
Greater Accra Regional Spatial Development Framework

Baseline Assessment Report

Volume 1

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Greater Accra Regional Spatial Development Framework
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Abbreviations / Acronyms / Definitions

ACARP	Accra Compost & Recycling Plant
ACE	Africa Coast to Europe
AfDB	African Development Bank
AMA	Accra Metropolitan Area
ASHMA	Ashaiman Municipal Assembly
ASIP	Accra Sewerage Improvement Project
AWDA	Ada West District Assembly
BRT	Bus Rapid Transit
BSP	Buk Supply Point
CaCl ₂	Calcium Chloride
CBD	Central Business District
CCAC	Climate and Clean Air Coalition
CEB	Communauté Electrique du Bénin
CWSA	Community Water & Sanitation Agency
DA	District Assembly
DFATD	Department of Foreign Affairs Trade and Development-Canada
DFR	Department of Feeder Roads
DMTDP	District Medium Term Development Plan
DMU	Diesel Multiple Units
DUR	Department of Urban Roads

EC	Energy Commission
ECF	Extended Credit Facility
ECG	Electricity Company of Ghana
ECOWAS	Economic Community of West African States
EF	Energy Foundation
EMDAT	Emergency Events Database
ENSO	El Nino Southern Oscillation
FDI	Foreign Direct Investment
GACL	Ghana Airports Company Limited
GAMA	Greater Accra Metropolitan Area
GAR	Greater Accra Region
GCAA	Ghana Civil Aviation Authority
GCMA	Ga Central Municipal Assembly
GDP	Gross Domestic Product
GEMA	GA East Municipal Assembly
GHA	Ghana Highways
GHC	Ghana Cedi
GIBB	GIBB PTY (Ltd)
GIS	Geographic Information System
GLSS	Ghana Living Standard Survey
GNWP	Ghana Netherlands Water Programme
GoG	Government of Ghana
GPHA	Ghana Ports and Harbours Authority
GPRTU	Ghana Private Road Transport Union
GRC	Ghana Railway Company Limited
GRIDCo	Ghana Grid Company Limited
GRTCC	Ghana Road Transport Coordinating Council
GSGDA	Ghana Shared Growth and Development Agenda
GSIF	Ghana Strategic Investment Framework
GWCL	Ghana Water Company Limited
GWh	Gigawatt hour
GWMA	GA West Municipal Assembly
GWSA	Community Water & Sanitation Agency
ha	Hectares
HDS	Hydrological Services Department
HFO	Heavy Fuel Oil
HIPC	Heavily Indebted Poor Country

IMF	International Monetary Fund
IPPs	Independent Power Producers
ITCZ	Inter-Tropical Convergence Zone
KIA	Kotoka International Airport
LAP	Land Administration Project
LCO	Light Crude Oil
LUPMP	Land Use Planning and Management Project
MA	Municipal Assembly
MAB	Man and the Biosphere
MgCl ₂	Magnesium Chloride
MMDA	Metropolitan, Municipal and District Authorities
MMT	Metro Mass Transit Limited
MRH	Ministry of Roads and Highways
MTDP	Medium-Term National Development Plan
MTDP	Medium Term Development Plan
MVA	Mega Volt Amp
MW	Mega Watts
MWRWH	Ministry of Water resources, Works and Housing
NaCl	Sodium Chloride
NCCP	National Climate Change Policy
NDPC	National Development Planning Commission
NEDCo	Northern Electricity Distribution Company
NEPAD	New Partnership for Africa's Development
NIP	National Infrastructure Plan (2013)
NMT	Non-Motorised Transport
NSDF	National Spatial Development Framework, 2015-2035
OSA	Omnibuses Service Authority
PPP	Private Public Partnership
PROTOA	Progressive Transport Owners Association
PV plant	Photovoltaic plant
PWC	Price Waterhouse Coopers
QE	Quantitative Easing
RFP	Request for Proposals
RSDF	Regional Spatial Development Framework
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SIP	Strategic Investment Plan
SLR	Sea Level Rise
SONABEL	Société Nationale d'électricité du Burkina Faso
SoW	Scope of Work
SWITCH	Sustainable Water management Improves Tomorrow's Cities Health

TAH	Trans-African Highway
TCPD	Town and Country Planning Department
TE	Technical Executive
TEN	Tweneboa-Enyenra-Ntomme
TMP	Transport Master Plan
TSM	Transportation System Management
UPT	Urban Passenger Transport
VALCO	Volta Aluminium Company Limited
VRA	Volta River Authority
WACS	West African Cable System
WAP	Wildlife Protected Areas
WHO	World Health Organisation
WRC	The Water Resources Commission
WWTP	Waste Water Treatment Plant

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 Regional TCPD
 District TCPD Directors
 District Development Planning Officers
 PCU/LAP
 NDPC Regional Representative
 Electricity Company of Ghana (Accra West & Accra East)
 Regional Head, Environmental Protection Agency
 Regional Head, Department of Urban Roads

Regional Head, Department of Feeder Roads
Regional Head, Ghana Highways Authority
Regional Head, Water Resources Commission
Regional Head, Ghana National Fire Service
Regional Head, Forestry Commission
Ghana Water Company
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Ministry of Trade and Industry Representative
Ministry of Water Resources, Works and Housing Representative
Rep. Chamber of Telecoms
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1 *Introduction*

Chapter one provides an overview of the background, purpose and composition of the Regional Spatial Development Framework (RSDF). It serves to introduce the project and provides the parameters in terms of which the study was undertaken. It confirms that the RSDF has legal standing and as a spatial planning directive will guide planning, development and projects in the Greater Accra Region (GAR).

1.1 Background (As per RFP)

The RSDF finds its origin in what is known as LAP-2. LAP-1 also known as Land Administration Project 1 was successfully completed some years ago and has now been superseded by LAP-2, which is a second series of projects to be undertaken by the Government. The Land Use Planning and Management Project (LUPMP), a sub-component of LAP-2, is presently being implemented by the Town and Country Planning Department (TCPD) and it comprises various activities spread across four town planning components. The most prominent of these activities entails the “preparation of improved maps and spatial data for land administration” which includes the preparation of Regional Spatial Development Frameworks for some selected regions in Ghana. Since Accra is the capital City of Ghana it only makes sense that an RSDF must be prepared for the GAR.

Integrated planning across the GAR remains a challenge and has led to massive duplications, conflicts, overlaps and waste. As per the Request for Proposals (RFP), in the absence of a mechanism to guide the location of facilities and services, invisible hands have determined their location in a laissez faire manner and caused great distortions in the hierarchy and functioning of settlements. The unguided exercise of District Assemblies’ power as planning authorities coupled with the absence of a clear mandate for plan preparation at the regional level has further heightened coordination challenges and caused a disconnect among otherwise complementary development interventions in the region. The absence of a clear and directive RSDF therefore has a profound impact on the prevailing spatial form.

Hence, funds were sourced to compile the RSDF which would guide development and direct public and private investment.

1.2 Ghana’s Legal Framework

In Ghana the National Development Planning (System) Act, 1994, Act 480 as well as the Land Use and Spatial Planning Act 2016, Act 925 provide for integrated and joint district development planning. It is in terms of these that the RSDF finds legal standing and importance, and its compilation is therefore not only a physical necessity but also a legal requirement.

The Land Use and Spatial Planning Act 2016, Act 925 provides in Section 53 that a RSDF shall have as its key object the judicious use of land and a supportive spatial strategy for exploiting unique regional prospects for increasing regional and national prosperity. Evidently, the

focus of the RSDF is to formulate development proposals that will advance and benefit the region, promote growth and development and achieve regional success to benefit the national economy. Moreover an RSDF must provide planning directives for a 20 year period.

Furthermore, in terms of the *Manual for the Preparation of Spatial Plans, 2011* a Spatial Development Framework (SDF) should consist of the following:

- An overall discussion of the population growth and distribution, the human settlements system and the location of various land use activities within the country, region and district.
- Where there was already an SDF, an evaluation of the effectiveness of the Framework during the previous planning period.
- A description and analysis of dominant development trends, which drive or influence spatial development.
- The current policy and planning responses covering socio-economic development and its spatial aspect.
- A clear vision and description of the spatial development goals and guidelines for the Nation, Region or District in accordance with the National and Regional or District development policies and SDFs.
- An analysis of the current challenges in population growth, human settlements and land use, and the identification of visions, goals and guidelines for the desired future. And a critical translation of these into policies, priorities and proposals for the key spatial development concerns which are:
 - Identification, conservation and utilisation of resources;
 - Areas with pronounced resources for agriculture and industry;
 - Location of economic development potential for employment;
 - Scale and location of housing needs;
 - Location of infrastructure and services;
 - Sustainable land use strategies with environmental protection; and
 - Institutional framework for ensuring effective spatial development.
- A map or key diagram which illustrates the general content of the spatial strategy and shows the physical extent of proposals, but does not identify specific site boundaries.
- A proposal for how the spatial strategy will be implemented with proposals for additional analysis, negotiations with other authorities, concrete steps to be taken, management, programme and identification of investments in new areas, which are to be transferred to the Medium Term Development Plans (MTDPs).
- An identification of clear targets for monitoring of the planning process and for periodic evaluation of the SDF's implementation. The impacts of the SDF will be evaluated together with the MTDP.

While the above guidelines define a high level of detail, the RSDF for GAR is sure to meet these requirements and more.

1.3 Three-Tier Planning System in Ghana

Planning in Ghana occurs at three primary levels. An extract from the *Manual for the Preparation of Spatial Plans, 2011* shows where the RSDF fits into the system of planning and so indirectly defines the level of detail it should analyse and proposals it should present.

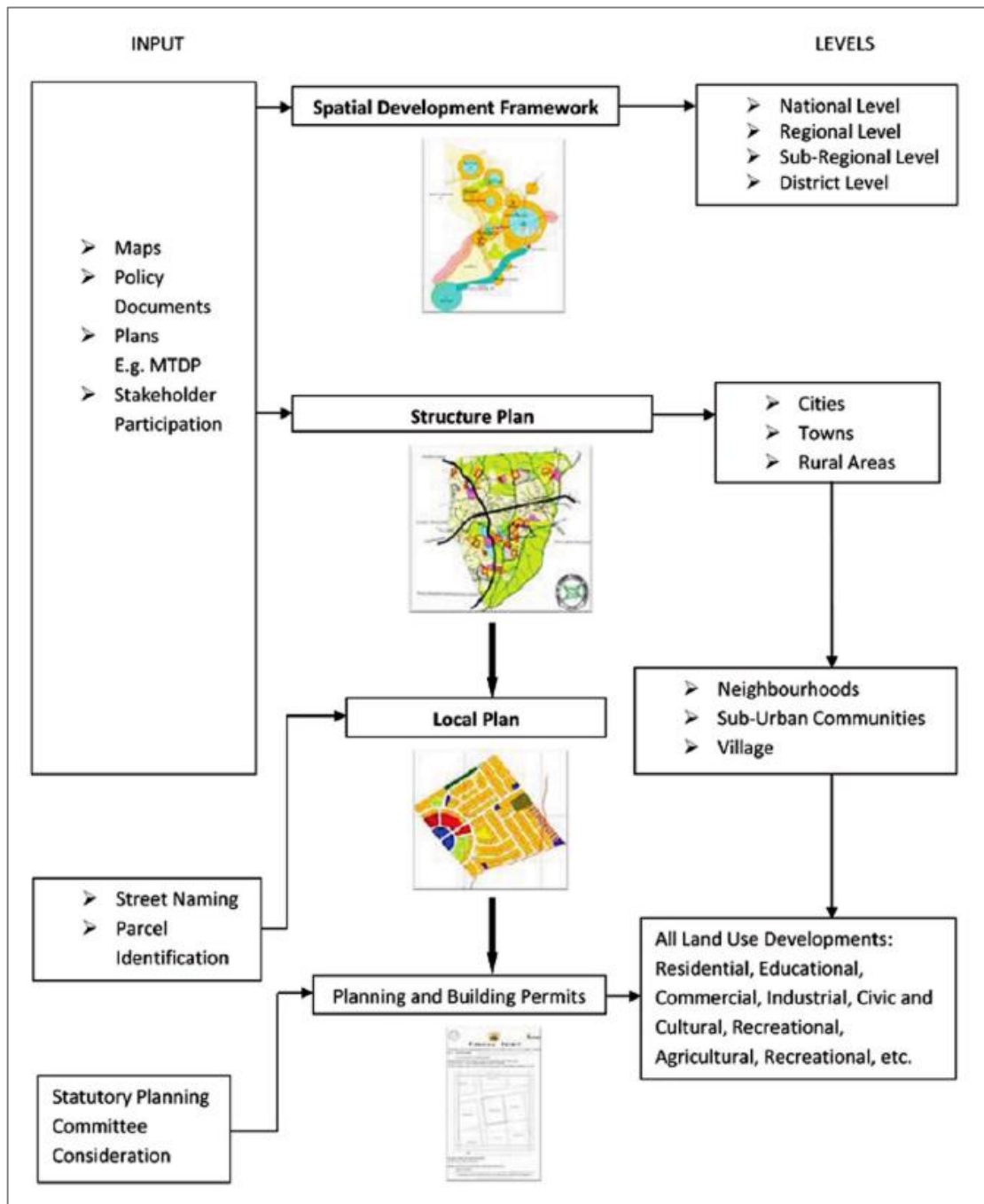


Figure 1.1: Ghana's Three-Tier Planning System

Evidently the RSDF is a high-level plan. It is overarching and encompassing with the clear intention to provide spatial directives for development. The RSDF will not and cannot provide precinct-level detail and cannot be confined by low-level detail, instead it must focus on the regional level to ultimately provide a strategic spatial document that provides critical drivers that will lead the way forward for the entire region.

1.4 Purpose of the RSDF

The reasons for compiling a RSDF are many and in essence are summarised as follows. The RSDF's purpose is to:

- Undertake a comprehensive status quo analysis / baseline assessment with the express purpose of gaining an understanding of the study area. This understanding entails knowing what the major developmental problems are, determining where development opportunities are, learning what the driving forces are, how sectors interrelate, what are major concerns and where the region's strengths lie. In other words it is getting to know the area based on research undertaken.
- Formulate a clear development vision for the region which should act as a guide for all development and be a directive in determining if any development or actions are beneficial or harming to the region.
- Identify strategic factors that would make a difference in directing the growth and development focus of the region.
- Prepare a spatial plan which would broadly allocate land uses to specific areas so as to inform development decisions and direct investment projects.
- Avail an implementation plan, informed by the spatial plan, prioritising development elements and areas for the next five years.

Evidently the RSDF is a composite effort involving many disciplines in order to provide an integrated, functional, useable and implementable plan that will deal with the problem areas of the region and build on the strengths and opportunities that have been identified.

1.5 Scope of Work

As extracted from the RFP the scope of work is the following:

The consultancy service involves the preparation of a RSDF and detailed implementation programme for the GAR. The Greater Accra Region Spatial Development Framework is expected to span 20 years and provide perspectives and proposals for what kinds of development should take place, how much of it should occur, and where and how it should happen.

It would also provide a spatial strategy for achieving defined social, economic and environmental policies as they relate to the region. The Plan should also address the spatial development implications of development interventions related to the region's economic

structure, employment structure, housing, infrastructure services (waste, water, energy, etc.), education, health care, tourism and leisure, transportation, communications, culture and the environment as a whole.

To ensure that the plan is adequately implemented, a clear programme of actions will be required, including guidance on investments and private sector involvement. The activities to be undertaken in furtherance of the above objectives are captured under four (4) broad areas.

(a) Assessment of the current situation and framework conditions for spatial development of the GAR:

It is expected that all requisite data and information will be collected, analysed and presented on the current state of development in the region. A number of policies and plans exist for the region and these will be thoroughly reviewed as part of the input. In addition, there are a number of planned and on-going projects in the region which will be reflected in the baseline assessments.

(b) Analysis of data and modelling of options for preparation of the RSDF:

This activity is expected to produce an outline of perspectives, policies and strategies for the future development of the region over a period of 20-25 years. Appropriate stakeholder consultations are expected to facilitate the selection of the preferred spatial development option. Key stakeholders may be drawn from the Ministries, Departments and Agencies (MDAs), Metropolitan, Municipal and District Assemblies (MMDAs), the private sector, non-governmental organizations / community-based organisations, traditional authorities, trade unions, etc.

(c) Formulation of the RSDF and appropriate programmes of action:

This activity is expected to produce the RSDF, backed by a five year programme of actions, an annual action plan, as well as an investment plan for the entire Framework. The RSDF document will be validated for further feedback from the public and at least one further round of consultations with the decision makers, before a final version is prepared for approval by the Greater Accra Regional Coordinating Council.

(d) Stakeholder consultation:

The consulting firm is expected to undertake a number of stakeholder consultations through meetings and workshops. This will be, especially after the inception report, during data collection and assessment of existing conditions, formulation of options for the RSDF and presentation of draft final reports/outputs. Key stakeholders such as regional agencies, national institutions, the National Development Planning Commission (NDPC), district assemblies, traditional authorities, civil society groups, and community-based organizations should be consulted. Guidelines prepared by the NDPC and TCPD on stakeholder consultations are expected to be used.

Part of compiling the interim report entailed significant stakeholder consultation. All elements pertaining to this participative process are included as **Appendix A**.

1.6 Project Approach

An integrated and holistic approach will form the basis of the project. This means an all-encompassing assessment will be undertaken covering all relevant planning facets in order to gain a comprehensive understanding of the study area, its functioning, role and future. To this end an integrated and diverse team of specialists was assembled to provide the necessary inputs into the process and proposals for the future.

The project is directed by the need for proper planning and regional restructuring. Therefore, development must be part of an integrated approach informed by an overarching vision to guide development, and directed by the various sectors that enable development.

To undertake holistic and integrated planning and attain appropriate and realistic outcomes for the Greater Accra Region, the analysis will be conducted in terms of the five pillars of planning and development, namely:

- Natural environment;
- Built environment;
- Social environment;
- Economic environment; and
- Institutional environment.

Where the natural environment is concerned, the research looks into elements such as the rivers, geology, agriculture, topography, protected areas, sensitive areas, etc. and where the built environment is concerned, the analysis looks into all engineering infrastructure and services, settlement patterns, transportation, land use



Figure 1.2: Five planning environments

arrangements, urban form, etc. The social environment assesses all issues related to people including demographics, economic conditions and social services. The economic environment reviews the economic status quo looking into economic sectors, growth areas, areas of concern and areas of economic potential. Finally the institutional environment

considers the administrative framework which exists and within which the RSDF will operate. This manner of research provides a desirable comprehensive outcome.

The professional team will appropriately analyse and define the development principles and guidelines applicable to development in Ghana. The principles that will be applied in this project will include:

- **Concentration** – of urban development to achieve sustainable development and growth of cities ensuring more effective use of underutilized urban land and more effective use of infrastructure and services. This, of course, will need to happen within the context of sustained decentralisation as is identified as a driver of transformation in the Long Term National Guidelines for Ghana.
- **Conservation** – of arable agricultural land to ensure food security and protection of natural and tourism resources such as wetlands, the ocean, etc.
- **Good linkage** – regionally, between urban areas via road, rail, etc. as well as internationally through airports and harbours to strengthen the economy and facilitate the movement of people, goods and services.
- **Sustainability** – the primary and overarching principle that will inform the development vision and all development proposals. The core notion would be to attain a balance between the sectors that drive development, i.e. the economy, the environment, people, their needs and growth, to devise economically viable development proposals.

A review of the National Spatial Development Framework (NSDF) 2015-2035 suggests that it also is founded on similar principles.

The review will further be issue-based whereby critical issues, both positive and negative for the above five environments will be identified and adjusted/amended to suite present day and future requirements. This will result in an integrated, structured and focused approach that will adequately deal with all critical issues.

A spatial concept will be generated depicting the core / critical development factors that should direct the future growth of the region. An effort will be made to present succinct proposals, i.e. rather a few critical factors and proposals than an unending list of tasks, projects, priorities and actions that are cumbersome and difficult to attain. Experience has shown that a focused plan is easier to implement, of greater value and a better facilitator of development than a too detailed and complicated plan.

The following figure illustrates the approach from which follows the proposed methodology.

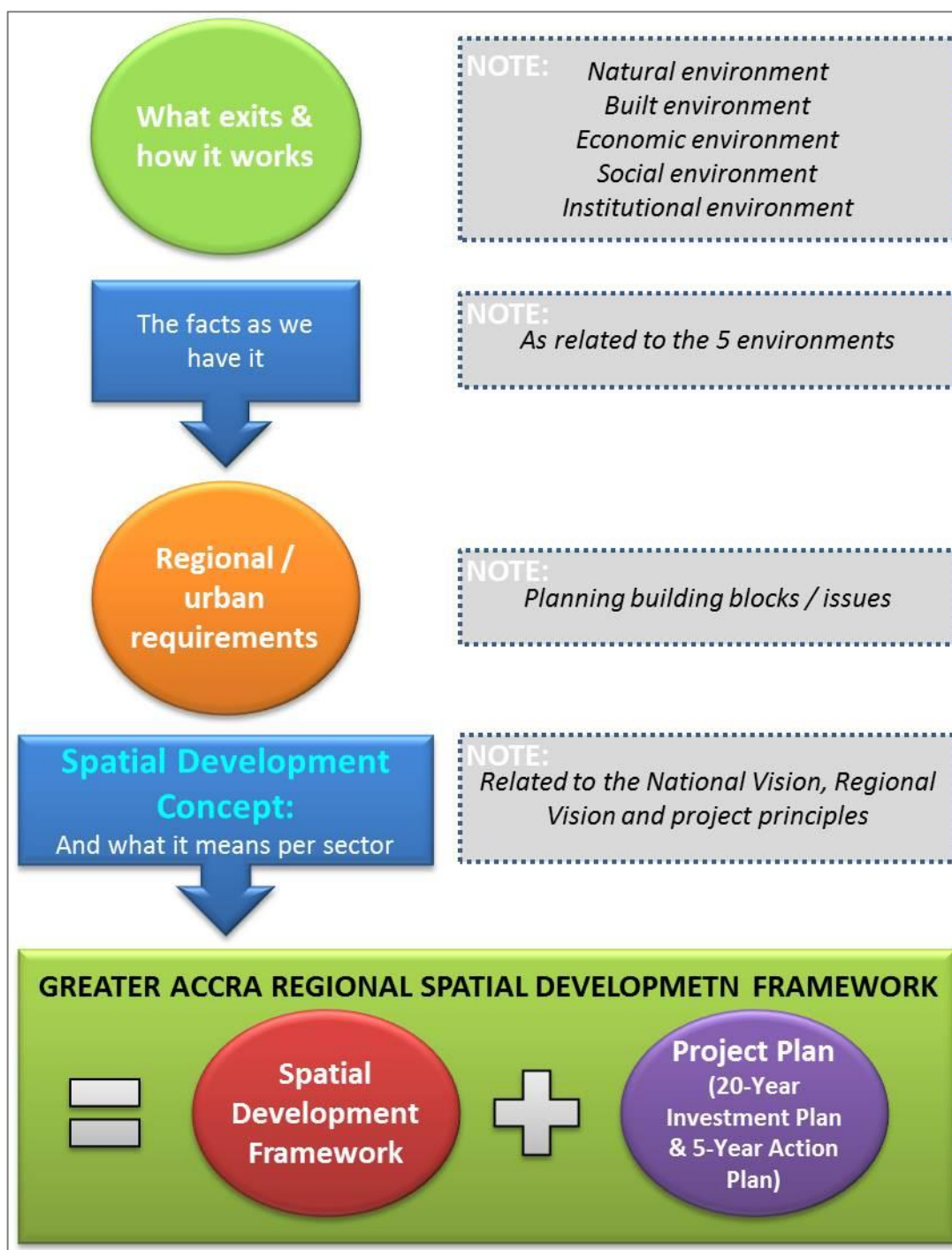


Figure 1.3: Project Approach

1.7 Methodology

A systematic project methodology has been adopted to comprehensively research the area and prepare astute proposals. The process is broadly shown in the following figure, which also corresponds to the figure above.

