the project is expected to cause species in the project site to migrate to nearby habitats and avoid mortality which could expose the wildlife to dangers such as poaching or increased predations. This migration is however only possible when the change in habitat quality (removal of vegetation) is gradual.

As expected from the habitat types available, the survey showed that the diversity and population of fauna within the project area was very low. The highly disturbed nature of the vegetation (grasslands and thickets) of the general area from heavy grazing and farming

makes it suitable for few species. A good number of bird species however use the area for feeding habitats and for grooming within the thickets. Few breeding areas were encountered for cattle egrets but none for the mammals encountered during the current survey.

The extremely low abundance and diversity of fauna (especially mammals) resulting from the few habitat types available in the project area and its immediate environments greatly reduces the sensitivity of the proposed project site. The project area is made up of mainly grasses and thickets therefore doesn't support rich communities of mammals hence their absence in the project area. The thicket clumps in the area which could support some fauna are heavily exploited for fuel wood by the local communities making it also unsuitable as habitats. These conditions reduce any impacts that the proposed project is likely to have on mammals.

The highly impacted nature of the habitats in the project area, caused by human activities such as farming, cutting of live trees for fuelwood, grazing of livestock etc also reduces the sensitivity of the project site to impacts from activities of the proposed project. The proposed project is therefore anticipated to have a trifling impact on wildlife and their habitat in the area.

From the surveys, none of the mammal species recorded were of international or national conservation interest. The fauna species encountered were all of least concern on the IUCN red list and partly protected by the Wildlife Conservation Regulations. This further renders the proposed project unlikely to significantly impact negatively on any mammal species of conservation interest.

One bird species (*Necrosyrtesmonachus*) was of international conservation importance was reported to have been seen in the area by local people but was not encountered during the current survey. The absence of any sign of the hooded vulture could be due to extremely low numbers in the area which makes it less likely for the project to greatly impact the species.Detailed vulture surveys are required to confirm or otherwise their presence in the area.

Two bird species, cattle egret (*Bubulcus ibis*) and yellow-billed kite(*Milvus aegyptius*)are also afforded protection at the national level and were encountered during the survey. There were no breeding signs for the *Bubulcus ibis* and *Milvus aegyptius*observed; these 2 species were in feeding flight which suggested that the species may only be foraging. This further reduces the likelihood of the proposed project impacting significantly on any bird species of conservation importance. The cattle egrets tend to follow foraging cattle and occur in high numbers outside the project area where they have suitable habitats. Also, the highly migratory nature of the yellow-billed kite as well as the other bird species makes them

relatively less likely to receive any significant impact from the construction phase (site clearing) of the project since they could migrate away from danger.

The *Ritchieareflexa* is rated as Gold Star species implying the species is rear in the project area. Conservation action is required for this species to ensure that it is not completely removed and wiped from the area by the project.

SECTION FOUR: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The field survey showed that the wildlife in the project area is low in diversity and could be due to the numerous threats emanating mainly from the human activities.

Observations made during the field survey of the proposed project area and its immediate surroundings suggested a significant change in the ecological condition of the habitat and the associated species over the years.

No species of international conservation interest was directly encountered in the project area. All the species recorded were classified as Least Concern (LC) by the IUCN Red List of Threatened Species and as Partly Protected (PP) by the Wildlife Conservation Regulation of Ghana.

The proposed project will not have any significantly adverse impact on the fauna of conservation interest.

Ritchieareflexa is rated as Gold Star species and hence of conservation importance.

5.2 Recommendations

Based on the result of the baseline study and the conclusions, the following recommendation is proposed as a measure to further reduce and mitigate the already low impact anticipated from this proposed project;

1. Notwithstanding the low faunal found in the area, construction activities for the project should commence during the dry season since some of the wildlife species encountered are likely to move out of the area during this period in search of food or water. Any activity is therefore likely to have less impact, if any, on the wildlife of the area.
2. All vegetation clearing associated with the construction phase of the project should be conducted during periods outside the close season when some of the animals are expected to be carrying or tending to their young. This reduce any impact on

burrowing organisms that may be staying in their burrows hence were not encountered by the recent survey.

3. A Management Plan should be developed for the Gold Star species encountered in the project area. This is to ensure that the project does not wipe out the species form the area.

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APPENDICES

APPENDIX A- TERRESTRIAL FAUNA APPENDIX

A-2: Legend for Conservation Status

A-2.1: IUCN (International Union for the Conservation of Nature)

The IUCN publishes a Threatened Species List *(Red List of Threatened Animals)* which categorizes globally-threatened animals as follows:

*Vulnerable (VU):*Species believed likely to move to the *EN (Endangered)* category, if the causal factors continue operating, because of rapidly decreasing populations and extensive habitat destruction.

*Lower Risk (LR):*Taxa which have been evaluated but do not satisfy the criteria for any of the above categories. There are three sub-categories

*Near Threatened (NT):*Taxa which do not qualify for *Conservation Dependent*, but which are close to qualifying for *Vulnerable*

*Data Deficient (DD):*A taxon on which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well-studied, and its biology well-known, but appropriate data on abundance and/or distribution is lacking,

A-2.2: National Criteria (Ghana Wildlife Conservation Regulations)

Ghana's Wildlife Laws (Ghana Wildlife Conservation Regulations, 1971 LI 685, and Ghana Wildlife

Conservation (Amendment) Regulations, 1988 LI 1357) also categorizes animal species into three main Schedules based on the level of protection required for a particular species:

Schedule I- Animals Wholly Protected; species are completely protected (CP); the hunting, capture or destruction of species under this schedule is prohibited at all times.

Schedule II- Animals PartlyProtected; species are partially protected (PP); the hunting, capture and destruction of any young animal, or adult accompanied by young, is absolutely prohibited at all times.