It will commence with a fully-fledged and multi-sectoral analysis of the entire study area. It will cover the five pillars of planning, viz. the natural, built, economic, social and institutional environments. The objective is to find out what exists and how the region works.

With the facts in hand conclusions will be drawn in the form of findings and critical factors and these will be measured against the regional and urban requirements of the GAR.

A vision and development concept will flow from the former, which will be the key drivers that will shape the framework and will be measured against the overall national vision, mission and goals. The development concept will be a broad land use categorised plan which should visually depict the vision. The concept plan will be the input for the spatial development framework and inform the various sectors of their development requirements.

With the concept in hand the various planning environments / sectors will prepare their development proposals, which in unison will form the spatial development framework. The latter will comprise a series of plans supported by relevant and advisory technical proposals.

An outflow from that will be an implementation plan for a five year timeframe listing and detailing the key development projects that should be addressed to further the RSDF.

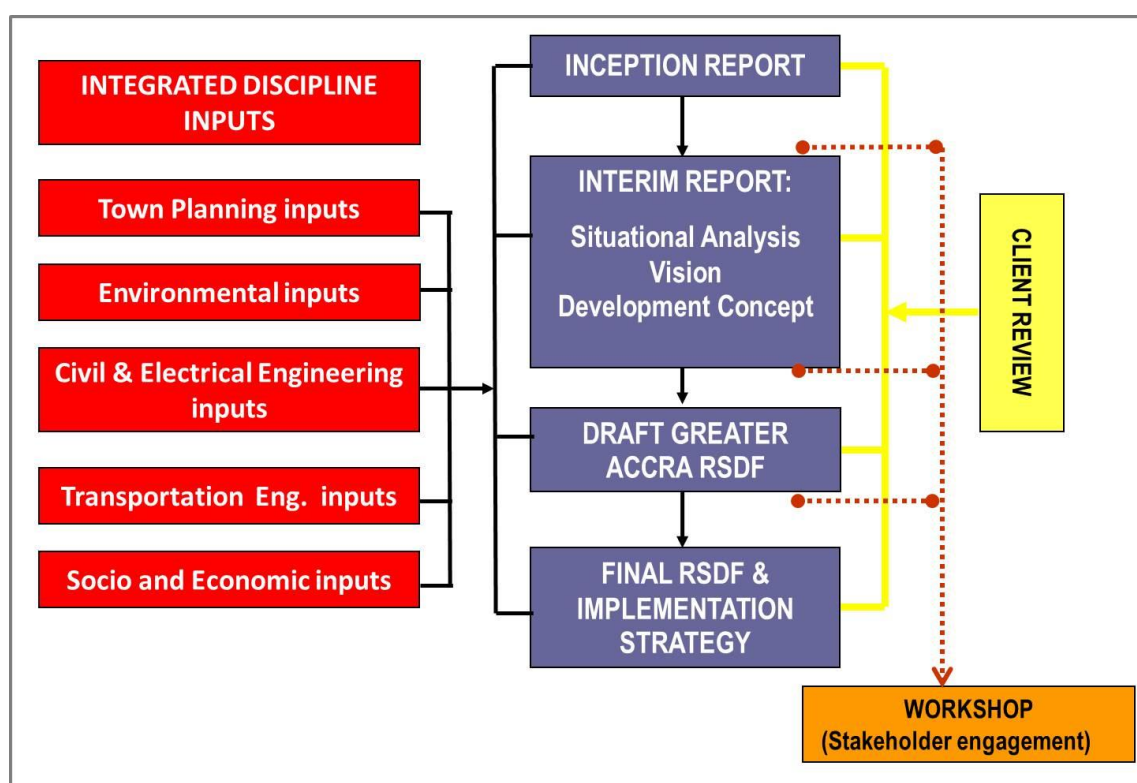


Figure 1.4: Project Methodology

1.8 This Report

This report is referred to as the Baseline Assessment Report. It is a stepping stone toward the compilation of the Draft RSDF which in turn will be transformed into the Final RSDF and Implementation Strategy.

Visually the position of the Interim Report is shown below, and following the completed Inception Report, it is the second project deliverable.

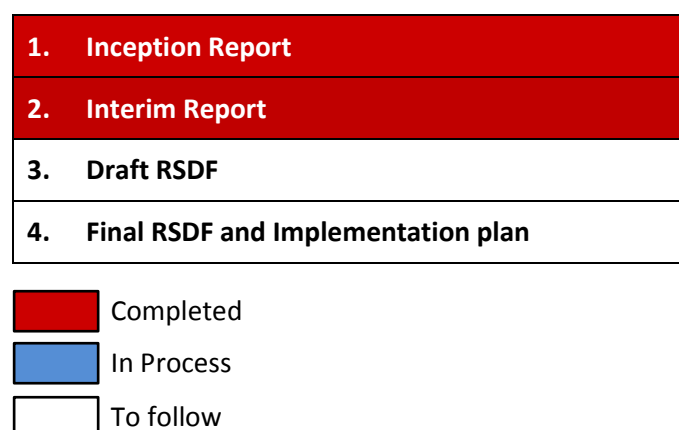


Figure 1.5: Project Deliverables

Broadly the Interim Report will comprise a comprehensive status quo analysis of all the planning environments from which clear findings will be extracted that should direct the way forward.

1.9 Project Comments

The status quo analysis is exclusively based on information available at the time of the project. The project did not make provision for primary information generation. For completeness all reports received from the government of Ghana were reviewed and extensive interviews and meetings were held with relevant departments and officials.

The purpose of this report is to prepare a REGIONAL spatial development framework for an area 4 354km² in extent. Since it has a regional perspective its focus must be retained at a regional level. Therefore to avoid entrapment in local level detail, the project team endeavoured to conduct the analysis at a regional level only. The focus of the status quo report is to determine how the area functions, what its constraints are and what the issues are that need to be addressed to ensure that this rapidly growing region can cope with the growth, and provide an improved future.

The study in general has endeavoured to identify the most critical spatial issues around which the Spatial Development Framework was prepared. Its focus is to ensure that a sustainable framework is produced for the Greater Accra Region.

Mapping is in the process of being refined and is continuously scrutinised as information feeds into the process.

2 The Greater Accra Region in Context

2.1 Location

The Republic of Ghana is situated on the West Coast of Africa on the Gulf of Guinea which forms part of the Atlantic Ocean. Spanning an area of 238 535 km² and stretching 560km along the Gulf of Guinea, Ghana is bordered by Ivory Coast in the west, Burkina Faso in the north and Togo in the east. The word Ghana means "Warrior King" in the Soninke language. The name "Ghana" is likely a derivative from the word "Guinea" (via French Guinoye) which was used to refer to the West African coast off Ghana, now known as in Gulf of Guinea.



Figure 2.1: Location of Ghana

Ghana is located only a few degrees north of the Equator, therefore giving it a warm climate. Ghana's longitude and latitude make that it is geographically closer to the "centre" of the Earth than any other country in the World. The country used to be covered by tropical forests but significant population growth led to deforestation and urbanisation over centuries. The country also has natural resources located in the south which have made it a prime location for mining of industrial minerals and timber. Ghana encompasses plains, waterfalls, low hills, rivers, Lake Volta the world's largest artificial lake, Dodi Island and Bobowasi Island on the south Atlantic Ocean coast of Ghana.



Figure 2.2: Ghana

As defined in the RFP, the study area is situated on the southern coastline of Ghana and is known as the Greater Accra Region (GAR).

All of Ghana is divided into ten regions and they represent the first level of sub-national government administration. The regions as they exist today were officially established in 1987. GAR is one of these regions and is situated between the Central, Eastern and Volta Regions as shown in the adjoining figure. Housing the capital city of Ghana (Accra) and the country's most prominent seaport (Tema) would



Figure 2.3: Location of Greater Accra Region

suggest that GAR is an important international gateway.

The table below provides an indication of proportional divide amongst the various regions. The physical extent and population size provides a quick view of the nature of the area.

Table 2.1: Regions of Ghana

Region	Capital	Area (km ²)	Population (2012/2013)* (Million)
Ashanti	Kumasi	24 889	5.2
Brong-Ahafo	Sunyani	39 557	2.6
Greater Accra	Accra	4 354	4.3
Central	Cape Coast	9 826	2.3
Eastern	Koforidua	19 323	2.7
Northern	Tamale	70 384	2.6
Western	Sekondi-Takoradi	23 921	2.4
Upper East	Bolgatanga	8 842	1.1
Upper West	Wa	18 476	0.8
Volta	Ho	20 570	2.3
Ghana			26.3

** This is a projected estimated figure from 2012/2013 GLSS 6*

Source: GLSS, Round 6, 2014.

It evidences that GAR is by far the smallest region covering a mere 4 354 km² yet as projected in 2012/2013 was the second most populated region in Ghana, then accommodating over 4 million people. In terms of size GAR is 4.5 times smaller than Upper West Region which by comparison has a mere 800 000 people in its region. The GAR has a notable population density of approximately 1 000 people per square kilometre, which internationally compares to cities such as Calgary (Canada), Nice (France), San Antonio (USA) and Vereeniging (SA).

2.2 The Study Area

The study area is all of GAR. It covers an area of approximately 4 354 km² which is but 1.4% of the total land area of the country. While small the area and its national role should not be underestimated. The fact that it houses the capital city and harbours the seat of government confirms its importance.

The study area, i.e. GAR comprises 16 administrative zones. These are listed in **Table 2.2** while the figure following contains the plan for the study area.

Table 2.2: Administrative Composition of Greater Accra Region

Districts in Greater Accra Region		
District	Capital	Area (km ²)
Accra Metropolitan	Accra	137
Tema Metropolitan	Tema	121
Adenta Municipal	Adenta	140
Ga East Municipal	Abokobi	96
Ga West Municipal	Amasaman	405
Ga South Municipal	Weija	502
Ga Central Municipal	Sowutuom	103
Ashiaman Municipal	Ashiaman	45
Ledzokuku-Krowor	Teshie-Nungua	50
Ada East	Ada Foah	291
Shai Osu Doku	Dodowa	971
La Dade Kotopon	La (township)	50
La-Nkwantanang Madina	Madina	75
Kpone Katamanso	Kapone	294
Ningo Prampram	Prampram	750
Ada West	Sege	324
Total		4 354

Source: GIS Information 2016 and Five Year Medium Term Plans

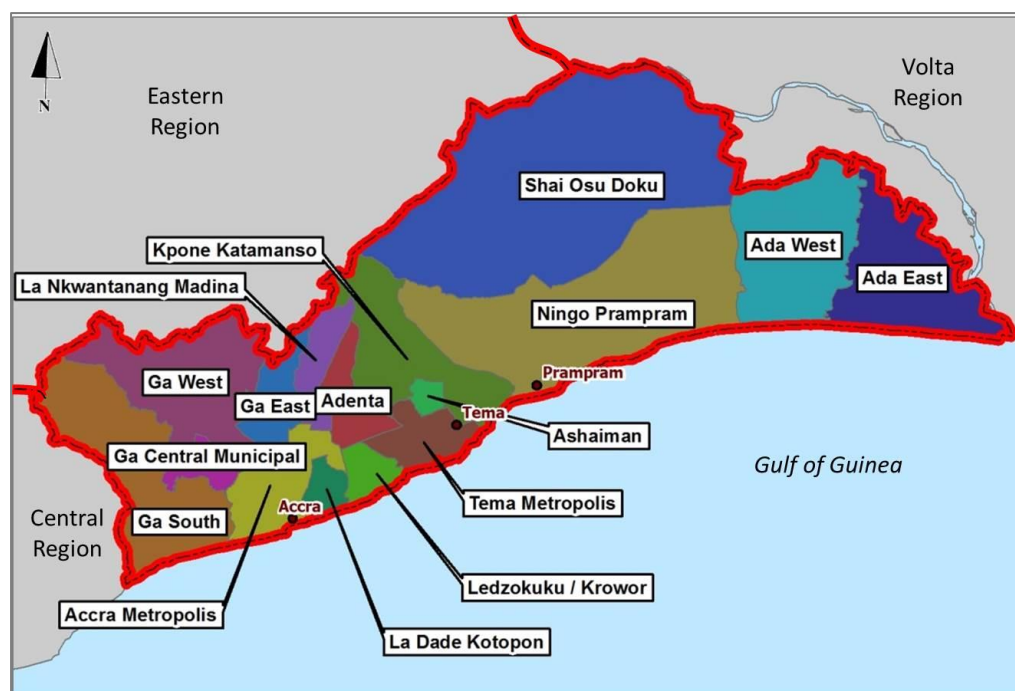


Figure 2.4: Study Area / Greater Accra Region

The study area stretches 130 km along the coastline from Langma in the West to Ada-Foah in the East. A part of the eastern boundary is created by Volta River which flows out of Lake Volta towards the Gulf of Guinea.

While having the highest population density the region also has the highest population growth rate, which in part is owing to continued in-migration by people seeking jobs and a better life. The vast majority of residents (83%) are Christians, followed by Muslims (10%) and other religions. The region has a wide variety of education facilities, shopping centres and is served by a network of road and rail infrastructure. Economic activities in the region include the financial and commercial sectors, fishing, manufacturing of processed foods, lumber, plywood, textiles, clothing and chemicals, with tourism emerging as a viable sector.

GAR is Ghana's most well-endowed region in terms climate and natural resources and has therefore attracted high levels of investment over past centuries. Recent off-shore oil and gas explorations have had some significant consequences. It has resulted in an increased demand for land, raised pressure on already overstretched infrastructure and led to vast in-migration, all of which have had further multiplier impacts. Presently planning and development proposals are haphazard with little comprehensive consideration for urban form and functionality. The overall development pattern is unstructured and random which suggests an absence of spatial plans, policies and instruments as well as adequately resourced governing institutions to co-ordinate and harmonise development.

2.3 History of the Region

Town planning in Accra and the surrounding region truly only started after World War II and it was significantly influenced by British Rule. Some areas were carefully planned and laid out while in others settlements appeared haphazardly creating shanty-town landscapes. The CBD also took shape during this time and it centred on a massive judicial / administrative complex. The then growing economy led to many more commercial buildings rising up around the administrative core.

Thereafter, a new British-influenced urban plan recommended a tight street grid and the preservation of broad open spaces for the design and establishment of many squares, fountains, statues and ornamental pools. However, following post-independence the new Prime Minister Kwame Nkrumah in 1957 created his own plan, shifting focus from serving the elite to creating spaces that would inspire pride and nationalism in his people. Accordingly, he replaced the squares, fountains, statues and ornamental pools with landmarks such as Independence Square, State House, the Organisation of African Unity building and the refurbishment of Chiristianborg Castle. In this plan the initial order and urban form



Figure 2.5: Landmarks

that was sought before independence was somewhat lost as the Nkrumah plan allowed for continued compression of commercial establishments in the central business district (CBD) and increased migration into Jamestown.

Around this time the small fishing village of Torman, today known as Tema, was transformed to become the new and ultra-modern seaport of Ghana. In 1952 the government acquired 166 km² of land north of the harbour with the intention to build an industrial and residential “new town”. The local villagers were relocated and Tema township and harbour were built. The Harbour was officially opened in 1962 and since then the town has grown into Ghana’s industrial hub. Because the town was planned, it reveals a carefully constructed road layout featuring landscaping and street lights, and boasted modern recreational centres and other social amenities rare among African cities at the time.

On the back of these plans and the promise of employment opportunities large population influx began in the 1960s; but the Tema Development Corporation was unable to construct housing and provide other services to meet the needs of the migrants. The Tema Newtown district was overwhelmed by the sudden population growth, and became the poor cousin of Tema Township, receiving none of the latter's improved housing, geometrically laid roads, or social amenities.

Today Tema is locally nicknamed the "Harbour Town" as it is Ghana's largest seaport. It is a major trading centre, home to an oil refinery and numerous factories, and is linked to Accra via highway and railway. The importance of Tema as a port and industrial hub is reflected by the fact that the Ghana Police Service maintains a special policing region devoted entirely to the city. Tema port handles 80% of the country’s import and export cargo and handles goods in transit for landlocked countries such as Mali, Burkino Faso and Niger.

These towns are important to GAR and their history provides a sense of where the region originated.

2.4 Spatial Dynamics of the Region

Being the administrative and commercial capital of Ghana, Accra (including Accra City Region and GAR) plays an important spatial and developmental role. Accra City Region accounts for 25 percent of the national gross domestic product (GDP) and leads, or is second to lead, in almost all non-primary sectors except education. It is a magnet for investment and a gateway for international trade.

GAR is roughly at the centre of the West African regional economic corridor also known as the West African Mega-region. Being inter-connected by good air, sea, rail and highway links, running from Abidjan to Lagos, GAR is ideally located to become an economic powerhouse. The mega-region spans approximately 600 km across four countries viz. Côte d'Ivoire, Ghana, Benin, Togo and Nigeria and has a fast growing urban population of over 30 million people. Indeed many experts consider this coastal urban corridor to be the engine of West Africa’s regional economy.

By itself, Ghana's coastal region already meets the criteria of being a mega-region, with a total population of almost 11 million, an urban population of over 6 million, a density of 186 p/km², and an urban population growth rate of 3.8 percent. Added to this are the large and growing Nigerian cities: Lagos from 10.8m to 18.8m by 2020; Ibadan from 2.8m to 5m, Ogbomosho from 1m to 1.8m, and Ilorin from 0.8m to 1.4 m. Evidently this is a strategic region.

The only planned region-wide interventions to date are the approved, though not yet aligned, Trans West Africa Highway and the proposed railway network along the coast. These projects will increase the region's attractiveness for economic development and will bring with it more rapid population growth and urbanisation.

The most prevalent cities in Ghana are Accra, Kumasi and Sekondi Takoradi. Sekondi Takoradi, like Tema is a coastal city and important seaport. Its industries are timber, cocoa processing, plywood, shipbuilding, harbour and railway repair, and more recently, sweet crude oil and crude oil. Kumasi is a city in Ashanti Region and is widely known as the "Garden City" because it is near Lake Bosomtwe, in a rain forest region and is the cultural capital of the country. These three cities form the "Golden Triangle" which is a key driver of national growth. The cities are strategically linked by road and rail and Kumasi creates the inland gateway for the coastal areas.

While reference is made to Accra, spatially Accra is not only a city anymore, but has grown into a region of urban and economic activities. GAR's spatial development centres around Accra and Tema, which are the administrative and economic cornerstones of the region. Though, approximately 25km apart, urban growth has consumed the space in between the two cities to the extent that the area is completely built-up and developed. Since both are located on the coast development radiates out from each at 180° northwards with the main arterial roads being the conduits of development. A radial road pattern with some interlaced grid is generally evident across the region. Urban development is therefore prominent around these two centres filling in the area up to the northern delineation of the region.

However, given its elongated shape and the absence of an economic anchor, town or city to the far-east, urban growth has not been drawn to the east. Consequently, the eastern part of the region has remained undeveloped and rural. It is typified by agricultural land, villages, mining, forestry and environmental conservation areas.

The following figure illustrates this spatial dynamic in the Region.

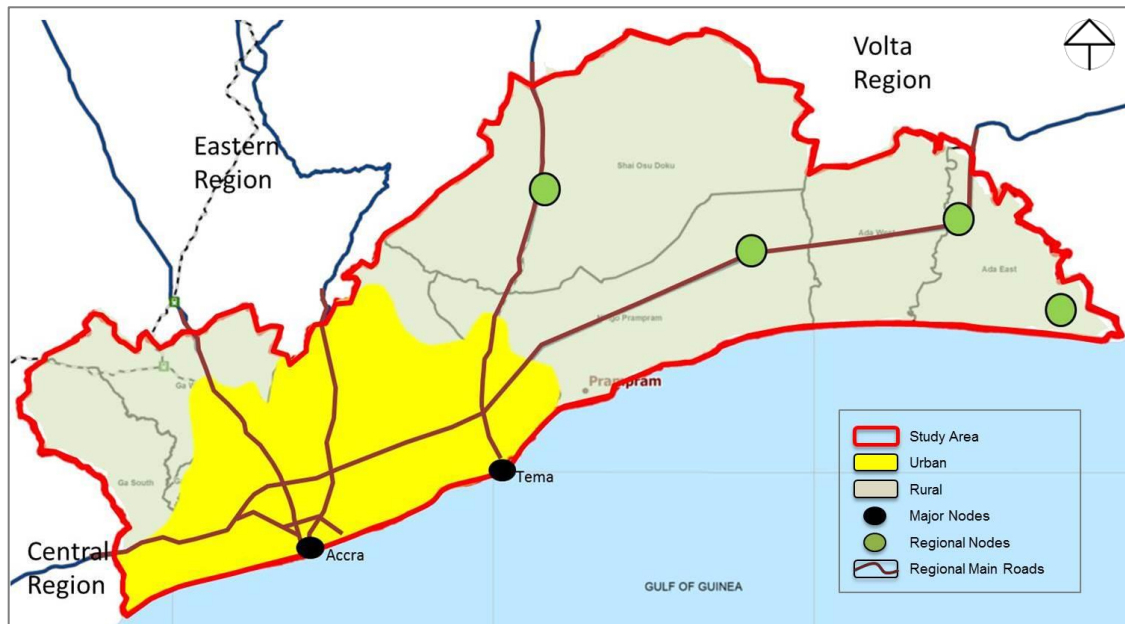


Figure 2.6: Urban Core and Rural East

2.5 GAR in terms of the NSDF

The National Spatial Development Framework (NSDF) 2015-2035 is a national spatial and policy document geared toward formulating clear development directives for the country's future development. The document contains a whole host of proposals and plans, yet only a few pertinent development guidelines have been extracted as an indicator of how growth and development of the GAR is seen by NSDF.