Schedule III- Animals Protected in Close Season; species are close season Protected (CSP); the hunting capturing or destruction of species under this schedule is absolutely prohibited between 1st August and 1st December of any season.

APPENDIX B – TERRESTRIAL FLORA APPENDICES

Appendix B-1: Species list of sample locations and habitat descriptions for Volivo and Dorfor-Adidome

Volivo

Sample 1

River bank; secondary thicket with bamboo clump (N 06.10150; E 000.24723)

Ipomoea aquatica

Vossiacuspidata

Ludwigiadecurrens

Scleriaverrucosa

Bambusa vulgaris

Rourea coccinea

Morinda lucida

Ruspoliahypocrateriformis

Brideliamicrantha

Ficus sur

Griffoniasimplicifolia

Millettiazechiana

Talinum triangulare

Azadirachtaindica

Panicum maximum

Chromolaenaodorata

Sidaacuta

Triclisia patens

Dracaena arborea

Elaeisguineensis

Alchorneacordifolia

Newbouldialaevis

Farm/farm re-growth (Cassava, Pepper, maize)

Diospyros abyssinica

Tiliacorafunifera

Azadirachtaindica

Lecaniodiscuscupanioides

Ruspoliahypocrateriformis

Tridaxprocumbens

Elaeisguineensis

Bambusa vulgaris

Chromolaenaodorata

Panicum maximum

Paulliniapinnata

Pupalialappacea

Dracaena arborea

Indigoferahirsuta

Vernonia cinerea

Rottboelliacochinchinensis

Mangiferaindica

Erigeron floribundus

Morinda lucida

Macaranga barteri

Croton lobatus

Desmodiumscorpiurus

Ceiba pentandra

Spondiasmombin

Lonchocarpuscyanescens

Carica papaya

Malacanthaalnifolia

Funtumiaafricana

Mezoneuronbenthamianum

Boerhaviadiffusa

Digitariahorizontalis

Antiaristoxicaria

Blighiasapida

Sample 2

Thicket/farm re-growth (N 06.10008; E 000.24689)

Mezoneuronbenthamianum

Elaeisguineensis

Diospyros abyssinica

Triclisia patens

Desmodiumscorpiurus

Spondiasmombin

Chromolaenaodorata

Ceiba pentandra

Antiaristoxicaria

Commelinaafricana

Dracaena arborea

Abutilon mauritianum

Lecaniodiscuscupanioides

Albiziazygia

Mucunapruriens

Azadirachtaindica

Ficus sur

Funtumiaafricana

Morinda lucida

Mallotusoppositifolius

Ritchieareflexa

Sample 3

Farmland (Cassava)(N 06.09948; E 000.24662)

Imperatacylindrica

Triclisia patens

Tridaxprocumbens

Azadirachtaindica

Carica papaya

Elaeisguineensis

Croton lobatus

Paspalumorbiculare

Vernonia cinerea

Lonchocarpuscyanescens

Millettiazechiana

Paulliniapinnata

Rottboeliacochinchinensis

Indigoferahirsuta

Abutilon mauritianum

Rourea coccinea

Antiaristoxicaria

Lecaniodiscuscupanioides

Funtumiaafricana

Cassia hirsuta

Sample 4

Farm re-growth/Thicket

Chromolaenaodorata

Elaeisguineensis

Azadirachtaindica

Panicum maximum

Diospyros abyssinica

Millettiazechiana

Centrosemapubescens

Cnestisferruginea

Sidaacuta

Flueggeavirosa

Ruspoliahypocrateriformis

Lecaniodiscuscupanioides

Malacanthaalnifolia

Morinda lucida

Ficus sur

Albiziaadianthifolia

Paulliniapinnata

Antiaristoxicaria

Abutilon mauritianum

Passiflorafoetida

Sample 5

Thicket dominated by Azadirachta/ Farm re-growth (N 06.09774; E 000.24630)

Crotalaria retusa

Rottboelliacochinchinensis

Chromolaenaodorata

Millettiazechiana

Triclisia patens

Passiflorafoetida

Diospyros abyssinica

Malacanthaalnifolia

Paulliniapinnata

Ficusumbellata

Urariapicta

Abutilon mauritianum

Hyparrheniarufa

Cassia hirsuta

Croton lobatus

Elaeisguineensis

Phyllanthus niruroides

Paspalumorbiculare

Vernonia cinerea

Desmodiumtortuosum

Mangiferaindica

Sample 6

Oil Palm plantation/ Cassava farm(N 06.09712; E 000.24580)

Elaiesguineensis

Mariscuslongibracteatus

Digitariahorizontalis

Chloris barbata

Sample 7

Dorfor-Adidome site

Grewiacarpinifolia

Chromolaenaodorata

Abutilon mauritianum

Ceiba pentandra

Elaeisguineensis

Adansoniadigitata

Panicum maximum

Leucaena leucocephala

Azadirachtaindica

Flueggeavirosa

Pupalialappacea

Launaeataraxacifolia

Ritchieareflexa

Sansevieria liberica

Diospyros abyssinica

Millettiazechiana

Capparis erythrocarpos

Morinda lucida

Mallotusoppositifolius

Paulliniapinnata

Flacourtiaindica

Zanthoxylumxanthoxyloides

Sarcostemmaviminale

Vernonia conferta

Mitragynainermis

Millettiathonningii

Hyparrheniarufa

Spondiasmombin

Indigoferahirsuta

Desmodiumscorpiurus

Elaeisguineensis

Nephrolepisbiserrata

Vitex simplicifolia

Imperatacylindrica

Sporobolus pyramidalis

Sample 8

Thicket dominated by Leucaena(N 06.10897; E 000.24852)

Cassia siamea

Azadirachtaindica

Leucaena leucocephala

Zanthoxylumxanthoxyloides

Urariapicta

Elaeisguineensis

Ceiba pentandra

Carissa edulis

Sample 8

Thicket/ Cemetery(N 06.10995; E 000.24846)

Sporobolus pyramidalis

Mitragynainermis

Diospyros abyssinica

Flacourtiaindica

Flueggeavirosa

Millettiathonningii

Leucaena leucocephala

Appendix B-2: General floristic composition of the Project sites

Species	Family	Life Form	Star Raring	Remarks
Abutilon mauritianum	Malvaceae	Shrub	Green	
Adansoniadigitata	Malvaceae	Tree	NA	
Albiziaadianthifolia	Fabaceae	Tree	Green	
Albiziazygia	Fabaceae	Tree	Pink	
Alchorneacordifolia	Euphorbiaceae	Tree	Green	
Antiaristoxicaria	Moraceae	Tree	Pink	
Azadirachtaindica	Meliaceae	Tree	NA	
Bambusa vulgaris	Poaceae	Tree	Green	
Blighiasapida	Sapindaceae	Tree	Green	
Boerhaviadiffusa	Nyctaginaceae	Herb	NA	
Brideliamicrantha	Euphorbiaceae	Tree	Green	
Capparis erythrocarpos	Capparaceae	Climber	Green	
Carica papaya	Caricaceae	Tree	Green	
Carissa edulis	Apocynaceae	Shrub	NA	
Cassia hirsuta	Fabaceae	Shrub	NA	
Cassia siamea	Fabaceae	Tree	NA	
Ceiba pentandra	Malvaceae	Tree	Green	
Centrosemapubescens	Fabaceae	Climber	NA	
Chloris barbata	Poaceae	Herb	NA	
Chromolaenaodorata	Asteraceae	Shrub	NA	
Croton lobatus	Euphorbiaceae	Herb	NA	
Desmodiumscorpiurus	Fabaceae	Herb	NA	
Desmodiumtortuosum	Fabaceae	Shrub	NA	
Digitariahorizontalis	Poaceae	Herb	NA	
Diospyros abyssinica	Ebenaceae	Tree	Green	
Dracaena arborea	Dracaenaceae	Tree	Green	
Elaeisguineensis	Arecaceae	Tree	Pink	

Erigeron floribundus	Asteraceae	Herb	NA	
Ficus sur	Moraceae	Tree	Green	
Ficusumbellata	Moraceae	Tree	Green	
Flacourtiaindica	Salicaceae	Tree	Green	
Flueggeavirosa	Euphorbiaceae	Shrub	NA	
Funtumiaafricana	Apocynaceae	Tree	Green	
Grewiacarpinifolia	Malvaceae	Climber	Blue	
Griffoniasimplicifolia	Fabaceae	Climber	Green	
Hyparrheniarufa	Poaceae	Herb	NA	
Imperatacylindrica	Poaceae	Herb	NA	
Indigoferahirsuta	Fabaceae	Shrub	NA	
Ipomoea aquatica	Convolvulaceae	Climber	NA	
Launaeataraxacifolia	Asteraceae	Shrub	NA	
Lecaniodiscuscupanioides	Sapindaceae	Tree	Green	
Leucaena leucocephala	Fabaceae	Tree	NA	Invasive, needs to be controlled
Lonchocarpuscyanescens	Fabaceae	Climber	Green	
Ludwigiadecurrens	Onagraceae	Shrub	NA	
Macaranga barteri	Euphorbiaceae	Tree	Green	
Malacanthaalnifolia	Sapotaceae	Tree	NA	
Mallotusoppositifolius	Euphorbiaceae	Tree	Green	
Mangiferaindica	Anacardiaceae	Tree	NA	
Mariscuslongibracteatus	Cyperaceae	Herb	NA	
Mezoneuronbenthamianum	Fabaceae	Climber	Green	
Millettiathonningii	Fabaceae	Tree	Blue	
Millettiazechiana	Fabaceae	Tree	Green	
Mitragynainermis	Rubiaceae	Tree	NA	
Morinda lucida	Rubiaceae	Tree	Green	
Mucunapruriens	Fabaceae	Climber	NA	
Nephrolepisbiserrata	Nephrolepidaceae	Herb	NA	

Newbouldialaevis	Bignoniaceae	Tree	Green	
Panicum maximum	Poaceae	Herb	NA	
Paspalumorbiculare	Poaceae	Herb	NA	
Passiflorafoetida	Passifloraceae	Climber	NA	
Paulliniapinnata	Sapindaceae	Climber	Green	
Phyllanthus niruroides	Euphorbiaceae	Herb	NA	
Pupalialappacea	Amaranthaceae	Herb	NA	
Ritchieareflexa	Capparaceae	Climber	Gold	Conservation action required
Rottboelliacochinchinensis	Poaceae	Herb	NA	
Rourea coccinea	Connaraceae	Shrub	Green	
Ruspoliahypocrateriformis	Acanthaceae	Shrub	NA	
Sansevieria liberica	Asparagaceae	Herb	Blue	Of conservation concern, no action required
Sarcostemmaviminale	Apocynaceae	Climber	NA	
Scleriaverrucosa	Cyperaceae	Herb	NA	
Sidaacuta	Malvaceae	Shrub	NA	
Spondiasmombin	Anacardiaceae	Tree	Green	
Sporobolus pyramidalis	Poaceae	Herb	NA	
Talinum triangulare	Portulacaceae	Herb	NA	
Tiliacorafunifera	Menispermaceae	Climber	Green	
Triclisia patens	Menispermaceae	Climber	Green	
Tridaxprocumbens	Asteraceae	Shrub	NA	
Urariapicta	Fabaceae	Shrub	NA	
Vernonia cinerea	Asteraceae	Shrub	NA	
Vernonia conferta	Asteraceae	Tree	Green	
Vitex simplicifolia	Verbenaceae	Tree	NA	
Vossiacuspidata	Poaceae	Herb	NA	
Zanthoxylumxanthoxyloides	Rutaceae	Tree	Blue	Of conservation concern, no action required