The NSDF advocates that Ghana must be integrated into the West African Economy and must do everything it can to attract investment. Hence the country should plan for population growth and in-migration, high urban populations, yet limit sprawl and fragmentation, strengthen the two largest urban areas (Accra and Kumasi) and create better rural linkages.

As for the hinterland the NSDF acknowledges that fragmentation of agricultural land is a problem and it should be limited since Ghana has less than half of the people/cropland ratio that experts recommend for sustainability. Stimulating rural productivity means providing better trading markets for agricultural produce, better market infrastructure and improved linkages and mobility between the urban areas and hinterland.

The NSDF identifies six pillars of spatial strategy which very briefly are:

- Emphasize balanced polycentric development;
- Improve regional, national and international connectivity;
- Strengthen the metropolitan city regions of Accra and Kumasi and focus on Accra as the engine of growth, magnet of investment and gateway to international trade;
- Promote development in networks and secondary cities; and

-
- Ensure sustainable development and protection of ecological assets.

With particular reference to Accra and its region the NSDF proposes to:

- Promote Accra Capital Region as a world class city and ensure that it can compete with places such as Lagos and Abidjan by establishing its role as a regional business, trade and investment hub (a role no other city can play);
- Promote existing urban settlements and discourage new ones;
- Promote larger and discourage smaller settlements;
- Improve connectivity to international markets through new and upgraded air, rail, expressway and marine infrastructure;
- Promote urban settlements along major transport corridors;
- Integrate rural settlements into expanding urban areas;
- Protect agricultural land and forests; and
- Maintain and improve efficiency of main expressway network.

Clearly GAR fulfils a multitude of roles and is important for the nation and the man on the street. The NSDF provides a clear framework of what it regards as the development focus for GAR which serves as critical input into the RSDF process.

3 *Natural Environment*

3.1 The Environmental Status Quo Approach

The environmental status quo takes into consideration that environmental management requires an integrated, holistic and multi-disciplinary approach. Therefore, the input of various disciplines was obtained at a desktop level to inform the environmental status quo and the way forward. The approach to the environmental status quo consists of a literature review, a spatial analysis and a constraints assessment.

3.1.1 Approach to the Literature Review and Spatial Analysis

Relevant existing datasets and documentation, such as GSIF for Sustainable Land Management were reviewed to inform the desktop study. The aim of the literature review was to provide an overview of the natural resources within Ghana, which provided an introduction to the relevant natural resources. The literature review then aimed to highlight the importance of these resources within the context of the GAR, further emphasised by the threats and pressures these resources face.

The GAR was used to create a study area map, which provided a point of departure for the spatial analysis of the study area. Spatial analysis of GAR utilised various national and regional data sets and an analysis of the information in the literature to provide criteria used in identifying environmental constraints for development.

3.1.2 Constraints Assessment

The aim of the environmental constraints is to provide areas that; based on the natural resources present and the role these resources play within the greater context of the region, should not be considered for high impact development (i.e. dense housing, industrial development etc.). These areas essentially form an integral part of the ecological infrastructure and the socio-ecological system.

The NSDF indicates the spatially most relevant areas to address in terms of environmental concerns include: “(i) natural resource management and mineral extraction; (ii) biodiversity management; (iii) protected areas management; (iv) land management and restoration of degraded forests; (v) integrated marine and coastal management; (vi) wetlands and water resources management; (vii) climate variability and change and (viii) natural disasters, risks and vulnerability” (GSGDA II, as quoted by Town and Country Planning Department, 2015:285). These areas correlate with the aspects reviewed in the development of the environmental constraints (**see section 3.11**) for the GAR SDF.

3.2 Environmental Related Policies

There are a number of policies relating to environmental issues within Ghana. The proceeding section describes these policies, thus giving insights into the principles required in developing the RSDF.

3.2.1 The Environmental Policy

Ghana's Environmental Policy was promulgated with the intention of creating an improved life and environment for the present and future Ghanaian population. This policy was devised to provide a basis for the implementation of the existing National Environmental Action Plan. The Environmental Policy intends to ensure economic development in the country, without compromising the receiving environment, thus, ensuring resource conservation and sustainable development. The maintenance, protection and management of the ecosystems and biodiversity as well as ensuring integrated decision making, are a few of the core principles underlying this policy (Environmental Protection Agency, 2002).

3.2.2 Forest and Wildlife Policy

In 1994, the Ghana Forest and Wildlife Policy was implemented. This policy was created with the intention of integrating both forest and wildlife resources, simultaneously ensuring the sustainable use and conservation of these resources. Given that many Ghanaian citizens utilise natural resources for the sustenance of their daily livelihoods and traditional practices, the policy was derived with the intention of ensuring that the citizens of Ghana have the right to access this natural resource base. However, this policy also ensures that citizens have the responsibility to ensure the sustainable use of these resources. Additionally, given the reliance on forests for timber, this policy ensures that emphasis is placed on reforestation initiatives to ensure sustainable use of timber (Environmental Protection Agency, 2002). In 2012, the Ghana Forest and Wildlife Policy was revised. This amended policy made provision for transparency and encouraged the establishment of small wildlife enterprises for locals. Emphasis was placed on empowerment of local communities through resource management, ecotourism and various restoration projects ensuring conservation of the natural resource base (Ministry of Lands and Natural Resources, 2012).

3.2.3 The Land Policy

The Land Policy was developed with the intention of assuring Ghanaian citizens access and ownership to land in a sustainable manner. The objectives of the Land Policy incorporate the integration between different land groups and stakeholders so to minimise conflicts. This ensures land use planning is undertaken in a sustainable manner, which allows for conservation of the land as well as maximised benefits to land owners. This will be achieved through the use of Geographic Information Systems and the establishment of a geo-spatial framework database. (Environmental Protection Agency, 2002)

3.2.4 National Water Policy

The National Water Policy for Ghana was adopted in 2006. Like many of the other environmental policies, this policy aimed at ensuring sustainable development. This was achieved by offering a structure to ensure that water resources are sustainably distributed, developed and utilised. Some of the outcomes of this policy which are being developed include: guidelines to ensure correct disposal of effluent discharge, the observation and monitoring of industries to ensure their compliance with the environmental authorisation

regulations, and the protection of water resources through the establishment of buffer policies and regulations (UNEP, 2011).

3.2.5 Biodiversity Conservation Policy

The Biodiversity Conservation Policy is established to promote conservation of biodiversity in Ghana. Efforts made to achieve this include: the establishment of forest and wildlife reserves, important bird areas which allow for the use of birds as an indicative species for quality of habitat, as well as the establishment of community resource management areas. This allows for the conservation of the natural resource base. Additional efforts resulting from the Biodiversity Conservation Policy include: the establishment of the Natural Biodiversity Strategy, preparation of a Biodiversity Strategic Plan, as well as the sustainable use of plants for medicinal practices in Northern Ghana (UNEP, 2011).

3.2.6 Coastal and Marine Environmental Policy

The Coastal and Marine Environment Policy is aimed at the protection and conservation of marine and coastal resources. This policy included: the graphical representation of environmentally sensitive areas of the Ghana coast, preparation of a Strategic Environmental Assessment for the oil and gas industries, introduction of pilot projects with local communities to ensure the protection of marine resources and ecosystems, and the establishment of Ramsar Sites. (UNEP, 2011).

3.2.7 National Climate Change Policy

The National Climate Change Policy (NCCP) for Ghana was developed in an effort to address the socio-environmental issues faced by the country, such as increased frequency of natural disasters such as floods and droughts which have negative social, environmental and economic impacts. The NCCP was aimed at ensuring sustainable development through the adoption of a climate-resilient and green economy as well as existing as a guide for policy makers to implement climate adaptation strategies nationally. Five areas of priority are highlighted in the NCCP. These are: Agriculture and food security, disaster preparedness and response, natural resource management, equitable social development and energy, industrial and infrastructural development. The focus on climate-resilient infrastructure and communities allows for improved food security across the region, as well as good management and conservation of resource bases, which align with the five priority areas (Ministry of Environment, Science, Technology and Innovation, 2013).

3.3 Topography and Relief

Ghana is characterised as having a generally low relief, with a few places reaching elevations of 1000m (Environmental Protection Agency, 2011a). The topography is undulating slowly, in low relief with slopes of between 3 to 4 % (Environmental Protection Agency, 2002). The highest hills are about 397m and most of the area lies between 153 and 244 m above sea level. The plan that follows (**Plan 3.1**) shows a general layout of the topography and relief of the region.

Plan 3.1: Topography and Relief in GAR

The types and measures of relief features found in the country are dependent on the nature and distribution of the different rock formations from which the land is built. It is further dependent on the intensity and the period of occurrence of earth movements which are experienced in the country, the nature of the weathering process, erosion and deposition and how long the land has been exposed to these processes (Environmental Protection Agency, 2000).

Almost half of the country comprises a series of plateau surfaces which are at different elevations. The remainder of the country is covered by the voltaian sandstone basin. The relief of Ghana is studied in detail through the following physiographic regions which are as follows:

- The coastal plain,
- The forest dissected plateau,
- The savannah high plains,
- The voltaian sandstone basin, and
- The ridges and escarpments bordering the voltaian sandstone basin.

The Accra (coastal) plains are almost flat and descend gradually to the gulf from a height of about 150 m. The relief is generally gentle and undulating, a low plain with heights not exceeding 60 m (200 ft.) above sea level (Accra Metropolitan Municipality, Medium Term Development Plan, 2014). The attribute of the topography is marked with a succession of ridges and valleys which are spoon shaped in nature. The hills and slopes in the area are favoured for agricultural development (Accra Metropolitan Municipality, Medium Term Development Plan, 2014).

The coastal plain which encompasses the GAR (refer to **Plan 3.1**) is broad in the east and west, stretching over 80 km inland and narrows inland extending no more than 16 km from the sea. The coastal plain may be divided into two broad sections which are the south-east coastal plains east of Accra, and the plains west of Accra (Environmental Protection Agency, 2000):

- The south-east coastal plains are very flat and have a few isolated hills which are called inselbergs, e.g. Shai, Krobo, Ningo and Osudoku hills, which rise from the surrounding plains. The general elevation of the land, except that of the inselbergs, is not more than 76.2 m above sea level, and at some places on the coast, such as Keta, the land is even below sea level and is subject to periodic invasions by the sea (Environmental Protection Agency, 2000). Between Accra and the Songor lagoon, the coastline has formed steep cliffs; but further east, the coastline is fairly smooth, without cliffs. It is marked by sandbars, the Volta delta (the only one of its kind in the country) and by numerous lagoons, the largest of which is the Keta lagoon (Environmental Protection Agency, 2000).

- Along the West of Accra, the plains display different characteristics. The land is not flat but undulating. The rock types found here are granites which also results in the formation of hills. Along the coastline, there is formation of a series of small bays and headlands.

3.4 Geology and Soils

3.4.1 Geology

The geology formation of Ghana comprises the following rock formations which are shown in the table below.

Table 3.1: Geology

Geology	Description
The Dahomean formation	This is the oldest, and features the whole of the south-east coastal plains. It constitutes the floor of the Accra plains and the southern part of the Volta Region. The rocks are mainly metamorphic, consisting of gneisses and schists.
The Birimian formation	This covers more than three quarters of the closed forest zone and comprises all the minerals exported from the country. The formation is divided into the Lower Birimian consisting of metamorphosed sediments as phyllites and schists, and the Upper Birimian (the younger of the two) consists of rocks of the Lower Birimian as well as metamorphosed lava. The Birimian formation generally follows a south-west to north-east trend.
The Tarkwaian formation	The Tarkwaian formation originally consisted of sediments eroded from the Birimian formation and deposited in a shallow narrow basin, and then folded along the same axis as the Birimian formation. This extends from Agogo to the middle of the Ankobra river and consists of schists, sandstones, quartzite and phyllites. A few areas of this formation consist of plutonic or volcanic rocks.
The Togo series	This formation consists of sedimentary rocks and their metamorphosed versions (e.g. quartzite, schists shale, and phyllites) which were strongly folded to form the Akwapim-Togo Ranges.

Source: Environmental Protection Agency, 2000

The geology of the Accra region (as shown in **Plan 3.2**) consists of Precambrian Dahomeyan Schists, Granodiorites, Granites Gneiss and Amphibolites to late Precambrian Togo Series comprising mainly Quartzite, Phillites, Phylitones and Quartz Breccias (Amponsah *et al.* 2009, Accra Metropolitan Municipality, Medium Term Development Plan, 2014). The coastline of Accra has a chain of resistant rock outcrops and platforms and sandy beaches near the mouth of the lagoons. It is further exposed to strong coastal wind action and as a result subject to severe erosion. The lagoon systems are fairly small and flushing has been obstructed by siltation and the construction of embankments which as a result has restricted tidal flows.

Plan 3.2: Geology within the Accra Region (Amponsah *et al.*, 2009)

Along the central part (Kpone-Katamanso District) and the south western areas of the GAR are the Precambrian rocks of the Dahomeyan formation: metamorphic rocks mainly consisting of granite, gneiss and schist have been probably derived from sedimentary layers (Kpone-Katamanso District Assembly, Medium Term Development Plan, 2014). These rocky formations are weathered or decomposed at the surface with a thickness not exceeding 12 m in the area. Most of the communities in these areas have taken advantage of this and are engaged in stone quarry as a form of employment. Geological resources such as salt deposits exist at Kpoi-Ete.

A large portion of the east of Greater Accra (Ada West District) is underlain by tertiary and recent alluvial deposits. Areas within the east of Greater Accra also fall under the Dahomeyan complex rocks of Precambrian age. The recent unconsolidated sand, clay and gravel occur in the deltaic areas surrounding the Songhor Lagoon. The rock of the basement is unknown, but it is expected to be Dahomeyan, similar to that cropping to the north of the basin (Ada West District Assembly, Medium Term Development Plan, 2014).

The North Eastern parts of the Greater Accra Region are underline by igneous rock types as well as metamorphic rock structures moving towards the west of the region. Some areas contain the accumulation of oyster shell deposits as well as clay-like soil (Ghana Shared Growth and Development Agenda, 2010-2013; Medium Development Plans for each district, 2014-2017).

3.4.2 Fault Lines

Although Ghana is situated a considerable distance away from key earthquake zones, it is susceptible to earthquake disasters. Three major seismic activities occurred in 1862, 1906 and 1939. The effects of these earthquakes were felt in the Great Accra Region (Amponsah, 2004). The variation of rock types, depths and weathering of rocks determine the level of seismic risk within the Greater Accra Region. Fairly industrialised and densely populated, the area is a high risk to the impacts related to seismic activity and natural disasters (Amponsah *et al.*, 2009). Potential impacts include destruction of buildings and damage to property and lives, as the design of the buildings are not retrofitted to withstand shocks and tremors. The fault lines situated within the GAR are depicted in the plan that follows.

Plan 3.3: GAR Fault Lines (Amponsah *et al.*, 2009)

3.4.3 Soils

Soil characteristics in Ghana are influenced by the local climate and vegetation (Environmental Protection Agency, 2011a). The major soil groups which occur in various agro-ecological zones include the following, refer to **Plan 3.4**:

- High Rainforest – Acrisols, Nitisols, Gleysols;
- Semi-deciduous Forest – Acrisols, Nitisols and Gleysols;

-
- Forest Savanna Transition – Lixisols, Nitisols, Plinthosols and Cambisols;
 - Guinea Savanna – Lixisols, Acrisols, Luvisols and Gleysols;
 - Sudan Savanna – Lixisols, Acrisols, Luvisols and Lithosols;
 - Coastal Savanna – Acrisols, Luvisols, Cambisols, Gleysols, Solonetz and integrades; and
 - Alluvial soils (Fluvisols) and eroded and shallow soils (Leptosols) are found in all the agro-ecological zones.

Plan 3.4: GAR Basic Soil Types (Environmental Protection Agency, 2011a)

Majority of the soils are formed thoroughly on weathered parent materials. Soils are generally old and low in organic matter due to being leached over a long period of time. The common deficient nutrients are nitrogen and phosphorous, in particular savannah soils where the organic matter is constrained further by regular burning of crops, as well as the competitive use of residues for fuel, animal feed, and building purposes. Therefore, the soils within the savannah and in particular the GAR have an inherently low fertility, making agriculture difficult. Consequently, areas (as discussed in the proceeding sections) with high suitability for agriculture are very important (Environmental Protection Agency, 2011a).

Furthermore, some soils situated within the Coastal Savannah zones, such as Greater Accra, contain swelling clays that are considered as poor draining (Environmental Protection Agency, 2011a). These soils further vex the current flooding problem within the region. The GAR soils can be characterised according to the following areas:

- The soils ranging from the North East, Central to the Southern region of the GAR are predominantly Black clay which is also known as Akuse. These clayey soils are elastic in nature when wet, while hard in texture when dry. The nature of this soil makes it difficult for subsistence cropping as the soil is low in nutrients. Limited areas of grasslands exist in this area, allowing for the practice of cattle grazing (Ghana Shared Growth and Development Agenda, 2010-2013; Medium Term Development Plans for all Districts of the Greater Accra Region 2014-2017).
- Soils found in the Eastern parts of the GAR, are a mix between sandy clay loams which are red to brown in colour. These types of soil are suitable for farming tropical crops (Ghana Shared Growth and Development Agenda, 2010-2013; Medium Term Development Plans for all Districts of the Greater Accra Region 2014-2017).
- The Western parts of the GAR contain savannah-like vegetation and soils that are pale and yellow in colour. The soils are sandy in some areas with quartzite and are rich in limestone and sandstone which are favourable to construction. Soil types found in the South Western parts of the Greater Accra region are sandy, clayey and rocky in some areas. On the one hand the sandy soil is healthy and nutrient rich, making it suitable for crop farming, while, on the other hand, the clayey rocky soils are suitable for construction, quarrying and sand winning activities (Ghana Shared Growth and Development Agenda, 2010-2013; Medium Term Development Plans for all Districts of the Greater Accra Region 2014-2017).

3.5 Climate and Climate Change

The overall climate experienced in Ghana is monsoon type (Environmental Protection Agency, 2002), which is tropical and influenced strongly by the West African Monsoon Winds (Amlalo and Oppong-Boadi 2015). The general climatic conditions are typically warm with temperature variability occurring during different seasons (Amlalo and Oppong-Boadi 2015). Ghana comprises of three main types of climatic zones, namely the southern savannah climatic belt, tropical forest and Accra plains. Of particular importance is the Accra plain which is situated along the coast of the south of Ghana. The climate in the Accra plains is very similar to that of the North because the area around Accra is also part of the savannah climate and lies in the coastal savannah zone. The Accra plain is an area in Ghana with less annual precipitation than the other climatic zones.

Humidity is made up by two different winds as shown in the following figure. These winds make up the relative humidity which is much higher in the south as compared to the northern areas. Although the seasons vary between the different climatic zones and are influenced by winds, the average annual temperature is the same throughout the country which is between 26°C and 30°C (Environmental Protection Agency, 2011b), with the average in GAR being 26.3°C.. The hottest months in the GAR are February and March, with the coolest being July or August alongside the coast (Ghana Meteorological Agency, 2016).

Ghana's rainfall seasons are mostly influenced by the movement of the tropical rain belt (known as the Inter-Tropical Convergence Zone, ITCZ), which blows back and forth between the northern and southern tropics each year. As a result it creates two rainfall seasons wherein the region receives most of its rain from April to June with the secondary season during September and October (WMO, 2017), receiving between 713-1184mm rainfall per annum across the various parts of the region (Ghana hydro-database, 2014; Climate-data.org, 2012). As a result it creates two rainfall seasons. As the ITCZ moves north and south over the year, the zones between the northern and the southern-most positions of the ITCZ experience a shift between the two opposing prevailing wind directions. This pattern is known as the West African Monsoon (Nkrumah et al., 2014),

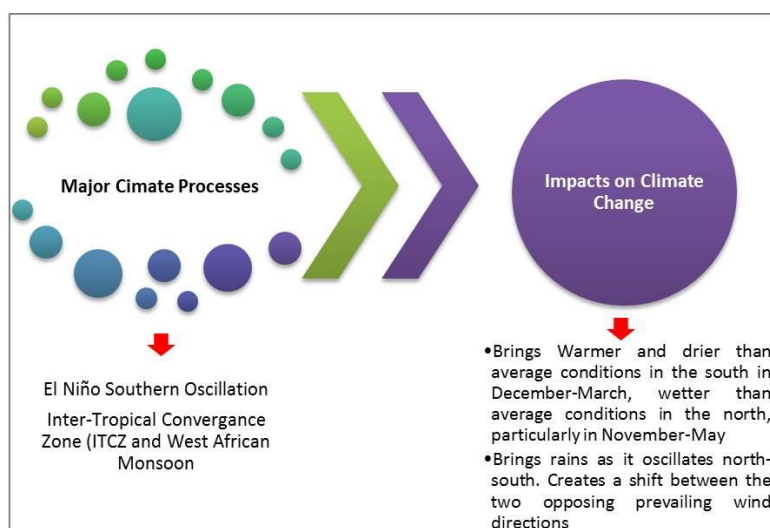


Figure 3.1: Major Climate Processes in Ghana and Impacts on Climate Change (GFDRR, 2011)

and the cause of these variations is due to the El Niño Southern Oscillation (ENSO). El Niño events are associated with drier than average conditions in West Africa (GFDRR, 2011). The

major climatic processes experienced by the region as well as its impact on climate change are shown in the accompanying figure.

3.5.1 Climate Change Policy in Ghana

The National Climate Change Policy (NCCP) lists critical climate change issues to be addressed in Ghana. Spatial planning, such as the RSDF, could facilitate the processes of addressing some of these issues through the environmental constraints assessment done for the RSDF. The constraints assessment cover issues highlighted in the NCCP, including: “develop climate-resilient agriculture and food security systems... increase carbon sinks; improve management and resilience of terrestrial, aquatic and marine ecosystems... and minimise impacts on access to water...” (National Climate Change Policy, 2013; as quoted by Town and Country Planning Department, 2015). In support of these critical climate change issues and objectives, protection of key agricultural areas and natural environments (to support access to water, to protect existing carbon sinks, and protect ecosystems) are included in the development of the environmental constraints (see **Section 3.11 Environmental Constraints**) for the GAR SDF.

3.5.2 Major Climate Change Vulnerabilities

GAR is vulnerable to climatic changes (as shown in **Plan 3.5**): experiencing the negative impacts of climate change which directly effects ecology, the economy and society. Climate change is further influenced by the types of economic sectors, the geographical spread of ecological zones and increasing poverty levels which undermine people’s ability to adapt and cope. The adjoining figure indicates areas where erosion hazards exist; pointing out that GAR is within the slight to moderate, and moderate to severe areas.