Appendix B-3: Volivo Species list

Species	Remarks
Abutilon mauritianum	
Albiziaadianthifolia	
Albiziazygia	
Alchorneacordifolia	
Antiaristoxicaria	
Azadirachtaindica	
Bambusa vulgaris	
Blighiasapida	
Boerhaviadiffusa	
Brideliamicrantha	
Carica papaya	
Cassia hirsuta	
Ceiba pentandra	
Centrosemapubescens	
Chloris barbata	
Chromolaenaodorata	
Croton lobatus	
Desmodiumscorpiurus	
Desmodiumtortuosum	
Digitariahorizontalis	
Diospyros abyssinica	
Dracaena arborea	
Elaeisguineensis	
Erigeron floribundus	
Ficus sur	
Ficusumbellata	
Flueggeavirosa	

Funtumiaafricana	
Griffoniasimplicifolia	
Hyparrheniarufa	
Indigoferahirsuta	
Ipomoea aquatica	
Lecaniodiscuscupanioides	
Lonchocarpuscyanescens	
Ludwigiadecurrens	
Macaranga barteri	
Malacanthaalnifolia	
Mangiferaindica	
Mariscuslongibracteatus	
Mezoneuronbenthamianum	
Millettiazechiana	
Morinda lucida	
Mucunapruriens	
Newbouldialaevis	
Panicum maximum	
Paspalumorbiculare	
Passiflorafoetida	
Paulliniapinnata	
Phyllanthus niruroides	
Pupalialappacea	
Ritchieareflexa	Species of national conservation concern
Rottboelliacochinchinensis	
Rourea coccinea	
Ruspoliahypocrateriformis	
Scleriaverrucosa	
Sidaacuta	

Spondiasmombin
Talinum triangulare
Tiliacorafunifera
Triclisia patens
Tridaxprocumbens
Urariapicta
Vernonia cinerea
Vossiacuspidata

Appendix B-4: Species list Dorfor-Adidome Species List

Abutilon mauritianum

Adansoniadigitata

Azadirachtaindica

Capparis erythrocarpos

Carissa edulis

Cassia siamea

Ceiba pentandra

Chromolaenaodorata

Desmodiumscorpiurus

Diospyros abyssinica

Elaeisguineensis

Flacourtiaindica

Flueggeavirosa

Grewiacarpinifolia

Hyparrheniarufa

Imperatacylindrica

Indigoferahirsuta

Launaeataraxacifolia

Leucaena leucocephala

Mallotusoppositifolius

Millettiathonningii

Millettiazechiana

Mitragynainermis

Morinda lucida

Nephrolepisbiserrata

Panicum maximum

Paulliniapinnata

Pupalialappacea

Ritchieareflexa

Sansevieria liberica

Sarcostemmaviminale

Spondiasmombin

Sporobolus pyramidalis

Urariapicta

Vernonia conferta

Vitex simplicifolia

Zanthoxylumxanthoxyloides

PHOTO GALLERY

A B

Plate 1A: Bamboo clump on bank of River Volta at Volivo; 1B: Thicket dominated by *Panicum maximum* at river bank.

Plate 2: Farm re-growth showing harvested maize farm at Volivo

Plate 3: Cassava farm at Volivo

Plate 4: Oil Plam plantation at Volivo

Plate 5: Grassland and Thicke Scrub with isolated *Adansoniadigitate*

(arrowed)at Dorfor-Adidome

Plate 6: Farm re-growth at Dorfor-Adidome (with cassava)

Plate 7: Grassland with isolated trees (mostly *Azadirachtaindica*

at Dorfor-Adidome)

Plate 8: An Individual of *Ritchieareflexa* with flower buds

in thicket at Dorfor-Adidome

APPENDIX B: ENVIRONMENTAL QUALITY MONITORING REPORT

REPORT ON ENVIRONMENTAL QUALITY MONITORING

VOLIVO BRIDGE PROJECT

December, 2019

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LIST OF ACRONYMS

NO_2 - Nitrogen dioxide

SO_2 - Sulphur dioxide

TSP - Total Suspended Particulate Matter

LEQ - Equivalent noise level

L10 - Nuisance noise level

L50 - Average noise level

L90 - Background noise level

Lmax - Maximum noise Level

1.0 INTRODUCTION

The government of Ghana wishes to begin the construction of a bridge across the river Volta. The two landing points for the bridge are Volivo and Dorfor Adidome. As part of regulations, the monitoring of water quality, ambient air (PM2.5, PM10, TSP and Gases) and ambient Noise levels have been undertaken at the proposed project sites to be incorporated into the project's environmental assessment study.

1.1 Purpose of Environmental Quality Monitoring

It is a legal requirement in Ghana under the Environmental Protection Agency Act 1994, Act 490and the Environmental Assessment Regulations 1999, LI 1652, that proposed undertakings of a certain threshold submits environmental assessment report to the Agency for permitting purposes.

The aim of this monitoring is therefore to gather relevant environmental quality data with respect to Ambient Air and Noise Levels to serve as part of baseline monitoring data during the project construction period. The data gathered will provide useful information to help monitor the project's operational impacts on the environmental and the health of employees and surrounding neighbours.

1.2 Monitoring Objectives

The objectives of the monitoring are to:

- Measure the concentrations of particulate matter (PM2.5, PM10 and TSP) and gases (NO_2, CO and SO_2) in the ambient air.
- Monitor the water quality of the river at both ends the bridge landing sites.
- Measure the ambient noise levels at the project sites.
- To fulfil the regulatory requirements of the Environmental Protection Agency.

2.0 ENVIRONMENTAL MONITORING METHODOLOGY

Particulate matter, gases, and ambient noise were monitored at the two landing sites of the proposed bridge. The weather conditions observed at the time of monitoring was sunny with temperature of 29°C and humidity of 81%.

2.1 Particulate Matter

Particulate matter was sampled using MiniVol samplers set to a flow rate of 5 L/min. Samples were placed at a minimum height of 5 meters above ground level to prevent the collection of ground level dust temporarily made airborne by gusting winds.

Pumped air was siphoned through a quartz filter paper, mounted in the sampling unit and sampling undertaken for 24 hours at each sampling location. The quartz filter paper was stabilised for a minimum of 24 hours before and after sampling in a desiccator.

The fresh quartz filter paper was weighed before sampling. After the 24-hour sampling period, post sampling filters were weighed and the difference in weight (W2-W1) was used to calculate the concentration of the particulate matter in $\mu g/m^3$ using the formula below.

$$(PM2.5,PM10,TSP)\mu g/m^3 = \frac{\text{Net dust weight} * 106}{\text{Flow rate (L/Min)} * \text{Sampling time (Min)}}$$

2.2 Gases

Sulphur dioxide and Nitrogen dioxide were sampled using the detector tube method. The detector tubes (dragger tubes) contain chemical agents that change colour in the presence of the pollutant gas of interest. The dragger tubes were opened at both ends and hanged for a period of 24 hours to allow the diffusion of ambient air through the chemical resins in the tube (passive method). After the sampling period the length of the coloured zone was read in parts per million (ppm) and the concentration of the gas calculated in $\mu g/m^3$ using the relation below.

$$\mu g/m^3 = \frac{\text{Concentration of gas (ppmh)*molecular weight of gas}}{22.4}$$

2.3 Ambient Noise

A decibel (dB) is the unit for the measurement of noise. The zero on a decibel scale is at the threshold of hearing, the lowest sound pressure that can be heard on the scale according to smith:20 dB is whisper, 40 dB the noise in a quiet office, 60 dB is normal conversation, 80 dB is the level at which sound becomes physically painful. Noise measurements/recordings were taken with a High Precision 3M Sound Level Meter, Model Type 1. The sound level meter has an inbuilt calibrator, and was calibrated before measurement/recordings were taken. The noise meter was calibrated at 114 dB (A) prior to the measurement. To obtain representative noise levels, measurements were recorded at a rate of 3dB at ten-minute (10) intervals for daytime and nighttime.

3.0 RESULTS

The results of the ambient air quality and noise levels monitoring are shown in tables 1, 2, 3 and 4 below.

3.1 Particulate Matter

Table 1. Ambient PM10 and PM2.5 Measured on 17/12/2019

LOCATION	PM2.5 (µg/m3)	PM10(µg/m3)	TSP(µg/m3)
Volivo	13.8	21.8	37.7
Dorfor Adidome	14.4	22.0	36.9
Ghana Standards for 24-hour ambient air quality for PM10 and PM2.5	35	70	150

3.2 Gases (NO_2, CO and SO_2)

Table 2. Oxides of Nitrogen and Oxides of Sulphur levels Measured on 17/12/2019

LOCATION	NO_2 (mg/m^3)	SO_2 (mg/m^3)	CO (mg/m^3)
Volivo	0.3	< 0.1	< 2
Dorfor Adidome	0.2	< 0.1	< 2
Ghana Standards for NO_2, SO_2 and CO	150	150	10 for 8 hours

3.3 Ambient Noise

Table 3. Daytime Ambient Noise levels (dBA) recorded on 17/12/2019

LOCATION	LEQ	L10	L50	L90	LMAX
Volivo	39.5	41.3	37.6	34.0	52.1
Dorfor Adidome	36.1	38.7	33.9	31.4	50.4
Ghana Standard for residential day time noise	55				

Table 4. Nighttime Ambient Noise levels (dBA) recorded on 17/12/2019

LOCATION	LEQ	L10	L50	L90	LMAX
Volivo	34.5	37.1	33.5	32.0	50.8
Dorfor Adidome	32.1	35.8	31.9	30.6	46.9
Ghana Standard for residential night time noise	48				

4.0 CONCLUSION

Ambient PM2.5, PM10 and TSP concentrations recorded at all the monitoring stations over the monitoring period were found to be below the standard values of 35µg/m^3,70µg/m^3 and 150µg/m^3 respectively.

The concentrations of the gases (NO_2, CO and SO_2) recorded for the monitoring periods were also below the standard value of 150mg/m^3 for both gases.

The ambient noise levels (LEQ values) recorded were also found to be below the standard values of 55 dB(A) for daytime and 48dB(A) for nighttime.