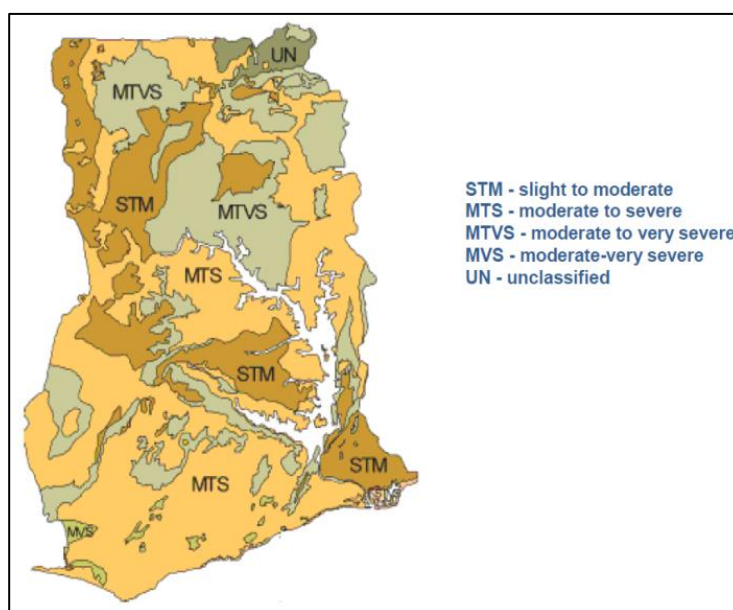


Figure 3.2: Erosion Hazards (NSDF Study, 2013; as quoted by Town and Country Planning Dept, 2015)

Plan 3.5: GAR Climate Change Vulnerabilities (Amlalo and Oppong-Boadi, 2015)

3.5.3 Climate Projections

(a) Historical Weather and Climate

- Observations indicate that average annual temperatures have risen 1.0°C since 1960, an average rate of 0.21°C per decade.
- Overall precipitation in Ghana decreased by 2.4% per decade between 1960-2006.
- Ghana experiences periodic extreme events such as rainstorms, floods, and droughts.
- Sea level has risen 2.1mm per year at the Port of Takoradi over the last 30 years.

(b) Future Climate Projections

- Average annual temperatures are predicted to increase by 1.0-3.0°C, from the 1970-99 average, by the 2060s.
- Projected changes in annual precipitation for the 2030s, range from a decrease of 9% to an increase of 8%, from the 1970-99 average.
- Rainfall is expected to exhibit greater variability, and a larger percentage of precipitation is anticipated to fall during heavy rainfall events.
- Droughts are anticipated to become more frequent and intense.
- Sea level may rise by 75-190 mm by 2100 for the coast of Ghana.

(Source: USAID, 2012)

(c) Climate Change Impacts for the Greater Accra Region

The GAR will be exposed to the impacts of increased climate change in the future. The coast along the Gulf of Guinea is already battered by strong Atlantic currents. The sea-level is expected to rise further by the year 2100, affecting low-lying coastal communities, particularly those that make a living off fishing. The mean temperature is also forecast to increase by 3.9°C by 2080. This presents increased drought risk across the country, potentially triggering secondary impacts such as migration threats into urban areas as well as further shortages in energy supplies.

3.5.4 Sea-Level Rise in the Greater Accra Region

The impact of sea-level rise is one of the greatest threats to the decline of Ghana's shorelines, particular to sandy shores, inundating low-lying coastal habitats contributes to increasing salt water intrusion into estuaries and aquifers (GFDRR, 2011). Internationally, flooding caused by sea level rise is exacerbated by the phenomenon of the sinking of large urban areas (due to the effects of soil compacting, ground water extraction); however, the extent to which this is occurring in Ghana, has not been documented (Town and Country Planning Department, 2015).

Physical changes to the coastline could have major socio-economic implications as it could lead to destruction of coastal habitats, which has biodiversity impacts, and livelihood impacts

on areas that are inhabited by fisherman and those areas on which farmers depend for their livelihood (GFDRR, 2011).

The coast of the GAR is at risk from sea level rise. According to Addy and Addo (2013), the shoreline for the Greater Accra Region would retreat approximately 90m and 109m respectively by the year 2100 according to climate scenarios. The GAR coast is at increasing risk and may experience significant damage due to anticipated extreme events due to the effects of global warming. Storm surges, erosion and inundation may disturb the coastal ecosystems such as the lagoons, mangroves and fisheries (Addy and Addo, 2013).

According to Addy and Addo (2013) the coast of the GAR will further encounter sand loss of about 12m to 109m inland with sea-level rise predicted to be about 5cm-42cm confirming the fact that sand loss will occur.

Approximately 13m of beach width will be lost to a sea level rise of 5cm and 10m by the year 2020. Accra coast is at an increasing risk and may experience significant damage due to anticipated extreme events from global warming. Storm surges, erosion and inundation may disturb the coastal ecosystem such as lagoons, mangroves and fisheries (Addy and Addo, 2013).

A study described in the NSDF, predicts loss of coastline and land (200m or 800m respectively) by 2100; which could impact 650 000 people and 900 buildings along the coast (Impacts of Coastal Inundation Due to Climate Change in a Cluster of Urban Coastal Communities in Ghana, West Africa, 2011; as quoted by Town and Country Planning Department, 2015).

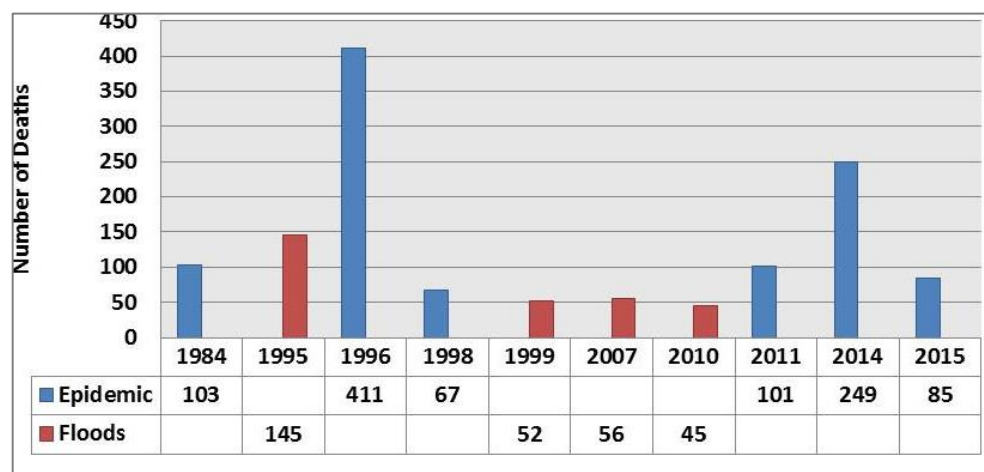
Accommodation facilities, food services and tourist attractions, which included beaches, lagoons and monuments along the coast of the Greater Accra Region, could be impacted by SLR and coastal erosion (ARUP, 2016).

3.5.5 Natural Disasters

(a) Context of Ghana

In the past five (5) years and more, Ghana has experienced several forms of natural disasters and hazards which range from droughts in 2006 to floods in 2007 and 2012. Disasters present serious challenges and setbacks to the development of the country. The major disasters include floods and epidemics (disease outbreaks, bacteria, pathogens etc.). This is shown over a period of nearly 20 years in the graph below.

Graph 3.1: Count of Natural Disasters in Ghana



Source: Emergency Events Database (EMDAT), 2016

(b) Greater Accra Region

Flooding is not a new phenomenon in the Greater Accra Region. A historical factor of flooding in the city was the relocation of the capital city of Ghana from Cape Coast to Accra. The relocation was combined with increase in trade, economic activities and migration inflows from other regions into Accra. Although the Town and Country Planning Department was charged with the responsibility of developing basic drainage and other infrastructure prior to residential building, many areas still lacked adequate drainage systems owing to the fact that lands were vested in the hands of clans or head of families (Odoi Danquah, 2013).

During June 2015, torrential rains started and continued well until the next day impacting many parts of the GAR (International Federation of Red Cross and Red Crescent Societies, 2015). The floods resulted in the displacement of community populations, loss of over 200 lives and loss of property and livelihoods (International Federation of Red Cross and Red Crescent Societies, 2015).

The GAR in particular has perennial flooding though rainfall is also a contributing factor towards flooding. In addition, other attributing factors include the following (Okyere *et al.*, 2012) and are illustrated in the figure below:

- Increasing flow of water;
- Poor drainage infrastructure; and
- Poor land use management.

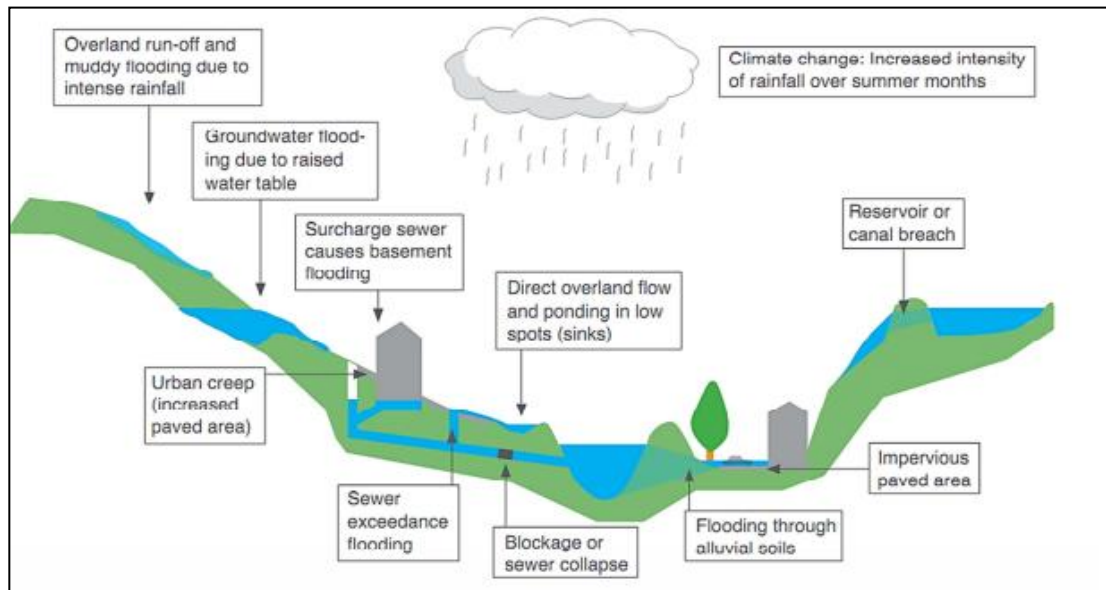


Figure 3.3: Flood Issues in Accra (Asumadu-Sarkodie et al., 2015)

The impact of these floods on the GAR include destruction of homes, impact on agricultural and non-agricultural land, livestock and impact on human life. Furthermore, the floods result in secondary disasters such as water borne and water related diseases.

Hydrological factors may also be linked to recurrent floods in the GAR which is also linked to social, political and economic issues (Okyere *et al.*, 2012).

Flood exposure in the region may also be attributed to the topography of the region. The topography determines the direction of infiltration and excess overland flow, and this informs the exposure to flash floods (Okyere *et al.*, 2012).

Areas like Weija, Accra Circle, New Town, Zongo Junction, Asylum Down, Christian Village, Adabraka, Nungua and Otenibi were the areas that experienced the highest floods. Downstream towns to the Weija Lake were also impacted by high floods (Odoi Danquah, 2013). Areas like Adenta, Kaneshie, Kwabenya and Osu were impacted with medium floods due to the landscape of such areas. Areas falling within elevation height of 10-30m like Achimota, Prekuso, Kissiman and most of the Tema communities experienced low floods. Areas with elevation height of 0-10m are characterized as the lowest flood impact regions as depicted in the vulnerability map above (Odoi Danquah, 2013).

To address flooding's impacts, vulnerability of residents should be reduced, which is called for by the key natural disasters, risks and vulnerability policy (as is indicated in the GSGSA 2014-2017 and referred to by the NSDF) (Town and Country Planning Department, 2015). Therefore, flood prone areas are included in the development of the environmental constraints (see **Section 3.11 Environmental Constraints**) for the GAR SDF.

3.6 Biodiversity

3.6.1 Overview of Biodiversity in Ghana

This section briefly describes biodiversity within the context of Ghana followed by a detailed overview of biodiversity within the GAR. There is limited data on biodiversity for the GAR and most data is represented according to the Wildlife-Protected Areas (WPAs).

Under the Forestry Commission of Ghana, the Wildlife Division is responsible for 16 WPAs, five (5) coastal Ramsar Sites, the Accra Zoo and Kumasi Zoo, as well as the management of two (2) community owned wildlife

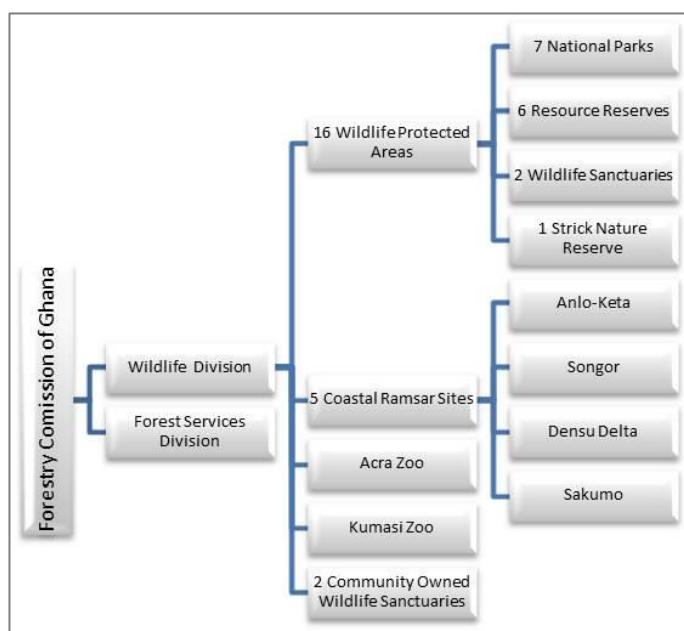


Figure 3.4: National Parks managed by the Forestry Commission of Ghana

sanctuaries (The Forestry Commission of Ghana, 2016). The 16 WPAs are grouped into seven (7) National Parks, six (6) Resource Reserves, two (2) Wildlife Sanctuaries and one (1) Strict Nature Reserve (See accompanying figure).

Ghana's biodiversity is very rich consisting of tropical high forests and savannahs. In total, there are 3 600 species of flora, 221 species of amphibians and reptiles, 728 bird species and 225 mammalian species. Communities surrounding biodiversity rich areas generally rely on the area as a source of wood and food, as well as being a source of economic and social value. Ghana's biodiversity areas also hold religious, cultural, aesthetic, recreational and environmental importance. Ghana has a strong economy due to its natural resources; however exploitation of these resources is high. Forests were reduced by 90 % between 1990 and 2005. Declines in biodiversity have also been reported in reserve and off-reserve areas.

Programmes such as the Man and the Biosphere (MAB) were introduced and aimed to bridge the gap between biodiversity and man (Environmental Protection Agency, 2016). Core aspects of MAB include reducing biodiversity loss, improving livelihoods and enhancing social, economic and cultural conditions for environmental sustainability. This programme has been implemented through the Environmental Protection Agency (Ghana) such that biodiversity should support the relationship between human and biodiversity and vice versa. The principles of MAB are also supported through policy objectives highlighted in the Ghana Forest and Wildlife Policy. This policy indicates that natural resources and land should be sustainably managed, which is sought to be achieved through wetland management being "mainstreamed" in the country's national land use policy. However, even though these policies are in place unsustainable use of natural resources continues (Ministry of Lands and Natural Resources, 2012:20).

3.6.2 Overview of Biodiversity in Greater Accra

None of the National Parks managed by the Wildlife Division falls within the GAR. There are however, 21 WPAs in Ghana totalling about 1, 347, 600 ha (5.6 %) of the country (UICN/PACO, 2010). UICN/PACO (2010) also includes the 5 coastal wetlands as a WPA. WPAs and Ramsar Sites contained within the GAR consist of Shai Hills Resource Reserve, Achimota National Forest, a Thicket Reserve, 3 Forest Reserves, Songor Lagoon Protected Area, Sakumo Lagoon Protected Area and the Densu Delta Protected Area. Refer to **Plan 3.6** on the following page.

Plan 3.6: Protected Areas in GAR

Of ecological importance, GAR largely comprises coastal scrubs, grassland and mangrove swamp, as well as small portions of guinea savannah and moist semi-deciduous forest (Refer to **Plan 3.7**).

Plan 3.7: Vegetation in GAR

Source: Environmental Protection Agency, 2011a

The Coastal savannah zone, which covers the majority of the GAR, mainly consists of grassland interspersed with dense short thickets with a few trees, such as *Antiaris africana*, *Ceiba pentandra*, *Albizia zygia* and *Azadirachta indica*. Short and medium grasses are the dominant plant species. These include *Andropogon gayanus*, *Hypertheria dissolute* in upland areas and *Vetiveria zizanioides*, *Brachiaria rufipennis* in low lying areas. *Panicum maximum* often occurs in the moist areas. The coastal thickets comprise small trees and shrubs dominated by *Baphia nitida* and *Griffonia simplicifolia*. Isolated trees found in the forest areas include *Albizia zygia*, *Ceiba pentandra* and *Antiaris Africana* (Environmental Protection Agency, 2011a).

The entire area is a rich platform for human communities as it serves host to a wide variety of plant, fish, bird and animal species. Although, vegetation is widespread across the Greater Accra, areas of high importance are discussed below. These include Shai Hills, Songor Lagoon, Sakumo Lagoon and Densu Delta, which are critical protected areas.

(a) **Wildlife Protected Area: Shai Hills Resource Reserve**

Shai Hills Resource Reserve was initially a forest reserve comprising of an area of 46.7 km and was later declared a game production reserve, with an extended area totalling 51 km. Shai Hills Resource Reserve is Ghana's smallest WPAs and is Greater Accra's only WPA. Located in the Dangme West District, Shai Hills is bordered by the Tema Jasikan road. Although the reserve was fenced up, the fence is in disrepair and cattle grazing persist to be problematic (UICN/PACO, 2010). It is important to note that Shai Hills is also home to the Shai people and though it is considered to be a protected area, the MAB relationship needs to be acknowledged. Shai Hills is noted in the NSDF as a reserve that could be utilised better in respect of educational and recreational activities (Town and Country Planning Department, 2015).

Shai Hills Resource Reserve is located in the Accra Plains where there is primarily low rainfall; and the rainforest belt is replaced by savannah vegetation types. Shai Hills also consists of a series of mountains that have been worn away, where the highest peak is 290 m. These hills are mostly covered by forest thickets and grasslands and surrounded by savannah-covered plains. Contained within the reserve are 397 plant species, including two endemic species (UICN/PACO, 2010). Refer to the accompanying figure.

Large mammals common to Shai Hills include olive baboons, kob, green monkey, spot-nose monkey and bushbuck. Also present are demidoff's galago, with possibilities of rock hyrax. Other smaller species include grascutters, crested porcupines, hedgehogs, togo hares, Oribi and slender tailed mongoose (UICN/PACO, 2010).

Shai Hills Resource Reserve does not consist of any permanent rivers or streams, however, is comprised of Adwuku dam. Introduced to Adwuku dam in 2005 were crocodiles and terrapins. Predators present in Shai Hills are spotted hyenas, leopards, civets, genets, servals and side-striped jackals (UICN/PACO, 2010).

Ghana is reported to have 681 bird species (Birdlife International, 2016), with at least 173 species documented to have been seen in Shai Hills. Barred owlet, rosy bee-eater, puvell's



Figure 3.5: Types of Vegetation in Shai Hills Resource Reserve (UICN/PACO, 2010)

illadopsis, stone partridge, cliff chat, rock-loving cisticola and freckled nightjar are some of the interesting species found in Shai Hills (UICN/PACO, 2010).

(b) Ramsar Sites

The Ramsar Sites have been recognised as habitats of ecological importance since it consists of over 80 % of migratory fowl which roost in Ghana. Peak seasons can accommodate over 100, 000 birds (Environmental Protection Agency, 2011a). Overall, these sites hold high international importance because of variety of bird species. All three Ramsar Sites in Greater Accra have coastal wetland vegetation types (UICN/PACO, 2010).

(i) Songor Lagoon Protected Area

Songor Lagoon is comprised of an area of 287.4 km² (Environmental Protection Agency, 2011a). The lagoon is 16 km long and 7 km wide with an average depth of 1.75 m and maximum depth of 4 m. It is also a closed or semi-closed coastal lagoon (Povlsen and Dahl, 2004b). While local communities fish and farm as well as produce salt in the area, the area has high ecological importance.

Vegetation at Songor lagoon consists of *Paspalum vaginatum*, *Cyperus articulatus*, *Sesuvium portulacastrum* and *Eleocharis mutata* at the floodplains; *Andropogon guyanus*, *Heteropogon contortus* and *Azadirachta indica* at the catchment areas. Degraded mangroves can also be found along the creeks (Povlsen and Dahl, 2004b).

Songor lagoon supports high concentrations of seashore birds such as terns, waders, herons and ducks as well as seven species of waders (spotted red-shank, greenshank, ringed plover, curlew sandpiper, little stint, avocet and black-tailed godwit). The area also consists of 32 species of water birds. Migrant birds arrive late August and leave when the lagoon begins to dry up by the end of January. The area has recorded a maximum number of 55 000 birds, which emphasises the outstanding importance of this site (Povlsen and Dahl, 2004b).

(ii) Sakumo Lagoon Protected Area

Sakumo Lagoon is comprised of an area of 13.4 km² (Environmental Protection Agency, 2011a) and is permanently connected to the sea via culverts. The main habitats of this brackish-saline lagoon are open lagoon, surrounding flood-plains, freshwater marsh and coastal savannah grassland. Fishing is Sakumo is the main livelihood, with farming and some industrial activities near Sakumo.

Open lagoons, such as Sakumo are reported to have 14 species of invertebrates (crabs, shrimps and molluscs) and 13 species of fish (brackish water species, freshwater species, marine visitors and juvenile forms). Fish species include lagoon species and freshwater species.

Sakumo is reported to have 25 000-35 000 birds with internationally important populations consisting of 6 wader species (spotted redshank, greenshank, curlew sandpiper, little stint, black-tailed godwit and black winged-stilt) nationally important species of at least 30

waterfowl. Sakumo is also documented to support 90-100 % of the total population of black heron, teal, black-tailed godwit and ruff. Migrant birds in this area are mostly abundant from September to March/April. There are also a variety of migrant birds (Kittlitz's sand plover, pratincole, little tern, pied kingfisher, yellow throated longclaw, plain-backed pipit, fantail warbler and red bishop). The area has recorded a maximum number of 14, 000 birds, which emphasises the outstandingly importance of this site (Povlsen and Dahl, 2004b).

(iii) Densu Delta Protected Area

Densu Delta is comprised of an area of 46.2 km² (Environmental Protection Agency, 2011a). Densu is a critical area of interest as it serves as a drainage area (19 420 km² drainage area). The site is a flood plain consisting of open lagoons, sand dunes, scattered mangrove stands, saltpans, marsh and scrub. Though there is no direct outlet to the sea, the lagoon overflows after heavy rains. Main activities in the area are large scale commercial salt operations and lagoon fisheries (tilapia and lagoon crab). This site is also used by the locals to gather wood as well as for farming practices.

The area has recorded 57 seashore bird species. Of importance is the roseate tern which is threatened species with recordings of 200 roseate terns on the Densu Delta. Other important water birds include waders and herons. The site supports internationally important populations of waders (curlew sandpiper, little stint, spotted redshank and black-winged stilt). Seashore birds are abundant from August to March with recordings of at least 70 species. The area has recorded a maximum number of 30, 000 birds, which emphasises the outstandingly importance of this site (Povlsen and Dahl, 2004b).

3.6.3 Proposed Greenbelt

A greenbelt has been proposed for the GAR, which would serve as an environmental area in which planning, environmental, socio-economic and other relevant issues are addressed for long-term solutions. The greenbelt would also impose a barrier consisting of selected physical features, reinforced by planning controls, to limit the outward sprawl of the Accra-Tema conurbation. Finally, the greenbelt will ensure that land use within the greenbelt is consistent with the maintenance of a predominantly rural landscape, and the conservation of soils, water sources, vegetation and scenic and historical areas. The total area of the proposed green belt is 959.56km². Refer to **Plan 3.8** on the following page.

[Plan 3.8: Proposed Greenbelt](#)

3.6.4 Pressures and Threats

Many Ghanaians depend on the forest for their livelihoods and as a result of forest dependency, there has been land degradation. Deforestation has been identified as a major problem that has led to significant loss of biodiversity (La-Nkwantanang Madina Municipal, 2013). The National Development and Planning Commission and United Nations Development Programme: Ghana (2012) reported a 1.68 % loss of forests per year between

the years 1990 and 2010. As shown in **Plan 3.9**, the degradation of land in the GAR increased from 43.6% in 1991 to 61.9% in 2017.

Plan 3.9: GAR Degraded Areas 1991-2017

Contributing to deforestation is the clearing of indigenous forests for agriculture, logging, and exploitation of wood for energy (firewood). Replenishment by natural vegetation of wood taken for energy supply has been exceeded (Environmental Protection Agency, 2011a; Town and Country Planning Department, 2015), especially considering that 60% of total energy consumption in Ghana is in the form of biomass from fuel wood and charcoal (Environmental Protection Agency, 2011a). Illegal grazing by livestock is documented to affect the overall productivity of reserves such as Shai Hills (IUCN/PAC, 2010). Activities leading to deforestation are documented to drive erosion and drying up of streams due to the removal of riverine vegetation that serve to protect watersheds. Other contributors of deforestation include mining and wildfires. As a result of these contributors there are a number of indigenous trees that are becoming extinct. Moreover, communities based in and around these areas suffer severe consequences, such as poor growth, reduced crop yields and low rural incomes. Building on the MAB concept, are several interlinked areas that significantly contribute to sustainable living in Greater Accra. The WPAs in particular hold economic importance in that sense that they contribute toward the standard of living of communities in and around the area (IUCN/PACO, 2010). The communities are reliant on wood for production and for medicinal plants contained within WPAs. In Ghana, communities are dependent on small-scale logging; however this activity persists as a challenge as some logging activities are conducted illegally. Hunting also presents challenges and is partially controlled through the issuing of licenses. Illegal gathering of wild plants and animals is also present in varying degrees in WPAs. To combat this, there have been community initiatives that have been established to regulate harvesting of non-timber. WPA's outside of Greater Accra have employed the local community to regulate harvesting, whereas Shai Hills does not have such employment strategies.

Forest degradation is intrinsically linked to biodiversity. Loss of biodiversity, however, is also attributed to illegal hunting for food and the use of fauna and flora for medicinal or commercial use nationally, as well as in international trade. The economic value of some plant species in WPAs is quite high and is therefore exploited. In the WPAs, animals such as rattan, elephants and leopard are hunted for craft, tusks and skin, respectively. Poaching, bush fires and farming are highlighted as major threats to WPAs (IUCN/PAC, 2010).

Greater Accra is located along the coast and communities are therefore dependent on natural resources in the area. Natural resources', including mining of salt and sand in areas surrounding WPAs has led to encroachment of Ramsar sites. Mining however is an important industrial activity which provides direct employment for a large number of people. Impacts on coastal ecosystems may however be negative.

Additional to deforestation and loss of biodiversity, alien invasive species such as the Neem tree has spread over the plains in reserves and lower slopes of the hills in Shai Hills Resource

Reserve. It is mainly spread by fruit-eating birds and bats and is known to be an aggressive alien species that is difficult to eradicate. It is also found to displace a large number of native species.

The constraints presented highlight an inherent need to protect biodiversity, not only for environmental conservation but also because man is also highly dependent on natural resources. Preserving and building on the relationship between man and biosphere is key to reducing risks associated to biodiversity. NCCP indicates the requirement to improve carbon sinks (forests and mangroves) and hence highlighted objectives to do so. These are supported by the NSDF (Town and Country Planning Department, 2015) and subsequently, by the RSDF, through including existing forests and mangroves in the environmental constraints plan.

3.7 Hydrology

The hydrological system in Ghana is characterised by the interweaving of rivers, dams, wetlands and lagoons. These water systems form an integral part of Ghana and the Greater Accra Region's livelihoods. Communities and cities have developed around these water systems due to the dependency on these systems for irrigation, sewerage, drinking, and for hydropower generation.

The hydrological systems in the GAR have been affected negatively by development, deforestation, industrial activities, agricultural activities and settlements in the vicinity of these water systems, in the system's catchment areas, or with such activities taking place in the system itself which inadvertently causes water pollution and in turn affects downstream water bodies and coastal areas. . The above threats and pressures clarify the requirement to conserve the wetlands; such conservation is called for by the key wetland and water resource policy (as is indicated in the GSGSA 2014-2017 and referred to by the NSDF) (Town and Country Planning Department, 2015). Therefore, conservation of these areas has been included in the development of the environmental constraints (**see Section 3.11**).

3.7.1 Wetlands and Lagoons

The GAR has various wetlands and three major coastal wetlands situated in the dry equatorial climatic region, which is a low annual rainfall zone. All three coastal wetlands became Ramsar sites in 1992 due to the wetlands functioning in the protection of the shoreline and the Palearctic bird population (Willoughby et al. 2001; as quoted by Kondra, 2016). Wetlands are important natural features for Ghana as they provide habitat for fauna and flora and support various communities who generate a household income from the wetlands (Kondra, 2016).

Wetlands, especially the three major coastal wetlands, are exposed to dense populations and resource exploitation, affecting overall quality and functioning of the wetlands (Kondra, 2016). The table below provides an overview of key characteristics of each of the coastal wetlands that play a significant role in the character of the region and the communities surrounding them.

Table 3.2: GAR Wetlands

Name	Densu	Sakumono	Songor
Location:	11 km south-west of Accra	3 km West of Tema District.	Dangme East District
Wetland Description:	An estuary with open lagoon, salt pans, freshwater marsh, scrub lands, and sand dunes.	A coastal brackish-saline lagoon. Floodplains surround the lagoon, marsh freshwater, and coastal savannah grasslands with thicket vegetation are prevalent. The lagoon has a narrow sand-dune connection to the sea. There is limited ground water in the area due to underlying rock bed and low rainfall in the area.	This site is a closed lagoon which includes islands, beaches, inundated mudflats, and flood plains linked to the Volta River estuary. Saline marshes, degraded mangroves, riverine woodland, waterlogged grassland, thickets of shrubs are some of the main habitats in the site. Degraded coastal savannah are also prevalent but has been impacted by farmland.
Size of the Ramsar catchment area:	5,893 ha	1,364.4 ha	51,133.3 ha
Estimated population dependent on Ramsar Sites:	485,700	141,500	523,180
Type of activity on which residents depend on the Wetland for:	Salt winning, recreation, grazing lands, agriculture, fishing, fuel wood.	Multiple communities utilise the lagoon for fishing as a source of income. This includes artisanal, semi-industrial, and industrial fishing practices.	Fishing, farming and intensive salt mining are activities on which communities' livelihoods depend in this area. The tourism sector is a growing in the area.
Biodiversity:	Multiple fish species.	30 000 water birds (which includes more than 70 species, and including species that are migratory, rare and endangered). The wetland is also has importance because of the marine and freshwater fish species inhabiting the lagoon.	This site crosses the boundary of the Atlantic and Mediterranean flyways of water birds. The site provides roosting grounds for various bird species at an estimated population of 50,000 individual birds. This site is also a reproduction site for fish species. Sandy beaches provides habitat to the green sea turtle, leatherback sea turtle and the olive ridley sea turtle.

Name	Densu	Sakumono	Songor
Pressures:	• Pollution (human and household waste pollution due to a lack of adequate toilets and waste facilities. • Oblogo Landfill site which borders the Densu Delta, where more than 1,000 tonnes of solid waste is discharged daily. • Human settlement development which encroaches on the site (houses are built in the wetland and the salt pans), which causes: - wetland drainage, - overfishing, - deforestation (for fuel wood and fishing materials), - biodiversity loss, - degradation of the ecosystem. • Salt mining in the wetland by the Salt Company, as well as artisanal salt winning leading to salinization of soil. • Reduced water inflow resultant from dam construction on the Densu River. • Cattle breeding. • Fertiliser and pesticide runoff.	• Population growth and urbanization in the area, leading to increase of sewerage and domestic waste in the wetland. • Fish populations are declining (this is assumed to be resultant from over fishing). • Lack of water inflow due to extensive damming. • Pollution from human waste due to a lack of toilet facilities. • Illegal fishing, and over fishing. • Encroachment is taking place around the lagoon however it is not yet affecting the Ramsar delineation zone. • Agriculture is practiced outside the Ramsar delineation zone (in the Ashaiman region), however, pesticides are used extensively, leading to agricultural run-off that could impact the lagoon. • Deforestation. • Urbanization and population growth within the Ramsar site is occurring. • Lack of adequate water inflow due to dams constructed on the two rivers flowing into the Sakumono lagoon. • High salinity levels in the lagoon prevents use of water for	• Coastal erosion and siltation are the main threats to the site • The lagoon floods during the rainy season, causing high salinity levels in the dry season. • Solid waste pollution, exacerbating flooding of the lagoon. • Deforestation of mangrove forests due to land use pressure, increased needs for fuel wood, and salt winning field development.

Name	Densu	Sakumono	Songor
		agricultural purposes. • Cattle breeding (albeit scares).	

Source: Kondra, 2016; Ramsar, 2015a; Ramsar, 2015c; Adank *et al.*, 2011; Town and Country Planning Department, 2015.

3.7.2 Rivers

The main rivers flowing through the GAR are the Densu and the Volta Rivers, the latter with an estuarine at Ada in Ada East District. Smaller seasonal streams leading through various lagoons and into the sea originate from the Akwapim Ridge (Ghana Statistical Service, 2013) as illustrated in **Plan 3.10** on the following page.

Plan 3.10: GAR Hydrology

UNEP (2011) indicated that the freshwaters system water quality is generally adequate for multipurpose use. This includes the Volta River, South Western River, and the coastal river system. However, Adank (*et al.*, 2011) quotes the World Health Organisation which indicates that the quality of water in GAMA's rivers and lagoons is below WHO and Ghana EPA standards; and specific water bodies noted in which this is the case, are listed as the Odaw and the Korle lagoon (Adank *et al.* 2011).

The Densu River drains into the Densu Delta (one of the most important wetlands in Accra), therefore protection of the catchment area is vital (Kondra, 2016). The Densu River however in close vicinity to a landfill from which pollutant leakage enters into the river and wetland (Nyame *et al.* 2012; Essumang *et al.* 2009; Tuani 2008, as quoted by Kondra, 2016), leading to algal blooms Osei *et al.* 2011 as quoted by Kondra, 2016); which is a cause of concern since many communities depend on the river for domestic water use (Oteng-Yeboah 1999 , as quoted by Kondra, 2016). The Weija dam controls water levels in the Densu river, however it is blocked by sediments which leads to interrupted water inflow during the dry season and severe flooding occurs during the rainy season (Appeaning Addo *et al.* 2008, as quoted by Kondra, 2016); occasionally the Weija dam is opened as a measure to relieve pressure and this causes flooding of agricultural activities practiced in valleys and coastal wetlands (Choudhary and D'Alessandro, 2015). Suspended sediments from the dam contributes to erosion of Accra's shoreline (Oteng-Yeboah 1999, as quoted by Kondra, 2016).

The Sakumono wetland is supplied with water by the Dzorwulu and the Mamahuma rivers. River flow is affected by dams that have been constructed on these rivers. Water is extracted from rivers for irrigation and livestock husbandry whilst the water is heavily polluted by domestic waste disposal (Nartey *et al.* 2011; Tay *et al.* 2009, as quoted by Kondra, 2016).

The Keta and Songor Lagoons' inflow is the Volta River, and the river is regulated by the Akosombo dam. Sediment discharges from the river leads to sediment supply on beaches

and on the littoral strip of the Keta lagoon. These areas are prone to floods due to its low-lying sea front (Boateng 2009, as quoted by Kondra, 2016).

General pressures affecting the rivers are the dams that should regulate river flow. Sedimentation in the dams has affected their functionality and has led to floods in rainy seasons and too little outflow in dry seasons. As with wetlands, pollution in rivers is caused by a lack of sewerage systems and waste management in the region.

3.7.3 Floodplains

Accra has been exposed to floods over a number of years, resulting from uncontrolled urbanisation and settlement patterns in areas that are prone to flooding. Flooding occurs for three main reasons, which have been grouped as: (1) drainage constraints (a lack of drainage systems, clogged drains and overflow of lagoons and rivers; (2) low-lying areas; (3) and wetland and swamp areas. These are indicated in **Plan 3.11** on the following page. It has been indicated that 90% of communities occupying flood prone areas reside in informal settlements (Amoako, and Frimpong Boamah, 2014).

Plan 3.11: Flood prone areas and types of floods in Greater Accra Plains

Source: Kagblor, 2010; as quoted by Amoako, and Frimpong Boamah, 2014

3.7.4 Groundwater

(a) Recharge of Groundwater Resources

Geological formations of the GAR are indicated in **Section 3.4 Geology and Soils**, these rock formations described in the aforementioned section influence the depth of the water table in the GAR, which could be found between 4.8 and 70m deep (Nyarko, 2002; as quoted by Adank *et al.* 2011). Direct infiltration (precipitation) is the main source of aquifer system recharge in Ghana whereas ephemeral streams, pools and runoff water accumulating in rainy seasons are sources of indirect recharge of aquifers (Obuobie *et al.* 2016). The total recharge of groundwater resources within Accra is 0.038km³/year (Adank *et al.* 2011; Obuobie *et al.* 2016); which is conservatively estimated at 4% (30mm) of the annual rainfall if 756mm.

(b) Availability of Groundwater Resources

In the GAR, with recharge rates as defined above, the volume of groundwater that could be extracted without deflating groundwater resources could be quantified as 93.6m³ per day (this is based on mean borehole yield of 3.9m³/hour x 1116 boreholes). It has been identified that the applicability of using groundwater as a supplementary source to the GWCL supply has been investigated (Lievers and Barendregt, 2009; as quoted by Adank *et al.* 2011). Details of water supply are provided in **Section 4.1.2 Sources of Water** and **Section 4.1.9 Status of Water Infrastructure and Services in the Various Assemblies**.

(c) Groundwater Uses

Ground water in Ghana is used:

- To supplement domestic water supply;
- For agricultural purposes (irrigation and water for livestock); and
- In industries (especially in the bottled water industry) (Obuobie & Barry 2012).

Section 4.1.9 Status of Water Infrastructure and Services in the Various Assemblies provides additional information on ground water uses an indication of the usage of borehole water by district populations.

(d) Quality of groundwater

Water types present in the region are $MgCl_2$, $CaCl_2$ and $NaCl$ waters, the latter being the dominant water type present, and the first two are the minority types present. The quality of groundwater in the GAR are stated to be too saline, which renders groundwater not usable for consumption, especially along the coastal areas (Adank *et al.* 2011); whereas factors influencing water quality are noted as weathering of bedrock, human activities and sea water intrusion (Obuobie *et al.* 2016). Soil types present in the area are one of the contributing factors to groundwater salinity, which decreases northwards from the coast. “Halite dissolution from the soil zone as a result of aerosol deposition seems to be the main cause of groundwater salinity, according to Kortatsi and Jørgensen” (2001 as quoted by Adank *et al.*, 2011:16).

Another factor influencing ground water quality is waste water disposal in the GAR which occurs directly into open environments, open storm drains or soak-away drains, and into streets, which seeps into groundwater resources. Adank *et al.* (2011) quotes the 2000 census, which states: “people in GAMA mainly disposed of their liquid waste by throwing it in gutters and storm drains (41.1%), on the ground within the compound (24.8 %) or into the street (18.3%) (GSS, 2002)”.

(e) Threats and Pressures to Ground Water Resources

The following list provides a summary of the key threats and pressures to ground water resources:

- Direct disposal or discharge of waste water into the environment;
- Salinity of water, caused by soil types and sea water intrusion;
- Contamination through agricultural activities (such as pesticide and fertiliser usage);

3.8 Coastal Areas

The Ghana coastal zone only covers 6.5% of the total land surface (UNEP, 2011), but homes approximately 25% of the total population (World Bank, 1998). The Ghana coastal zone contains a variety of habitats and resources, such as mangroves, rocky shores, sandy

beaches, deltas, estuaries and coastal wetlands, coral reefs and lagoons. Subsequently, the coastal zone, through the presence of these coastal habitats and ecosystems, provide a significant contribution to the livelihoods of coastal communities and to the national economy. The provisions comprise of fishing, agricultural activities, tourism, oil and mineral mining and infrastructure development. However, the coastal zone also provides an intrinsic value including shoreline stability, beach enrichment, nutrient generation, recycling and moderation of pollution (Ministry of Environment Science and Technology, 2012).

The coastal fisheries that exist in Ghana is considered as the fourth most productive of the 36 countries in the Atlantic and is also considered as the major primary activity of the coastal zone as it contributes about 3% to the GDP (UNEP, 2011). The main types of fishing within the industry in Ghana are categorized as artisanal, inshore, industrial and tuna fishing, with artisanal fishing dominating the industry. This type of fishing provides about 70% of the total marine production in Ghana and is generally a year-round activity. Artisanal fisheries in the coastal zone of Ghana rely on fish from both the inshore and offshore marine environment. Coastal lagoons and estuaries (as discussed in section 3.5) are also very important sources of fish and shell-fish, even though these operations are fairly small; they provide substantial quantities of fish products for subsistence purposes (Povlsen and Dahl, 2004a).

The habitats and features that occur along the coastal zone, such as beaches, cliffs, lagoons, wildlife, cultural and historical sites and coastal landscape provide significant opportunities for developments in tourism and recreation (UNEP, 2011). The coastal zone has been noted for providing suitable habitat for thousands of migratory birds, various fish species (UNEP, 2011) and the waters offshore is thought to be a significant migration and calving habitat for whales, marine turtles and other marine mammals (Arcon, 2015).

The coastal zone within the GAR is dominated by rocky shores, which is located between Axim and Prampram and occurs as rocky out-croppings alternating with sandy bays, while sandy shores can be found between Prampram and Aflao. The Greater Accra coastal zone contains many estuaries, lagoons and coastal wetlands (as described in previous sections). These areas provide habitats for a wide variety of fauna and flora (Povlsen and Dahl, 2004a) and are significantly utilised for fishing.

3.8.1 Threats and Pressures

As a result of the increasing pressure on the coastal zone from threats such as conflict over land, water and resource utilization constraints aggravating social and sanitation issues as well as climate change impacts, there has been notable depletion of resources and an increase in coastal erosion (UNEP, 2011). Furthermore, the habitats within the coastal zone have been polluted as a result of poor waste management and discharges from both industrial and agricultural sectors (Ministry of Environment Science and Technology, 2012). As mentioned, there are three major sources of pollution in the coastal area, which are (Povlsen and Dahl, 2004a):

- Municipal waste: Municipal waste including sewage, faecal waste and household garbage;

-
- Industrial waste: The main producers of industrial wastes are textile, food, petroleum refineries and processing industries; and
 - Agriculture: Agricultural sources include pesticides and fertilizers, which reach the coastal zone as land run-off and river discharge.

Pollution and depletion of resources will have a major affect through the degradation of fisheries and especially the artisanal fisheries. The degradation of these fisheries may result in the loss of species as well as declines in sustainable harvesting, which would be a major concern for the livelihoods of communities living within the coastal areas (Povlsen and Dahl, 2004a).

In addition to pollution and loss of resources, coastal erosion that occurs both naturally and as a results of human influences along the coastline presents a threat to the natural and man-made environment. The degree and rate of erosion is dependent on the location and geology of the area concerned, however the average annual rate at which land in the coastal zone is being lost to the sea in some areas exceeds 1.5 m per annum. The causes of erosion in Ghana are due to sand and pebble winning, hydrographic conditions and the disappearance hydraulic groins at the mouths of fast flowing rivers due to dams constructed on them (Povlsen and Dahl, 2004a). Furthermore, climate change (as discussed in section 3.4) will also have a significant role to play to coastal erosion. The well-known areas under serious erosion threats in the GAR are (Povlsen and Dahl, 2004a):

The above threats and pressures clarify the requirement to conserve the coastal forests and wetlands in the GAR; and such conservation is called for by the marine and coastal zone policy (as is indicated in the GSGSA 2014-2017 and referred to by the NSDF) (Town and Country Planning Department, 2015). Therefore conservation of these areas has been included in the development of the environmental constraints (**see Section 3.11**) for the GAR SDF.

3.9 Agriculture and Fishing

3.9.1 Agriculture

Agriculture is an important sector in Ghana due to the vast contribution this sector makes to the country's Gross Domestic Product and the number of people dependent on this sector for livelihood and income. The GAR has lower importance for agriculture than the rest of Ghana, however 10% of the population in Greater Accra is actively involved in agriculture (Choudhary and D'Alessandro, 2015). Cropland consitutues 337km² of the land cover in the GAR where three (cassava, maize, rice) of the eleven major crop types are produced, whilst all other regions in Ghana produce at least seven of the eleven major crop types). This is 1% of the national area under crops, and 9% of the GAR's land cover (Town and Country Planning Department, 2015). The region falls within one of the six agro-ecological zones in Ghana, namely the coastal savannah, which has low rainfall and is an area that is prone to drought. Agriculture along the coastline is limited further as a result of shallow layers of top soil and

low organic content in the soil (Ministry of Local Government and Rural Development, 2016; Ghana Statistical Service, 2013).