APPENDIX C - PUBLIC FORUM IN 2012

Record of Previous Public Forum held during the F/S

(1) Public Consultation at Asutsuare

a) Overview

Date: September 10, 2012

Place: Osudoku Senior High Technical School

Style: Public meeting

NumAber of attendants: 328

Chiefs and traditional community's key persons: 9

GoG officials: 9 including Minister of Roads and Highways, and Members of Parliament

Language: English and 2 local languages

b) Major comments from the public and response from the GHA/government officials

Table A2-1 Comments and Responses in the Public Consultation at Asutsuare

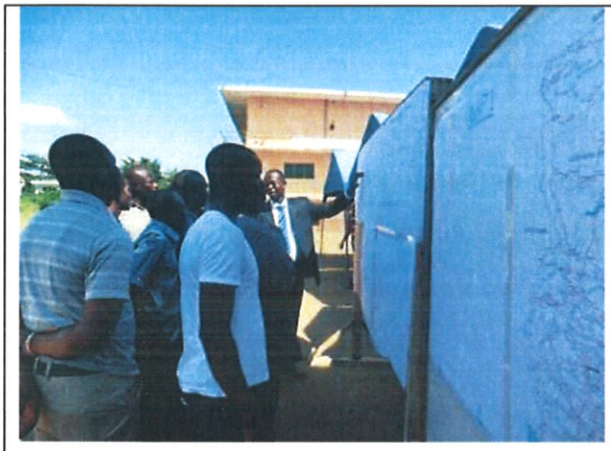
Comments from the Public	Responses from GHA or GoG officials
- Schedule of the project.	The GHA described the status of the Study and expected detail design, but no specific schedule was announced.
- Without government officials supervision on site, contractors tend to do poor quality construction work. The GHA should monitor the contractors and make sure the quality is good.	The MRH/GHA will assure proper implementation of the construction work.
- In the past, due to the lack of government funds, PAPs agreed to relocate before full payment. However, some PAPs never received the rest of the compensation without proper explanation. The GHA should take this issue seriously and prevent.	The MRH/GHA will ensure necessary mitigation measures including payment of compensation and recovery assistances.
- Why the road will not pass through Asutsuare Township.	Asutsuare was excluded because it would require too much involuntary resettlement.
- During the construction of the Kpong Dam, some PAPs were not compensated. For the proposed road projects, all PAPs should be compensated.	The MRH/GHA will ensure that the necessary mitigation measures are taken in accordance with the resettlement policy. The issue of the Kpong Dam is not clear due to the different jurisdiction.

Source: Study Team

c) General responses from the public

No objections to the proposed projects were made. In general, the attendants agreed with the proposed projects and were looking forward to seeing them actually be implemented. Historically, many projects were promised not only roads but also other public facilities, especially before elections. People in general are skeptical about politicians' promises. As the Minister of Roads and Highways himself explained his strong intention that the proposed projects be carried out, the attendants seemed excited about the high priority status of the projects.

d) Selected photographs

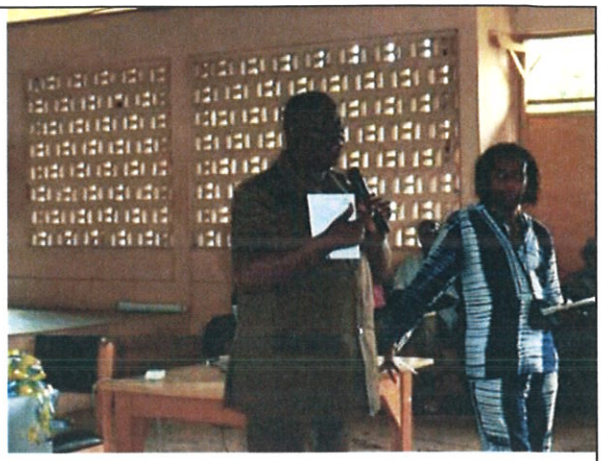


Project Description by Planning Director of GHA

Meeting Hall

Meeting Hall

Additional Attendants next to the Meeting Hall

	
English Presentation followed by Two Local Language Translations	**Responses by the Minister of Roads and Highways**

Photos taken by the Study Team, September 2012

(2) Public Consultation at Juapong

Though the Juapong community is not located close to the project site, it plays a central role in the region and will be affected by the proposed bridge construction project across the Volta River since a portion of the traffic that cross the river would be departing from or to Juapong.

a) Overview

Date: 11th September, 2012

Place: St.Francis of Assisi Catholic Church

Style: Public meeting

Number of attendants: 376

Chiefs and traditional community's key persons: 70

GoG Officials: 8 including Members of Parliament

Language: English and 2 local languages

b) Major comments from the public and response from the GHA/government officials

Table A2-2 Comments and Responses in the Public Consultation at Juapong

Comments from the Public	Responses from GHA or GoG Officials
- The reason for excluding the Juapong to DuforAdidome road from construction of Asutsuare Jct. and Asikkuma Jct.	The road project is now under another agency, but it is at the procurement stage at present.
- The reason for little description of DuforAdidome's resettlement requirements despite the social environmental survey.	The GHA will conduct a detailed survey at a later stage. This time, the consultants conducted a survey for rough estimation purpose only.

- Request to hire young local people for the project implementation.	No specific response was given.

Source: Study Team

c) General responses from the public

No objections to the proposed projects were made. The majority of comments concerned the Juapong to DuforAdidome road, which has been postponed for some reason and people are anxious about implementation of the project. However, in general, the attendants agreed with the proposed projects and are looking forward to seeing them actually be implemented. Some Juapong-based people are concerned about depopulation of Juapong and reduction of business opportunities due to construction of road between Asutsuare Jct. and Asikuma Jct.

d) Selected photographs

Project Description by Planning Director of GHA

Meeting Hall

Meeting Hall

Attendants' Registration

	
English Presentation followed by Two local Language Translation	**Responses from Member of the Parliament (Volta Region)**

Photos taken by the Study Team, September 2012

APPENDIX D - PARTICIPANTS' LISTS

A. PARTICIPANTS' LISTS

REVIEW OF DETAILED DESIGN STUDY OF THE CONSTRUCTION OF A NEW BRIDGE ACROSS THE VOLTA RIVER ON THE EASTERN CORRIDOR PROJECT

RESETTLEMENT ACTION PLAN (RAP)