The agricultural activities predominantly practiced in the region include livestock and poultry, fishing, maize, cassava, vegetables and fruit crops (Ministry of Food & Agriculture, 2016; Choudhary and D'Alessandro, 2015). Quite importantly, apart from providing income to farmers, urban agriculture in the GAMA contributes to the vegetated areas (which is the source and supply chain of fresh food), esthetical value and ground water recharge as well as reduced stormwater run-off (Adank *et al.*, 2011).

A series of maps produced indicate suitable agricultural zones (**Plan 3.12**) and suitable pastures (**Plan 3.13**) in the GAR. As shown in the plans on the following pages, there are limited areas that are considered as being highly suitable for both crop and livestock grazing, subsequently making these areas extremely important in terms of subsistence farming for local communities.

Plan 3.12: Suitable Agricultural Zones

Plan 3.13: Suitable Pastures

(a) Threats and Pressures

Greater Accra's agricultural sector is on average more exposed to risks than the rest of Ghana's agricultural sector. For example, seven extreme weather events were experienced over a 30 year period (measured up until 2010); these events include severe drought, excessive rainfall, flooding, and common pests and diseases. Further shocks to the sector include 14 "crop loss events impacting key crops maize (5), rice (5), and cassava (4)" (Choudhary and D'Alessandro, 2015:64). This does however not have significant impacts on the greater agricultural sector's production rates for the rest of Ghana. A World Bank report by Choudhary and D'Alessandro (2015) indicates the risks and the level of vulnerability of these risks that the GAR's agricultural sector faces. These are ranked in the table below.

Table 3.3: GAR Agricultural Risk and Vulnerability

	Risks	Vulnerability
1	Drought	Low
2	Crop disease and pests	Medium to high
3	Flooding and excessive rainfall	Medium

3.9.2 Fishing

Fishing supports multiple communities in the GAR, where for many, it provides the only source of income. Fishing practices occur frequently in all coastal wetlands where the most commonly caught fish is the Tilapia. One of Tema's major economic sectors is the fishing

industry, which includes industrial, semi-industrial and artisanal fishing practices (Sal Consult Limited 2015; as quoted by Kondra, 2016).

Fish resources are severely affected by various common pressures on the natural environment as well as by the unconventional fishing practices employed by the communities.

(a) Threats and Pressures

Fish resources are at threat due to unsustainable fishing practices employed across various of the water bodies in the GAR, especially so in the coastal wetlands. It is reported that any possible technique will be used to capture fish, which ranges from the use of chemical poisoning, and dynamite (Kondra, 2016). “Acaday” fishing is also practiced which involves fishing with fish traps made from mangrove forest branches, leading to over harvesting of these forests (Oteng-Yeboah 1999; as quoted by Kondra, 2016). Declining fish stocks have been widely reported. Over and above the unconventional fishing practices that lead to this reduction of the resource, it is exacerbated by increasing plastic and sewage waste pollution. Another impact on those communities dependent on fishing in the Densu Delta, is the opening of the Weija dam in the rainy season to relieve pressure in the dam. This makes fishing in the delta impossible due to the increase in water levels (Kondra, 2016).

3.10 Sand Winning and Quarrying

Quarrying activities within the GAR have increased significantly, contributing largely to land degradation and soil erosion. The need for sand for construction and development has warranted the need for sand mining in the GAR. On the one hand, associated solid waste from quarrying may not necessarily be hazardous to the environment; however it may have the potential to contaminate water sources (Aduku and Awaah, nd). On the other hand, air pollution associated with quarrying activities has the potential to impact human health as well as surrounding ecosystems and biodiversity.

Given that many local households rely on the land for agricultural purposes, sand winning and associated land degradation poses a threat to food security as the land becomes barren and infertile (Adjei, 2010). Additionally, sand winning in the GAR has many other socio-environmental impacts, some of which include: depletion of farmlands, dust and noise pollution and the potential to decrease tourism (Adjei, 2010).

The wetlands that lie within the GAR are important ecosystems for goods and services within the area, and there are many factors threatening this ecosystem, some of which include quarrying and sand winning. Both activities result in land degradation, which has the ability to alter the topography of the land (Peprah, 2013).

3.11 Environmental Constraints

The key environmental criteria identified during the literature review and used in the development of environmental constraints are included in the table below. The table

describes the reasoning for the inclusion of these aspects into the environmental constraints for the GAR. A spatial representation of the environmental criteria is shown in **Plan 3.14** while the amalgamation of these criteria to form the environmental constraints for the region is shown in **Plan 3.15**. As previously discussed, the aim of the environmental constraints is to provide areas that; based on the natural resources present and the role the resources play within the greater context of the region, should not be considered for high impact development (i.e. dense housing, industrial development etc.). These areas essentially form an integral part of the ecological infrastructure and the socio-ecological system. The rationale for this approach is that the MAB programme has been adopted and implemented by the Environmental Protection Agency (Ghana) in order to reduce biodiversity loss, improve livelihoods and enhance social and economic and cultural conditions for environmental sustainability, through the concept that biodiversity and communities should support the relationship between human and biodiversity.

Table 3.4: Description of the Environmental Criteria of Constraints Development

Environmental Criteria	Rationale	Source
Forest Reserve	These areas are integral in the livelihoods of communities as they provide products and services. These areas are also harvested sustainably which allows for a degree of conservation.	CERGIS
Protected Areas	These areas are integral in the livelihoods of communities as they provide products and services. These areas are also harvested sustainably which allows for a degree of conservation.	CERGIS / Google Maps
Forestry or Game Reserve Purposes	These areas are integral in the livelihoods of communities as they provide products and services. These areas are also harvested sustainably which allows for a degree of conservation.	EPA, 2011
Flood Prone Areas	In terms of hydrology and climate change, flooding is a major issue for areas within the GAR. Therefore flooding prone areas are seen as a priority.	Hotfmonlinegh, 2015
Drainage Lines / Wetlands / Water body / Salt flats	Pollution in the hydrological system is of concern. Additional development may result in further pollution affecting livelihoods that rely on this natural resource. Terms of hydrology and climate change, flooding is a major issue for areas within the GAR. Therefore drainage lines, wetlands, water bodies, rivers and salt flats should be avoided to reduce increased run-off and siltation.	CERGIS Landcover 2002, TCPD

Environmental Criteria	Rationale	Source
Proposed Greenbelt	To serve as an environmental area in which planning, environmental, socio-economic and other relevant issues are addressed for long-term solutions. To impose a barrier consisting of selected physical features reinforced by planning controls to check the outward sprawl of the Accra-Tema conurbation. To ensure that land use within the greenbelt is consistent with the maintenance of a predominantly rural landscape, and the conservation of soils, water sources, vegetation and scenic and historical areas.	EPA, 2006
Highly Suitable Agricultural Zones	Agricultural and food security is vital for livelihoods of communities.	EPA, 2011
Riverine vegetation / Riverine vegetation with/without scattered farms	Riverine vegetation is vital for maintaining slope stability and preventing erosion (ecosystem services). These also create habitats for various species.	CERGIS Landcover 2002
Reserved shrub-thicket / Reserved mosaic of thickets and grassland	These areas are integral in the livelihoods of communities as they provide products and services. These areas are also harvested sustainably which allows for a degree of conservation.	CERGIS Landcover 2002
Beach	Habitat for variety of species and an important landscape feature.	CERGIS Landcover 2002

Plan 3.14: Environmental Criteria for Constraints Development

Plan 3.15: Environmental Constraints for GAR

3.12 Main Findings – Natural Environment

The main findings pertaining to the Natural Environment follow:



NATURAL ENVIRONMENT FINDINGS

- Ghana's environmental conservation strategies are informed and entrenched in the concept of environmental sustainability, such as the notion of Man and the Biosphere programme of UNESCO. Conservation efforts not only provide protection of biodiversity but all conserved areas, protected features or

ecosystems marked as sensitive, also provide services and products that are vital to the livelihoods of communities.

- Important features, within the ecological infrastructure, that are vital for both the services and products that they provide, as well as the biodiversity that they protect, include, but are not limited to:
 - Protected/Ramsar wetland areas such as Densu Delta, Sakumo Lagoon and Songor Lagoon;
 - Forest reserves such as the Shai Hills;
 - River, drainage lines and wetlands (hydrological system) within the region;
 - Sensitive vegetation that provide critical products and services, such as mangroves and riverine vegetation.
- The products and services supplied by the ecological infrastructure of the region, which are vital aspects of the livelihoods of the communities include, but are not limited to:
 - Firewood for energy, as approximately 60% of the population still utilizes firewood as the main source of energy;
 - Fish products, as artesian fishing is the largest type of fishing within the Ghana industry;
 - Forest and wildlife reserves, which provide various products; and
 - The hydrological system, which not only provides water, but is vital for natural flood prevention.
- Protection of the natural resources in the region is required for not only biodiversity conservation and sustainable community livelihoods, but also in terms of infrastructure development.
- The effects of climate change on the region are evident and predictions show the situation will only become more critical. Therefore, climate change adaptation and mitigation must be considered in all aspects to ensure sustainable development.

4 *Man-made Environment – Engineering Services*

4.1 Water Infrastructure and Services

4.1.1 Water Infrastructure Authorities

The Ministry of Water Resources, Works and Housing (MWRWH) is an infrastructure sub-sector civil service organisation, with the responsibility for the initiation, formulation, implementation and co-ordination of policies and programmes for the efficient development of the country's infrastructure requirements in respect of Works, Housing, Water Supply and Sanitation, Hydrology and Flood Control Systems.

The following sub agencies exist under the Ministry and are responsible for the provision of water:

- **Ghana Water Company Limited** (GWCL / GWC), with the responsibility for urban water supply only;
- **Community Water and Sanitation Agency** (CWSA), with the mandate to facilitate the provision of safe drinking water and related sanitation services to rural communities and small towns in Ghana; and
- **The Water Resources Commission** (WRC), the commission has a responsibility to issue water abstraction licenses and to educate and create awareness of water conservation.

Ghana Water Company is the main supplier of water in the region, but the Community Water and Sanitation Agency also plays a role in the provision of water in the rural areas.

4.1.2 Sources of Water

Ghana is well endowed with surface and ground water. The bulk infrastructure from a water reticulation point of view includes pipelines, reservoirs and pressure towers. The provision of drinking water in the GAR is from the following improved water sources:

- Household connection;
- Pipe-borne water;
- Boreholes;
- Protected dug well; and
- Protected spring.

Due to the lack of access to improved water sources, residents resort to contaminated drinking water from the following unimproved drinking water sources:

- Rivers or ponds;
- Buckets;
- Unprotected wells;

-
- Unprotected springs;
 - Vendor-provided water; tanker truck water; and
 - Bottled (and sachet) water.

The Greater Accra Metropolitan Area (GAMA) is supplied with water by two main water supply systems namely the Weija and Kpong Headworks. The Weija Treatment Plant has an installed capacity of 264,430m³/d (58 MGD) and takes its source from the Weija Dam on the Densu River.

The Kpong Treatment Plant which takes its source from the Volta River, has a total installed capacity of 462,818m³/d (101.8 MGD) following the completion of 186,000m³/d (41 MGD) capacity expansion works carried out by Messrs China Gezhouba Group Company (CGGC). The Kpong Headworks has three Water Treatment plants operating currently. They are;

- The existing works which produces 181,818 m³/day (39.9MGD) of water to Accra through the Akosombo-Tema-Accra highway
- The newly completed Chinese Water treatment plant which produces 186,000 m³/day (40.9MGD) of water to Accra through the Kpong-Dodowa- Adenta highway,
- The old works which has three separate modules, namely the new TAHAL plant, the new Siemens Plant and the existing old plant which serves the ATMA rural and Krobo areas. [combined installed capacity of 95,000 m³/day (20.9MGD)]

Plan 4.1 on the following page shows the locality of the above-mentioned water treatment works in the GAR.

Plan 4.1: GAR Water Distribution Network

4.1.3 Climate Change Impact on Water Sources

Although the two water bodies mentioned above are quite extensive, it should not be taken for granted that these water sources will sustain future growth indefinitely. According to the “CSIR-WRI 2000 report” on the climate change impact on water resources in Ghana, the implications of Climate Change can result in the following:

- Decrease in the quality of freshwater as water pollutants become more prevalent;
- Amendments to the water facilities, planning and water allocation decisions; and
- Unpredictable weather conditions.

The river flows in Ghana will decrease by 15-20% for the year 2020 and 30-40% for the year 2050 CSIR-WRI 2000, due to global warming. It is also estimated that by the year 2020, all the river basins will be vulnerable resulting in acute water shortage. It is therefore very important that water resources are managed sensitively and in a sustainable manner.

Although the Weija Reservoir is located inside the GAR and the Kpong Reservoir just north east of Accra, it is still fed by rivers originating in the northern parts of the country and beyond. The Volta River Kpong-Akuse Reservoir situated downstream from Lake Volta, is fed by the Volta basin which is a major river basin that drains an area of approximately 400,000 km² into the Gulf of Guinea. The basin is shared by six riparian countries, of which Burkina Faso (46%) and Ghana (39%) share the major portion, and the remaining 15% are shared by Togo (6%), Benin (4%), Mali (3%), and Cote d'Ivoire (2%) (Barry et al. 2006).

The Weija Reservoir, a much smaller water resource than the Kpong Reservoir is located on the western side of the GAR and is fed by the River Densu.

4.1.4 Services Areas and Water Supply Coverage

As mentioned earlier, GWCL is the main agency supplying water to the GAR. Information received indicates that the GAR is divided into three “sub-regions” in terms of water provision in the region, namely Eastern Region, Western Region and the Rural Areas.

The status of water supply coverage in the GAR is summarised below.

(a) The Western Region

Water is supplied by the GWCL. The current supply coverage for the region is approximately 55% and the existing distribution network is not expanding fast enough to provide for the needs of the growing population. The major source of water for the region is the Weija Treatment Plant with an average production of 193 000 m³/day.

(b) The Eastern Region

Water is supplied by the GWCL. The current water supply coverage for the region is at 50%. Major distribution improvement works are being undertaken to improve water supply to Achimota, Ofankor and surrounding areas that have been without water for the past twenty five years. The region has three main water sources, the Kpong Headworks (China Gezhouba), Kpong New Works through Tema and Weija Headworks.

(c) The Rural Areas

Water provision is managed by the Community Water and Sanitation Agency (CWSA). According to CWSA, the GAR does not fall under the umbrella of rural areas. Most of the outlying areas of GAR are classed as Sub-Urban or Peri-Urban, but some rural communities in the GAR receive water from CWSA. The three main systems used by CWSA in rural areas are:

- Boreholes with either a hand pump or electric pump with a central collection point,
- Limited reticulation system with small scale supply network, and
- Small town water supply schemes with a slightly larger network than the limited reticulation system.

The water supply coverage of the three sub-regions is illustrated on the foregoing plan.

With reference to the mentioned plan, it is evident that water supply coverage for the entire GAR is poor and the existing water distribution network is not expanding fast enough to compete with the rapid expansion experienced by the Region.

Furthermore, there is a decline in the provision of piped water. Water quality seems to be a concern since there are reports that water from the Kpong Waterworks taste better than from Weija, and a possible cause could be high levels of pollution in the Weija area. Treating this water to acceptable consumption levels becomes highly impossible. The overall effect is that almost all residents of the western parts of Accra use the water from Weija for non-drinking purposes. (Accra Metropolitan Assembly: 2014-2017 Medium Term Development Plan).

4.1.5 Existing Water Supply Networks

Plan 4.1 indicates the current water network situation in the region. It is quite evident that the majority of the piped networks are situated in the more urban areas and that the rural landscape is somewhat void of substantial water networks.

GWCL is facing a bottleneck in supplying water to the region due to the condition of the existing piped infrastructure. The existing networks mainly located in and directly around Accra and Tema are quite dated. The result of this is that pipe bursts are quite frequent, lack of networks in the unplanned and slum areas of the city and the third problem that GWCL face is illegal connections.

4.1.6 Existing Water Treatment Infrastructure & Capacities

Accra Metropolitan Assembly (AMA) receives water from two sources; Weija, Teshie-Nungua Desalination and Kpong water works. Weija is located 15km west of Accra. It supplies water to Accra's west and north-east districts via gravity. Raw water is drawn from River Densu and passed through three treatment plants that work in parallel; Adam Clark, Pintsh-Bamag and Candy Patterson.

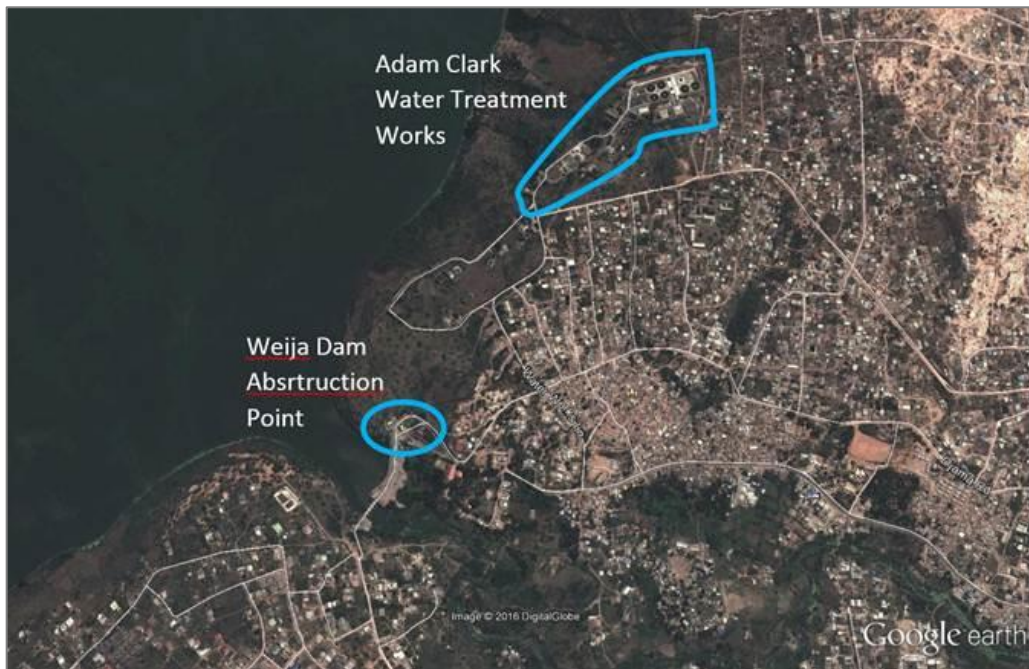


Figure 4.1: Adam Clark Water Treatment Works near Weija Reservoir

The Kpong Headworks currently has three operational Water Treatment plants:

- The existing works which produces 181,818 m³/day of water to Accra through the Akosombo-Tema-Accra highway;
- The newly completed Chinese Water treatment plant which produces 186,000 m³/day of water to Accra through the Kpong-Dodowa-Adenta highway; and
- The old works which has three separate modules, namely the new TAHAL plant, the new Siemens Plant and the existing old plant which serves the ATMA rural and Krobo areas. The combined installed capacity of all three modules is 95,000 m³/day.

The Kpong Treatment Plant which takes its source from the Volta River has a total installed capacity of 462,818m³/day.

Kpong is located 75km north-east of Accra. It supplies water to Tema, and eastern and central Accra. Raw water is drawn from the Volta River and passed through two plants working in parallel; Kpong Old Plant and Kpong New Plant. From the New Kpong Plant, a high-lift pumping station delivers treated water via a 54 km long pipeline (1 050 mm diameter) to the Tema terminal reservoir.



Figure 4.2: Kpong Water Treatment Works near Volta River

Although the Weiija Reservoir is located inside the GAR and the Kpong Reservoir just north east of Accra, it is still fed by rivers originating in the northern parts of the country and beyond. The Volta River Kpong-Akuse Reservoir situated downstream from Lake Volta, is fed by the Volta basin which is a major river basin that drains an area of approximately 400,000km² into the Gulf of Guinea.

The Volta basin is shared by six riparian countries, of which Burkina Faso (46%) and Ghana (39%) share the major portion, and the remaining 15% are shared by Togo (6%), Benin (4%), Mali (3%) and Cote d'Ivoire (2%) (Barry et al. 2006).

The capacity and output of the different systems are contained in the table below.

Table 4.1: GWLC Water Supply Network Capacity - GAMA

System Name	Plant Design Capacity (m ³ /Day)
Existing Kpong Works	181 818
Chinese Treatment Works	186 000
Old Works	95 000
Total Kpong	462 818
Total Weiija	264 430
Overall Total	727 248

The water bodies mentioned that feed the water treatment plants are quite extensive, it should not be taken for granted that these water sources will sustain future growth

indefinitely due to the effects of climate change. The effects of climate change are listed below:

- Decrease in the quality of freshwater;
- Amendments to the water facilities; and
- Unpredictable weather conditions.

4.1.7 Estimated Future Water Demand

The estimated future water demand is shown in **Table 4.2** on the following page.

Table 4.2: Estimated Growth in Water Demand - GAMA

District	2010 Population	Population Growth Rate	2017			2027			2037		
			Population	Demand / capita	Water requirement	Population	Demand / capita	Water requirement	Population	Demand / capita	Water requirement
				(ℓ/c/d)	(m ³ /day)		(ℓ/c/d)	(m ³ /day)		(ℓ/c/d)	(m ³ /day)
Accra Metro	1 665 086	3.10%	2 061 804	137	282 467	2 797 912	143	400 101	3 796 825	145	550 540
Tema Metro	292 773	2.60%	350 399	137	48 005	452 935	143	64 770	585 477	145	84 894
Adenta	78 215	2.60%	93 610	137	12 825	121 003	143	17 303	156 412	145	22 680
Ga East	147 742	4.20%	197 051	137	26 996	297 341	143	42 520	448 676	145	65 058
Ga West	219 788	4.20%	293 142	137	40 160	442 339	143	63 254	667 471	145	96 783
Ga South	411 377	4.30%	552 370	137	75 675	841 537	143	120 340	1 282 084	145	185 902
Ga Central	117 220	3.60%	150 148	137	20 570	213 854	143	30 581	304 590	145	44 165
Ashaiman	190 972	4.60%	261 632	137	35 844	410 212	143	58 660	643 169	145	93 260
Ledzokuku- krowor	227 932	3.10%	282 238	137	38 667	383 003	143	54 769	519 744	145	75 363
Ada East	71 671	3.10%	88 747	137	12 158	120 432	143	17 222	163 428	145	23 697
Shai Osudoku	51 913	2.40%	61 288	137	8 396	77 692	143	11 110	98 486	145	14 280
La Dade Kotopon	183 528	3.10%	227 255	137	31 134	308 390	143	44 100	418 491	145	60 681
La-Nkwant. Madina	111 926	3.10%	138 593	137	18 987	188 074	143	26 895	255 220	145	37 007
Kpone Katamanso	109 864	3.10%	136 040	137	18 637	184 609	143	26 399	250 518	145	36 325
Ningo Prampram	70 923	3.10%	87 821	137	12 031	119 175	143	17 042	161 723	145	23 450
Ada West	59 124	3.10%	73 211	137	10 030	99 348	143	14 207	134 818	145	19 549
Total Greater Accra Region	4 010 054		5 055 348		692 583	7 057 855		1 009 273	9 887 131		1 433 634

The abovementioned figures are based in the following assumptions:

- The latest demographic information as obtained by the consultant; and
- The demand per capita figures as recorded in the report “Towards Integrated Urban Water Management in the Greater Accra Metropolitan Area – SWITCH 2011” (SWITCH Report).

4.1.8 Estimated Potable Water Shortage

From the above the following pertinent issues can be highlighted as shown in the table that follows.

Table 4.3: Estimated Shortage in Potable Water - GAMA

Description	2017 (m ³ /day)	2027 (m ³ /day)	2037 (m ³ /day)
Existing WTW Capacity			
- Design	727 248	727 248	727 248
Estimated Demand	692 583	1 009 273	1 433 634
Estimated Projections			
- vs. Design Capacity	34 665	-282 025	-706 386

The table highlights that the existing treatment capacity falls well short of the demand. Through interpolation the design capacity will be reached in the year 2018. If the bulk water supply to the GAMA is not augmented the shortage in potable water will increase significantly during the next 20 years.

4.1.9 Status of Water Infrastructure and Services in the Various Assemblies

The following table indicates the status of water infrastructure and services per assembly in the GAR. The aforementioned information was mainly derived from the Medium Term Development Plans of the various assemblies.

Table 4.4: Status of Water Infrastructure and Services for all assemblies in GAR

Assembly	Status of Water Infrastructure and Services
The Ga South MA	• Weija Water Reservoir and Treatment Plant serve about half of Accra’s population. • Overall safe water coverage in the municipality is approximately 70%. • Weija Zonal Area, which covers the urban and peri-urban areas, has coverage of 78%. • Weija water works provides 40% of water in the Weija Zonal Area. • The main distribution line covers 15% of the area along Kasoa-mallam Highway and ends at Danchira. • Inadequate pressure to distribute water to residents of Aplaku, New Bortianor, Kokrobitey etc.

Assembly	Status of Water Infrastructure and Services
	150 boreholes have been completed in the Obom-domeabra area, but there is poor accessibility due to the dispersed settlement pattern.
The Ga West MA	- Water supply in the municipality is a fundamental problem with a limited number of communities having access to potable water. - Pipe-borne water is periodically supplied to areas such as New Achimota and Tantra Hill. - Only a 1/3 of 300 rural communities have access to surface water treatment plants, boreholes and hand-dug wells. 35% of settlements depend on dams, dugouts and streams for water. - Potable water is a challenge in the urban/peri-urban areas as there is no control over urban water supply. - The assembly provides water to rural areas through the Municipal Water and Sanitation Team. - Approx. 21.85% of people in rural areas have access to potable water from a borehole, stand-pipe or hand dug well. - The assembly will focus on providing water to the remaining 76.15% by providing more boreholes and standpipes and ensuring they serve not more than 300 and 600 persons respectively. - There are 169 water points in the municipality, of which 148 are in full operation.
The Ga East MA	- Potable water is a challenge in the urban/peri-urban areas as there is no control over urban water supply. - Some areas have limited or no access to pipe-borne water, whilst other areas depend on tanker services and hand dug well.
The Accra Metropolitan Assembly	- There are two major water sources, namely Weija Waterworks (feeds the west of Accra) and Kpong Waterworks (feeds the east of Accra). - Both waterworks supply 401 800m³ of water daily, with more than 130 000m³ shortfall (still required). - Water to Accra flows through other Municipal/ District areas, and most of these areas are also served with the same treated water giving rise to inadequate supply to the City of Accra. - As a result of shortfall, 60 mechanised boreholes have been constructed. - The implementation of the GAMA Sanitation project will seek to improve and expand the water distribution network.
The Adenta MA	- Most residents rely on poly tanks and concrete built tanks to store water and also harvest rain water. - During the dry season, potable water becomes an essential commodity and lorry tankers supplying water often charge exorbitant prices. - A new treatment plant of 186 000m³ per day is being built in Kpong, to serve the eastern part of Accra, including Adenta. - A 40 000m³ reservoir will be constructed at Obiyi and serve the surrounding areas including Adenta through a grant by the Chinese Government. Another 1 000m³ reservoir will be constructed at Dodowa. - A 28 000m³ treatment plant is planned for Kpong.
Ledzokuku - Krowor MA	Inadequate supply of potable water.
Ashaiman MA	- Ashaiman MA is served with a network of water connections by the Ghana Urban Water Company Ltd. (GUWCL) from the Kpong Water Works which serves Tema Metropolis and parts of Accra. - The water company provide 15 fire hydrants in the event of an emergency. - At least 25% of households purchase water from tankers and other sources.

Assembly	Status of Water Infrastructure and Services
	The majority of residents have access to piped water indoors and are serviced by trucks.
Tema Metropolitan Assembly	- The Tema Metropolis is served with a network of water connections from the Kpong Water Works. 90% of households in Tema have access to pipe borne water compared to 64.4% for the Greater Accra Region. - The majority with access to pipe borne water are from urban areas, with peri-urban areas depending on tanker services. - Problems with irregularity of flow.
Shai-Osudoku DA	- The main source of drinking water is pipe-borne outside dwelling (37.3%). 17.3% of households also use pipe-borne inside dwelling. 16.1% percent of households use public tap/standpipe whilst 8.8 percent also use sachet water for drinking. 5.6% of households use bore-hole/pump/tube well. 4.6% percent of the population also depends on rivers/stream for drinking water whilst a further 3.6% get their source of drinking water from tanker supply/vendor provided. - Pipe-borne water and borehole in the district are a result of the Osudoku Small Town Water Supply Scheme that helped in extending water into the district. - The predominant sources of water for both urban and rural areas are pipe-borne outside dwelling and pipe-borne inside dwelling. 18.7% of urban households use sachet water for drinking whilst 18.7% of urban households use public tap/standpipe. - Households also use public tap/standpipe (15.7%) for domestic purposes.
Ada West DA	- There are six main sources of drinking water for dwelling units in the District. These are public tap/standpipe (63.1%), pipe borne outside the dwelling unit (19.9%), sachet water (7.2%), pipe-born inside the dwelling unit (4.7%), Dugout/Pond/Lake/Dam/Canal (2.2%) and borehole/pump tube well (1.5%). - In the urban areas more dwelling units use public tap/standpipe (69.6%) compared to 60.3% used in the rural areas. 21.0% of rural dwelling units use pipe-borne outside dwelling than in the urban locality (17.5%). Besides, more dwelling units in the urban areas use sachet water 10.5% compared to rural dwelling units sachet water use of 5.7%. The use of Dugout/Pond/Lake/Dam/Canal is 3.1% in rural dwelling units with 0.0% use in urban communities in the district.
Ga Central MA	Inadequate / poor supply of potable water.
La Dade-Kotopon MA	- The MA accesses water from Kpong Water Works. - Over 40% of the people have access to pipe-borne water. In the same vein, close to 40% of the people have access to water outside their various households. - The supply of water through the usage of tanker services has insignificantly gained momentum over the years. - Water provision can be broken down into three classes, namely (1) first class residential who are connected to the water supply network, (2) residents who live in areas connected to the network but supplement by buying water from vendors and (3) the majority of residents who are not connected to the network (the poor and vulnerable), buy their water from vendors. - Water supply from the Ghana Water Company Limited (GWCL) supplies water to urban dwellers, however, it is irregular and has been rationed on a trial-and-error basis since 1996.

Assembly	Status of Water Infrastructure and Services
	Water service delivery models include utility water supply services, private (intermediary and independent) water supply services and community managed water supply services. Households rely on a mix of different service delivery models for their water supply.
La Nkwantanang-Madina MA	No information available.
Kpone-Katamanso DA	- Most of the communities have access to either pipe borne or borehole. - Accessibility to potable water is not much of a problem in the district. - In areas where there is absence of either pipe-borne or borehole, the residents resort to tanker services. The residents also harvest rainwater during the rainy seasons. - The district is fast developing with people constructing new houses, hence, the need to extend potable water to newly developing areas.
Ningo-Prampram DA	- The Three District Water Supply Scheme (3-DWSS) is one of the peculiar small towns water supply schemes constructed in Ghana. It is presently the biggest Community-Managed Small Town Water Supply Scheme in Ghana. It serves communities and institutions in the then Dangme West, Dangme East in the Greater Accra Region and North Tongu District Assembly in the Volta Region. - Some challenges include the following: - Some Fulani herdsmen break the distribution pipes and divert water to service their livestock; - Some residents connect illegally; - Some WATSAN Committees are not functioning; and - Embezzlement of funds by some collectors at water points.
Ada East DA	- There is one main water source the Volta River, with the contribution of perennial tributaries of the Futue and Tamatoku. - The district is engaging innovative techniques to utilize its water sources. - Under the 3-District Potable Water Scheme, DANIDA and the Ghanaian government have connected 53 communities with potable water. - Aveyime hosts a head pump for the region. - A levy of 5% as a commitment fee is required by the community with the District Assembly aiding in subsidy.

4.1.10 Planned Projects

There are on-going projects in the GAR to improve the provision of water. The projects include:

- GAMA Sanitation and Water supply project funded by World Bank
- Extension of distribution pipelines in some parts of GAMA

4.1.11 Recommendations

Addressing the shortages in part over the short term can be done through the following measures:

- Water Conservation and Demand Management (WCDM); and

-
- Upgrading / refurbishment to the existing water treatment plants to reinstate the original design capacities.

The only long term solution, however, is to identify and develop additional resources. This can be achieved through the following:

- Identification and development of groundwater resources;
- Optimisation of existing surface water resources;
- Identification and development of additional surface water resources; and
- Desalination of sea water.

All of the abovementioned options require additional further investigation as well as technical and financial feasibility studies. These options also include inherent risks / complications. **Table 4.5** below highlights these aspects.

The table shows the complicated nature of augmenting the bulk water supply to GAMA as well as the extent of the studies / investigations required to address the matter in a sustainable manner. It furthermore reveals the fact that no solution is without risks / complications.

Table 4.5: Options to Augment Potable Water Supply with Risks

Description	Identification and development of groundwater resources	Optimisation of existing surface water resources	Identification and development of additional surface water resources	Desalination of sea water
Actions / Investigations	- Geological and geophysical studies; - Exploration; - Environmental impact studies; - Development and equipment of well fields; - Infrastructure development; and - Integration into existing infrastructure.	- Improved Decision Support Systems; - Development of improved multi-lateral basin agreements for the Volta basin; - Harvesting of water releases downstream of the hydropower generation sites for human and industrial use; - Environmental impact studies; - Design and development of new water treatment plants, reservoirs, pump stations and bulk transmission infrastructure; and - Integration into existing infrastructure.	- Surface water studies (Identification and feasibility studies); - Development by / multi – lateral basin agreements (if required); - Environmental impact studies; - Design and development of new dams, water treatment plants, reservoirs, pump stations and bulk transmission infrastructure; and - Integration into existing infrastructure.	- Technical and financial feasibility studies into site selection, appropriate abstraction and discharge alternatives and viability of options; - Technology selection; - Environmental impact studies; - Infrastructure development; and - Integration into existing infrastructure.
Risks / Complications	- Availability of adequate / suitable resource(s); - Potential pollution of resources as a result of human development; - Environmental impacts; and - Potential pollution of resources due to ingress of salt water in the event of the resource in proximity of the coast.	- Resource being stressed due to developments (industrial, irrigation and energy requirements); - Yield of resource being impacted upon by climate change; - Conflicting priorities of multi-national stakeholders; - Complex multi-national agreements; - Environmental impacts; - Potential impact of water harvesting related infrastructure on the power generation ability of existing facilities; and - Developmental cost if infrastructure.	- Availability of adequate / suitable resource(s); - Yield of resource being impacted upon by climate change; - Environmental impacts; - Potentially complex multi-national agreements; - Potential conflicting priorities of multi-national stakeholders; and - Developmental cost if infrastructure.	- Suitable sites for the development of desalination plants; - Long term environmental impact on marine life; and - Community resistance; - Development costs; - Lack of suitable expertise to operate infrastructure; and - Operational costs;

4.1.12 Main Findings – Water

The main findings pertaining to water engineering services follow:



WATER FINDINGS

- Ghana Water Company is the main supplier of water in the region.
- Ghana is well endowed with surface and ground water.
- Due to a lack of access to improved water sources residents resort to contaminated drinking water.
- There are two main water sources supplying the GAR namely the Weija Dam and the Kpong Water Works, both operated by GWCL and delivering insufficient capacity.
- The Teshie desalination plant that supplies the people of Teshie-Nungua and its environs.
- Water supply coverage for the entire GAR is inadequate and the existing water distribution network is not expanding fast enough to compete with the rapid urban expansion of the Region.
- There is a decline in the provision of piped water and water quality also seems to be a concern.
- Rural water supply is rudimentary because the formal supply of water would be very costly for the dispersed rural settlement pattern.
- There are three planned projects in the GAR to improve the provision of water.

The following strategic elements need to be considered to ensure that the water network in the GAR is functioning optimally and that building blocks are in place to support the SIP:

- Decreasing demand for water;
- Improving GWCL water supply services by:
 - Decreasing physical losses,
 - Increasing GWCL revenues, and
 - Improving access to the GWCL systems;
- Ensuring lower water prices for low-income households;
- Ensuring services for people outside the reach of the GWCL network; and

-
- A Master Plan for GAR is on-going.
 - Alternative water supply systems for example a desalination plant could be considered for the outlying areas of the GAR.
 - Rainwater harvesting.

4.2 Sewerage and Sanitation Infrastructure and Services

4.2.1 Sanitation Infrastructure Authorities

The responsibility for setting sanitation policies and coordinating funding is shared between the Ministry of Local Government and Rural Development and MWRWH. In line with governments' decentralisation policy, sanitation policies are to be carried out by the Metropolitan, Municipal and District Assemblies. It is the responsibility of the Environmental Protection Unit (EPU) under the Ministry of Environment and Science to examine the impact of sanitation development activities on the environment.

4.2.2 Existing Level of Sanitation

There is a serious lack of proper sewerage infrastructure in GAR. In some areas the systems are well over four decades old and in need of major reconstruction. The concrete sewers in Accra for example are completely eroded at certain sections of the network, allowing raw sewage to seep into the environment. (Accra Metropolitan Assembly: 2014-2017 Medium Term Development Plan).

Access to sewerage remains very limited. Most households dispose of liquid waste directly in drainages, and in smaller towns, most liquid waste is simply disposed of outside. Even in Accra and Tema, little more than 10 percent of households discharged their liquid waste through the sewage system. Access to liquid waste disposal services is better closer to the city centres, but a large majority of households in peri-urban areas do not have adequate liquid waste disposal Infrastructure. (Project Performance Assessment Report - Report No.: 105746 - Independent Evaluation Group – World Bank Group)

Further to this report, information gained from the <http://ghanadistricts.gov.gh/> website indicates that the rest of the districts follow roughly the same pattern and that the availability of toilet facilities is limited. The outlying and rural areas of GAR do not have water borne sewer.

Sanitation coverage in general in the GAR is very low, for example:

- In the GA East MA 32% of households have private toilets and 37% use public toilets (2014-2017 GEMA MTDP report); and
- In Ashaiman MA communities either have water closets, Ventilated Improved Pit latrines (VIPs) or Kumasi Ventilated Improved Pit latrines (KVIPs). However, most households in Ashaiman do not have domestic toilet facilities in their houses. Households without either of these dispose of excreta indiscriminately in drains and dumping sites. (Ashaiman Municipal Assembly Medium-Term Development Plan 2014-2017)

The figure below gives a high-level indication of the relative distribution of different available sewerage system within the GAR. (Greater Accra Region sanitation facilities - GSS, 2005)

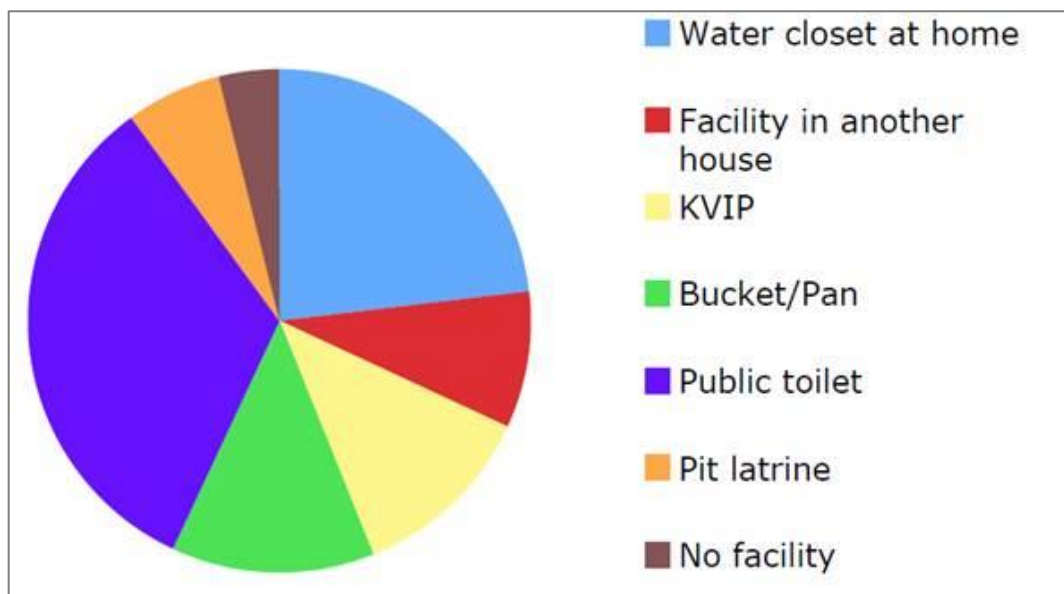


Figure 4.3: Distribution of Sanitation Facilities in GAR

- Water closets and communal facilities are shared amongst households. The conveyance for this system is in disrepair and, as a consequence, sewage leaks out into the environment and poses health, safety and environmental risks;
- Bucket system, whereby buckets are periodically collected and disposed of at specified treatment facilities;
- Public toilets, which are by far the most widely used system;
- The application of pit latrines and similar systems is not recommended, since the majority of the catchment area is low lying, and with a high water table ground water pollution is a dangerous reality; and
- There are areas with no sanitation services.

Vacuum tankers empty cesspits/septic tanks around communities in Accra and surrounds and then discharge the content in an area called Lavender Hill (see both figures below). This disposal site, located at Korle-Gonno beach, remains the major official faecal sludge dumping site where untreated sludge is discharged directly into the ocean.



Figure 4.4: Korle Lagoon at Korle Gonno and James Town



Figure 4.5: Lavender Hill Sewerage Disposal Site

Although it was hoped that the new waste water treatment plants at Lavenderhill were going to eliminate the need to dump raw sewage into the ocean, it would seem that the new treatment plants can only handle around half the amount of trucks it was designed for

In most cases, untreated/raw sewage and industrial waste are being discharged into the Korle Lagoon and the ocean on a daily basis.

4.2.3 Major Waste Water Treatment Plants

GAR has several Waste Water Treatment Plants, namely:

- The Jamestown Waste Water Treatment Plant
- Mudor Liquid Waste Water Treatment Plant

- Lavender Hill Faecal Waste water Treatment Plant
- Kotoku Septage Treatment Plant; and
- Tema Waste Water Treatment Plant

The combined treatment capacity of these works is insufficient to cater for the existing population. Each of the facilities mentioned above are discussed briefly below.

The exact status of these treatment plants is unknown. Several reports indicate that the Jamestown Sewer plant is in a state of disrepair and that the Tema waste water treatment plant has not been functioning properly for some time. Further investigation would be required to determine their exact capabilities to enable a more realistic supply and demand comparison between sewage generated and waste water treatment. All documents and literature consulted reflect the same lack of sewage treatment ability in GAR.

(a) Jamestown Waste Water Treatment Plant

The Jamestown Waste Water Treatment Plant in Accra is situated next to Korle Lagoon as depicted in the accompanying figure. The original Jamestown Waste Water Treatment Plant capacity built in 2002 was 16 200 m³/day. Only 8 000m³/day is currently treated by this plant.

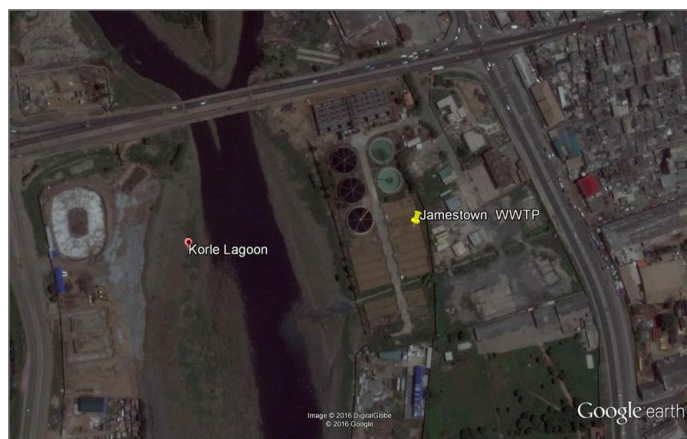


Figure 4.6: Jamestown Waste Water Treatment Works, Accra

The Jamestown waste water treatment plant has seen its fair share of problems. It is currently unknown if the plant is operational or not. In a report by Takamoto Biogas, the plant is described as defunct and the sewer from 1.2 million inhabitants that was supposed to be treated at this plant is now again pumped directly into the ocean.



Figure 4.7: Jamestown WWTP - filter shroud rusted through

(b) Mudor Liquid Waste Treatment plant commonly known as the Lavender Hill

The Government of Ghana in partnership with Zoomlion constructed the Mudor Faecal Treatment Plant at a cost of \$35 million. The plant was commissioned on the 25 November 2016 and will utilise the methane gas produced to power itself.

(c) Lavender Hill Faecal Waste Water Treatment Plant

This plant has a maximum treatment capacity of 2400 m³/day. This is quite a minor system compared to the old Jamestown WWTP. Zoomlion commissioned the plant in November 2016. The plant was designed for a lifespan of 20 years and more will be owned and operated by Sewage Systems Ghana Limited, a subsidiary of Zoomlion Company Limited, through a private public-partnership after.