PARTICIPANTS' LIST
MEETING WITH CHIEF AND OPINION LEADERS

MMDA: Shai Osudoku **COMMUNITY :**Volivo **DATE:** 14th January, 2020

#	Name Of Participant	Age	Gender	Education Level	Occupation	Position	Contact
01	Hon. Nicholas Owen	30	Male	Tertiary	Farmer/ Lab Scien...	Assembly member	0542446925/0549815463
02	Teye Gideon	29	Male	SSCE	Farmer	Unit Committee Member	0245876018
03	Isaac K. Amanor	52	Male	MSLC	Farmer	Youth Leader	0242859995
04	Teye Comfort	30	Female	JHS	Farmer	Unit Committee Member	0557698926
05	Comfort Alema	55	Female	MSLC	Farmer	Women Leader	0540265181
06	Emmanuel Martey	40	Male	Tertiary	Farmer	Youth Leader	0546586224
07	Seth Kpokpontor	37	Male	SSCE	Farmer	Youth Representative	0245398269

#	Name Of Participant	Age	Gender	Education Level	Occupation	Position	Contact
08	Samuel Dzokpor	53	Male	JHS	Farmer	Youth Leader	0249578581
09	NarhFio N.	54	Male	JHS	Farmer	Opinion Leader	0246812118
10	OdonkorKwesi	40	Male	JHS	Farmer	Opinion Leader	0248357864
11	Tetteh Peter K.	52	Male	MSLC	Farmer	Opinion Leader	0244206359
12	Florence Hondyazi	50	Female	JHS	Petty Trader	Women Leader	0558706392
13	Emmanuel Boaduah	45	Male	MSLC	Farmer	Youth Leader	0240799988
14	Regina A. Mensah	57	Female	MSLC	Farmer	Women Leader	0276942208
15	WayoAsuwed Samuel	33	Male	Tertiary	Prison after care officer		0247005373
16	Thomas TettehWayo	58	Male	MSLC	Farmer	Youth Leader	0241197157
17	Gladys Egble	70	Female	MSLC	Farmer	Opinion Leader	0545735875
18	Mabel Lawer	40	Female	MSLC	Trader	Women Leader	0541391405
19	Alice Hondyazi	40	Female	MSLC	Trader	Women Leader	
20	Joyce NarhWayo	35	Female	MSLC	Trader	Women Leader	
21	John Hondyazi	51	Male	MSLC	Farmer	Opinion Leader	0248177954

#	Name Of Participant	Age	Gender	Education Level	Occupation	Position	Contact
22	Philip Ayertey	49	Male	SHS	Farmer	Assembly Member	0247537023
23	Kofi Atterh	71	Male	JHS	Farmer	Opinion Leader	0246224976
24	Nene OgbeyAssuman (IV)	50	Male	MSLC	Farmer	Chief	0243617893
25	Nicholas Amanor D.	79	Male	MSLC	Farmer	Opinion Leader	0242466341
26	James Tetteh	49	Male	SHS	Farmer	Opinion Leader	0509943233
27	Joseph Amanor	71	Male	MSLC	Farmer	Opinion Leader	0241934165
28	Hon. Prince Zao	56	Male	Tertiary	Journalist	Local Contact	0243174493
29	Isaac Matey T.	59	Male	MSLC	Farmer	Opinion Leader	0545140362
30	Emelia Teye	38	Female	MSLC	Trader	Women Leader	0270610941
31	Joseph Guamah	50	Male	MSLC	Farmer	Opinion Leader	0553001581
32	KwesiOgbey	42	Male	MSLC	Farmer	Youth Leader	0242880017
33	Janet Tetteh	27	Female	JSS	Petty Trader	Women Leader	0543848987
34	Tetteh Rebecca Abla	43	Female	SHS	Petty Trader	Women Leader	0248718518
35	Teye Patience	32	Female	JSS	Trader	Women Leader	0546638563

REVIEW OF DETAILED DESIGN STUDY OF THE CONSTRUCTION OF A NEW BRIDGE ACROSS THE VOLTA RIVER ON THE EASTERN CORRIDOR PROJECT

RESETTLEMENT ACTION PLAN (RAP)

PARTICIPANTS' LIST
MEETING WITH CHIEF, OPINION LEADERS AND PAPs

MMDA: North Tongu **COMMUNITY:** DorforAdidome **DATE:** 14th January, 2020

#	Name of Official	Age	Gender	Educational Level	Occupation	Position	Phone number
01	Saviour Tomenu	21	Male	JHS	Farmer		0244129477
02	Emmanuel Alipe	40	Male	JHS	Farmer		0559545518
03	AmenumeBekind	40	Male	JHS	Farmer		
04	Aflo Emmanuel	42	Male	SHS	Carpentry		0249233889
05	Nutsi Moses	42	Male	JHS	Farmer		
06	GbetornuSefa	30	Male	JHS	Mason		0549520570
07	Dabah Matthew	28	Male	Tertiary	Finance Officer		0541843740
08	GbotornuAnani	33	Male	JHS	Mason		0249347476
09	Seledzi Stephen	47	Male	MSLC	Farmer		
10	Obani Forgive	24	Male	JHS	Farmer		0550323176

#	Name of Official	Age	Gender	Educational Level	Occupation	Position	Phone number
11	Nutsi Solomon	22	Male	JHS	Mason		0545473076
12	Gbetornu Michael	45	Male	JHS	Farmer		0540698765
13	Torfu Jacob	54	Male	MSLC	Operator	Youth Chairman	0242180560
14	DzetormeKwesi	75	Male		Farmer		
15	Norvinya Daniel	26	Male	SHS	Electrician		0543017512
16	NorvinyaSelorm	30	Male	JHS	Operator		0240246226
17	Azietor Ben	70	Male	JHS	Security guard		0249391872
18	AzietorTse Kofi	29	Male	Tertiary	Student	Assemblyman	0248579999
19	NutsiTse	62	Male	MSLC	Farmer		0545265947
20	Nukpedu Christiana	70	Female		Farmer		
21	Samuel Gakpetor	54	Male	MSLC	Farmer		0541280288
22	Eric Kumah	45	Male	MSLC	Security guard		0541224877
23	Patience Ahoto	80	Female	MSLC	Farmer		0247034687
24	Amansrunu Gladys	58	Female		Farmer		
25	AhotoAnani	28	Male	JHS			0549734507

#	Name of Official	Age	Gender	Educational Level	Occupation	Position	Phone number
26	Ivy Nutsi	27	Female	JHS	Trader		0542221574
27	Prosper Akpaligah	31	Male	JHS	Caterpillar Operator	Member	0246318419
28	Gideon Adzam	28	Male	SHS	Carpenter	Member	0547582676
29	Michael Dzam	30	Male	SHS	Driver	Youth Member	0555024245
30	Famous Dzam	30	Male	SHS	Driver	Member	0249988820
31	Emmanuel Gidi	45	Male	SHS	Farmer	Stool father	0245577351
32	Raymond Dzam	50	Male	SHS	Mason	Youth Member	0552529091
33	Godson Atsu	49	Male	JHS	Farmer	Youth member	0201811125
34	Matthew Nyakpo	52	Male	JHS	Plumbing	Linguist	0540998435
35	Tomenu Wellington	55	Male	Tertiary	Teaching	Opinion Leader	0246605122
36	Simon Agbohla	78	Male	JHS	Mason	Member (Chief)	0241046576
37	Godson K. Amekah	40	Male	Degree (BSc)	Electrical Engineer	Paramount stool father	0243830221
38	Togbe M. Agbohla		Male	SHS	Businessman	Chief	0244844741
39	KabuteyKwesi	35	Male	JHS	Barber	Member	024466329

#	Name of Official	Age	Gender	Educational Level	Occupation	Position	Phone number
40	Raymond Azietor	30	Male	JHS	Tractor Operator	Member	0550608478
41	AfenyaElinam	22	Male	JHS	Welding	Member	0540348936
42	Nelson Gedza	50	Male	Diploma	Teaching	Member	0249482998
43	Maxwell Ataban	55	Male	MSLC	Farmer	PTA Chairman	0558537595
44	Alhassan Ali	28	Male	SHS	Farmer	Member	0240408718
45	Forfoe Frank	25	Male	JHS	Welder	Member	0241027591
46	Gbolomor Raymond	18	Male	SHS	Student	Member	0556113818
47	AkudeyHorlasi	18	Male	SHS	Student	Member	0543049327
48	Elizabeth Azietor	40	Female	JHS	Farmer	Member	0245263869
49	Priscilla Fiagbenu	37	Female	JHS	Seamstress	Member	0249407054
50	Peter Akposu	47	Male	Degree	Teacher	Member	0200514844
51	Dzatey Francis	49	Male	JHS	Farmer	Youth Leader	
52	Rejoice Hodogbe	50	Female	MLSC	Farmer	Member	
53	Prince Zao		Male	Tertiary	Journalist	Assembly Member	0243174493
54	Bertha Awunyama	48	Female	None	Farmer		0249067028

#	Name of Official	Age	Gender	Educational Level	Occupation	Position	Phone number
55	Bertha Atarli	70	Female	None	Farmer		0541796422
56	AugustinaAglova		Female		Farmer		0557272814
57	Mary Kwao	78	Female		Farmer		0541134127
58	Florence Kwao	65	Female		Farmer		0545038544
59	Dora Adzubu		Female		Farmer		0550614862
60	KwamwHodogbe	35	Male		Farmer		
61	Lawrence Gbenuor	63	Male		Trader	Former Assemblyman	0244477834
62	AustineDabah	42	Male	JHS	Carpenter		0246713507
63	Richard Ahernu	37	Male	JHS	Farmer		0247196227
64	AhenuMoris	39	Male	JHS	Mason		
65	Desmond Dogli	29	Male	JHS	Mason	Electoral Area Coordinator	0554049217
66	Ben Tofu	25	Male	JHS	Farmer		0547615872
67	Jonathan Doe Nutsi	60	Male	MSLC	Fisherman		
68	AniakoGifty	33	Female	JHS	Trader		0202354383

#	Name of Official	Age	Gender	Educational Level	Occupation	Position	Phone number
69	Afeatorgbor Angela	37	Female	JHS	Seamstress	Ladies' Committee Chairperson	0543798332
70	Faustina Galley	31	Female	JHS		Ladies' committee Organizer	0541196130
71	Sophia Notsi	29	Female	Vocational	Seamstress		0549168747
72	Millicent Azumah	29	Female	JHS	Seamstress		0540974283
73	Mary Adokpa	46	Female	Primary	Farmer		
74	SelegeAmetepe	49	Male	JHS	Security guard		0240685106
75	Awuku Jonathan	39	Male	SHS	Farmer		0249751034
76	Simon Akude	39	Male	JHS	Operator		0244196602
77	Moses Tovide	64	Male	JHS	Farmer		0246883821
78	Amansunu Kofi	42	Male	JHS	Farmer		0249582249
79	Anita Sodolo	39	Female	JHS	Seamstress		0240213233
80	Vivian Apotsi	60	Female		Farmer		0545265947

#	Name of Official	Age	Gender	Educational Level	Occupation	Position	Phone number
81	GamorDayawa	50	Female	JHS	Farmer		0549734507