(d) Kotoku Septage Treatment Plant

The Kotoku Septage Treatment Plant located in Adjen Kotoku near the border of the Eastern Region and the GAR has a maximum treatment capacity of 1100 m³/day, with a septage design capacity of 1000 m³/day and 100 m³/day Leachate. The plant has a lifespan of 20 years.



Figure 4.8: Mudor Faecal Treatment Plant

It is believed that a second Mudor Faecal Treatment Plant was constructed in Adjen Kotoku, north-west of Accra.

(e) Tema Waste Water Treatment

The old waste water treatment plant in Tema is in a state of disrepair and the new system that was constructed in 2005 is also not functioning properly. TMA had difficulty in operating and maintaining the sewerage system in Tema. Waste disposal trucks are emptying faecal matter into the concrete inlet to the treatment plant which is blocked and sewage is spilling over the entire site. Raw sewage is pumped into the ocean without treatment. (33rd WEDC International Conference, Accra, Ghana, 2008 – Access to Sanitation and Safe Water: Global Partnerships and Local Actions – Management of Sewage Systems: Case Study Tema.)

The Tema Metropolitan Assembly (TMA) reportedly committed to refurbishing the existing infrastructure and the treatment plants. It is not clear if this has been done.

4.2.4 Status of Sewerage and Sanitation Infrastructure in the Various Assemblies

The following table indicates the status of the sewerage and sanitation infrastructure per assembly in the GAR. The aforementioned information was mainly derived from the Medium Term Development Plans of the various assemblies and from the responses received during the workshop dated 17 November 2016.

Table 4.6: Status of Sewerage and Sanitation Infrastructure and Services for all assemblies in GAR

Assembly	Status of Sewerage and Sanitation Infrastructure and Services
The Ga South MA	• In collaboration with the Ministry of Local Government and Rural Development and the Netherlands Embassy the Ghana-Netherlands Wash Programme (GNWP) aims to address water, sanitation and hygiene challenges in the Municipality. • There is a door to door refuse collection by waste management contractors assigned to zones for refuse collection. • There is, indiscriminate dumping in some public places in the municipality that needs attention. • Sanitation challenges due to increasing population and cutting of trees to pave way for housing and estates development especially in the middle and north eastern zone of the Municipality. • Lack of enforcement of existing by-laws on sanitation.
The Ga West MA	• Only 22% have adequate sanitation. • A number of people have access to some type of sanitation facilities be it public or private. • Defecation in public places is highlighted as a problem. • Total sanitation coverage is estimated at 47% for domestic and 65% for institutions. • Facilities in use include water closets (WC) toilets, KVIPs, Household VIPs and public KVIPs and in some areas pit latrines. • Some water and sanitation facilities are being constructed in selected communities under the Community Based Rural Development Project.
The Ga East MA	• In the peri-urban to rural areas, 32% of households have a private toilet. • 37% of the population uses public toilets and 42% has access to potable water.
The Accra Metropolitan Assembly	• Implementation of a project aimed at alleviating sewerage and sanitation conditions has commenced. • Acquisition of 4 waste management trucks and 20 waste (Bola) taxis.

Assembly	Status of Sewerage and Sanitation Infrastructure and Services
	Implementation of a project aimed at alleviating flooding in low-lying areas.
The Adenta MA	- Liquid waste is disposed of unofficially at Nunguna Farms. - Due to inadequate labour and machinery, the collection of waste has been outsourced to private service providers, who only service registered households. - There is a need for Adenta Municipal Assembly to identify and acquire land for the development of a disposal site for both solid and liquid waste. - Over 100% of households have access to a toilet, as most homes have more than one toilet facility.
Ledzokuku - Krowor MA	- Poor sanitary conditions, including inadequate household toilets, high unsustainable expenditure on waste management, limited number of household toilets, inadequate refuse. - Inadequate budgetary allocation for sanitation due to limited resources. - Door-to-door collection which attracts service fees and occurs mostly in affluent or areas that have a good layout. Low-income areas are serviced by communal containers.
Ashaiman MA	- The few existing drainage facilities are choked with solid waste. - Most households do not have domestic toilet facilities. - Households, which have facilities, have either water closets, ventilated improved pit latrines (VIPs) or Kumasi Ventilated Improved Pit Latrines (KVIPs). - Households without the above dispose liquid waste indiscriminately in drains and dumping sites.
Tema Metropolitan Assembly	- Tema Metropolitan Assembly ensures proper disposal of liquid waste through its Waste Management Department. - Challenges that exist include choked sewers, over aged sewer lines and negative attitudes of people towards sanitation. - Most communities have household toilets except in Tema Manhean and Community 1. - An additional 65 public toilets are located at vantage points in the city, which are mostly used by households without access to domestic. - Defecation is rampant in areas with adequate public and private toilet facilities. - The Septage Treatment Plant at Nungua Farms serves both the public and private service providers in liquid waste disposal and is the only approved dumping septage in the greater Accra Metropolitan Area (GAMA). - Challenges faced, include poor accessibility to the plant, broken plant fence, no security and broken down poles carrying power to the plant. - Water-borne sewerage system which connects a number of communities, but experiences frequent blockages which discharge effluent onto the streets, open drains and sometimes residential facilities.
Shai-Osudoku DA	- Majority of households (30.0%) use public toilets (WC/KVIP/Pit/Pan). 21.1% use pit latrine. 8.9% use water closets. - Majority of households in the Shai-Osudoku District use 'shared open cubicle' (29.9%). 27.3% of households use 'own bathroom for exclusive use' whilst 18.4% use a shared separate bathroom in the same house. 8.5% of households do not have a bathing facility and therefore bath in open space around house. - The majority of households in rural areas use own bathroom for exclusive

Assembly	Status of Sewerage and Sanitation Infrastructure and Services
	use (32.2%). - Majority of households in the Shai-Osudoku District throw their liquid waste onto compound (63.1%). 22.2% of households throw their liquid waste onto the street/outside whilst 6.2% use the drainage system into a gutter. A few households dispose of their liquid waste through the sewerage system (1.3%). Both urban and rural households mostly throw their liquid waste onto compound.
Ada West DA	- One of the major challenges confronting the Ada West District in liquid waste management is the open defecation in most communities. 58.4% of households in the district use open defecation as the most popular method of human excreta disposal and this is more pronounced among rural household (69.7%). This practice is more common among the poor and those with relatively low levels of education. 18.5% of households use public toilets while 11.03% of households use KVIP, 5.0% of the households have access to W.C. toilets and 4.4% use pit latrines. - The use of public toilets is very high among rural households (73.4%) when compared to urban households (26.6%). The proportion of households that have no access to toilet facilities is prevalent more in the rural locality (69.7%) than in the urban household (30.25%). - Among the households that use of W.C.in the district, 89.4% of the households are in rural communities while only 10.6% are in the urban areas.
Ga Central MA	- The GCMA Municipality is not endowed with a central sewerage system. - The use of public toilets facilities as means of excreta disposal is currently very low, nevertheless there are a few of them. - KVIP -13 toilets with a total 76 squatting holes. - VIP - 2 toilets with a total of 8 squatting holes. - There were plans in the 2013 budget to construct two more public toilet facilities at the Anyaa and Chantan markets and Lorry Parks respectively. This is expected to provide urinary and toilet facilities for the transient population. - Challenges identified include, inadequate toilet facilities in some residential areas, no final disposal sites for both liquid and solid waste, perennial water shortage and the lack of abattoir.
La Dade-Kotopon MA	- Lack of motivation among sanitation workers. - Poor enforcement of existing sanitation laws.
La Nkwantanang-Madina MA	No information available.
Kpone-Katamanso DA	- Despite the fact that the public dump site is in Kpone, refuse is disposed of indiscriminately in the district. - Most households do not have access to toilet facilities in their various homes thereby resorting to open defecation. - There is the need to sensitize and promote household ownership of toilets. - The district has a Kraal market and an emergency slaughter slab. Unfortunately the slaughter slab is challenged with requisite amenities to operate under hygienic condition. The condition at the slaughter slab does not encourage large patronage.

Assembly	Status of Sewerage and Sanitation Infrastructure and Services
Ningo-Prampam DA	More than 50% of households are engaged in open defecation popularly known as 'Free Range' whilst over 20% visit public toilet facilities. The situation of open defecation is especially appalling in communities along the sea shore where such activities are marring the aesthetics of the beaches in the District. Toilet facilities commonly used are largely public in nature and include WCs, KVIPs and some household VIP and pit latrines. "Free range" is common in the district especially in the coastal and the forest areas.
Ada East DA	- With the change in tide the sea helps with drainage of waste from its fresh water sources. - Indiscriminate disposal of waste materials, open defecation, inadequate drains and indiscriminate dumping of refuse into existing drains, inadequate staff, etc. all contribute to compound the sanitation problems of the District. - Inadequacy of sanitation facilities coupled with the inadequacy of logistics is hindering the smooth operation of ensuring and intensifying sanitation related inspections as well as the management of waste.

4.2.5 Projected Sewage Generation

It is assumed that 80% of the consumed water is generated as sewage. The projected sewage to be generated by the long term additional population growth of 5 million is estimated at approximately 520 Mℓ/d.

(a) Proposed Treatment Plan

(i) Current Treatment Capacity

The current population is estimated to generate a total sewage volume of approximately 416Mℓ/d. There is currently no sewage treatment master plan to increase the current level treatment capacity to meet the present demand.

- The existing WWTWs are to be evaluated to determine their capacity and upgrade requirements.
- It is imperative that they are operated and maintained as per design to realise their design life cycles.
- The conveyance network to these treatment works will need to be rehabilitated to ensure that all sewage reaches the treatment facilities.

The treatment facilities are to be upgraded to accommodate the existing population with no access to sanitation services. In addition, they must also accommodate the anticipated increase in population densification in the current precinct. Treatment facilities that are constructed in the flood plain should be protected from flooding if possible or converted to marine outfall sewers with the required prior treatment.

(ii) Future Treatment Capacity

It is anticipated that all future developments will be serviced with water borne level of sanitation. The sewage that is generated will be treated at designated wastewater treatment facilities.

Accra's topography ranges from coastal plains in the south east, with some areas lying below sea level, to hilly formations in the west. As a result of this, decentralised treatment facilities will be a suitable solution to accommodate the generated sewage.

The size and location of the decentralised treatment facilities will be determined by the size and characteristics of the development catchments and topographies.

There are various treatment technologies to be considered such as membrane reactors, sequence batch reactors, activated sludge and wetlands. The technologies to be implemented will be determined by the location of the treatment facilities and required treated effluent standards to be met. In the coastal low lying areas, marine outfall sewers may be a feasible solution to cater for required treatment capacity.

The sewage that is generated will be treated to international standards that prescribe the level of treatment required before discharging to water resource bodies. The intention will be to minimize the negative environmental impact of the treated effluent on the receiving water bodies. This treated effluent can also be treated to specific standards that will make it possible to be reused for agricultural, industrial or irrigation purposes. This will benefit Accra in that the demand for potable water supply by the sectors use the reclaimed water will decrease.

The solid waste that is generated from the treatment facility can be further treated to generate methane gas which can be converted to electrical energy. This energy can be used to operate the treatment facility and consequently decrease the energy supply demand by the facility. In addition to this, the same waste can be further treated to produce compost that can be used in the agricultural sector.

4.2.6 Current Projects and Recently Completed Projects

To solve the sewerage and sanitation problem, the Accra Metropolitan Assembly received funding from African Development Bank (AfDB) and Government of Ghana (GoG) for the implementation of the Accra Sewerage Improvement Project (ASIP). The following have been completed under the project (Accra Metropolitan Assembly: 2014-2017 Medium Term Development Plan):

- Construction of the Legon Waste Water Treatment Plant (6 424 m³/day) inclusive of an 8km pumping mains.
- Construction of Four Sewage Transfer Pumping Stations associated with the treatment plant (two at Presec-Legon, one at University of Ghana and one at Accra High School).

- Construction of Septage Dewatering Plant behind the Fire Service Training School, Accra in order to decommission Lavender Hill.

On-going projects include:

- Rehabilitation of the Mudor Waste Water Treatment Plant (18 000 m³/day) (expected to be completed by end of the first year of plan 2014).
- Construction of 18 water closet institutional toilet facilities (expected to be completed by end of first year of plan period 2014).
- Construction of 60 mechanised boreholes for the toilets constructed in schools, institutions and communities (expected to be completed by end of first year of plan period 2014).

4.2.7 Main Findings – Sewerage and Sanitation

The main findings pertaining to sewerage and sanitation engineering services follow:



SEWERAGE AND SANITATION FINDINGS

- Limited Households have WCs, VIPs or KVIPs.
- Indiscriminate defecation and dumping in public spaces is a major issue across the board.
- Sanitation facilities include both public and private ablutions, where households without private facilities use public facilities.
- There is a Community Based Rural Development Project for the construction of water and sanitation facilities in selected communities.
- There is inadequate budgetary allocation for sanitation due to limited resources.

The following strategic elements need to be considered to ensure that the sewerage networks in the GAR are functioning optimally and that building blocks are in place to support the SIP:

- Reducing the practice of open defecation across the entire region by introducing more public toilet facilities.
- Maintaining existing sewerage infrastructure effectively and ensure that there are funds available year on year for basic maintenance on treatment plants.
- Reducing blockages in pipelines as and when these occur.

-
- Upgrading existing facilities to cater for existing and future demands.
 - Ensuring lower service rates for low-income households.
 - Compiling a Sewer Master Plan for GAR.

4.3 Stormwater Infrastructure

The Hydrological Services Department (HSD) is responsible for the programming and coordination of coastal protection works, the construction and maintenance of stormwater drains countrywide and the monitoring and evaluation of surface water bodies in respect of floods.

During prolonged and heavy rain storms water from urban and surrounding hilly areas drain into the sea. There are various drainage basins (including watercourses) in and around the GAR although the majority of the basins are not lined.

With the expansion of the urban footprint, vast areas of previously open and undisturbed land have now been transformed into impermeable areas. The loss of permeability has resulted in increased volumes of stormwater run-off, which will surely increase flooding frequencies and the subsequent damage to infrastructure.

The GAR has an underdeveloped drainage network and, consequently, solid waste that remains uncollected often finds its way into open drains and natural water courses causing severe blockages, flooding and pollution.

For instance, in Accra there has been an increase in the construction of residential properties below Akwapim Hills, when this area should have been used as detention basins for stormwater management.



Figure 4.9: Natural Stormwater Channels filled with Solid Waste



Figure 4.10: Odwa Channel, Accra choked with garbage

Stormwater management is exacerbated by the fact that the capacities of the constructed drains are limited by their size and that they are sometimes silted or choked with refuse. A project to upgrade the city's drainage and flood mitigation was undertaken in 2013. However, it is unclear how far the project has progressed. General maintenance on the Accra stormwater drains seems to be an ongoing issue for the city. Refer to the figures below.



Figure 4.11: Flooding in Accra during 2014 and 2016

The majority of the drainage issues in the GAR can be attributed to poor maintenance on existing drainage, the lack of proper drainage in urban areas and the poor planning and design of stormwater facilities.

4.3.1 Main Findings – Stormwater

The main findings pertaining to stormwater engineering services follow:



STORMWATER FINDINGS

- The majority of the drainage issues in the GAR can be attributed to poor maintenance on existing drainage, the lack of proper drainage in urban areas and the poor planning and design of stormwater facilities.
- The Hydrological Services Department (HSD) is responsible for the programming and the coordination of coastal protection works, the construction and maintenance of stormwater drains countrywide and the monitoring and evaluation of surface water bodies in respect of floods.
- Indiscriminate dumping of solid and liquid waste into the stormwater system.

The following strategic elements need to be considered to ensure that the water

network in the GAR is functioning optimally and that building blocks are in place to support the SIP:

- Effective maintenance of the exiting stormwater system.
- Educate residents on the effects and causes of dumping solid waste into the stormwater systems. Encourage communities to participate in cleaning areas in and around stormwater channels.
- Introduce a maintenance program to clean and desilt the major channels prior to the rainy season.
- Increase permeable areas and natural vegetation and reduce occupancy of low lying areas and floodplains.
- Develop a Stormwater Master Plan for the entire region.

4.4 Solid Waste Infrastructure and Services

Solid waste management is one of the most challenging and contentious issues in the GAR. In a citywide survey conducted in 2010 in Accra, solid waste management was viewed by residents as the third-most important urban service, behind sanitation (including toilets) and drainage (*World Bank, 2010*).

Due to sprawl and uncontrolled development in the urban areas refuse collection companies are finding it difficult to access many of the areas. As a result small informal dump sites have emerged in all places as shown in the figures below. These informal solid waste disposal sites include abandoned stone quarry sites, gouged natural depressions in the ground, old mining areas, or man-made holes in the ground. Open burning occurs at some of the open dumps, particularly during the dry season. Dumping of solid waste in open drains is problematic as illustrated in the figures below. In low income areas, community bins are constantly overflowing as a result of delayed or the absence of institutional collection mechanisms (*Urbanization and Flooding In Accra, Ghana - by Kizito Afeku*).

4.4.1 Solid Waste Sites

There are a couple of official landfill sites currently in operation in the Greater Accra Region namely:

(a) Nsumia Landfill (New)

As part of an effort to manage disposal of waste in Accra and elsewhere in the country, a new landfill site, known as the Nsumia Waste Disposal Site, has been completed and is ready for use. The site, located in the Nsawam-Adoagyiri Municipality off the Accra Nsawam highway, has a capacity of about 680 000m³. It is estimated that the site can take about 1,000 tonnes of solid waste daily (wastelandfill.com.gh).

(b) Tema/Kpone Landfill (Existing)

Located in Tema MA, the Kpone Landfill site (in operation since 2013) is a well-engineered landfill site (total area 17 hectares) with four cells (2.5 hectares each), an anaerobic pond and two facultative ponds (for leachate treatment) and a hazardous waste section. The site has been developed by TMA with financial support from the Worldbank. About 1,500 T/day reach the landfill from all sections of greater Accra, equivalent to 100 to 150 truckloads/day. Expansion and construction of new cells at the Tema landfill are planned. A feasibility study and EISA are ongoing. (Ghana Netherlands Water Programme - GNWP Closing Conference, Friday 26 June 2015)

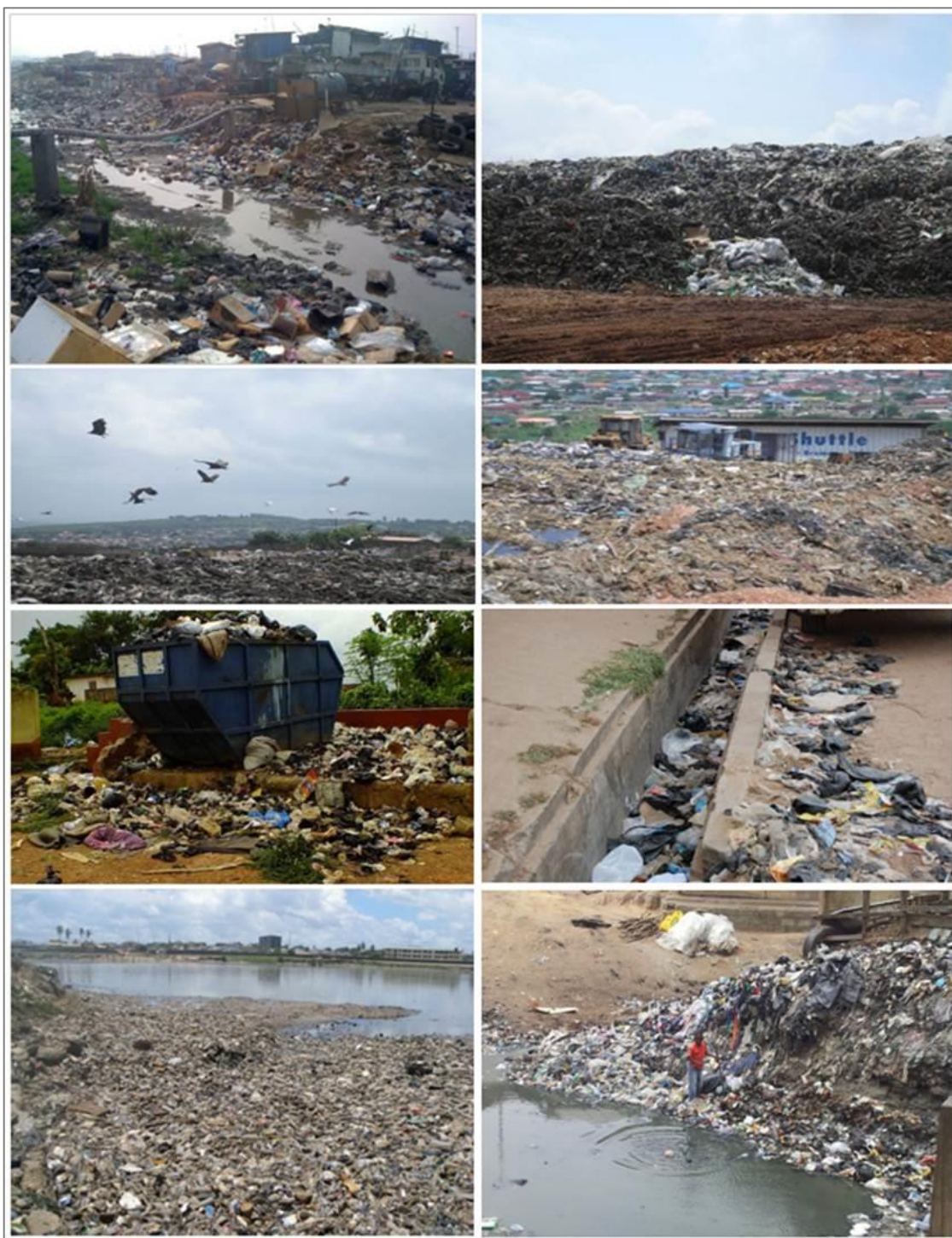


Figure 4.12: Informal Dump Sites on Open Land, Streams and Stormwater Channels

Solid waste collection in GAR is mostly privatised. However, some of the assemblies have contracts with waste collection firms that are responsible for all residential, commercial and industrial waste generated in their respective collection districts. Other waste disposal methods include door to door collection, burning and burying, designated public dump sites and illegal dumping. Waste collection is generally managed by the local municipalities and not on a region basis.

4.4.2 Challenges Regarding Solid Waste Management

The GAR faces the following challenges regarding solid waste management:

- Lack of funds to address the solid waste problems;
- Environmental regulations are not strictly enforced;
- The authorities responsible for solid waste management find it difficult to enforce regulation dealing with the environmental issues;
- Solid waste is dumped indiscriminately and irresponsibly in various places like street corners, stormwater drains and open areas;
- Poor management in collecting, transporting and storing of solid waste; and
- Land ownership.

4.4.3 The status of solid waste infrastructure in the various assemblies

The following table indicates the status of solid waste infrastructure per assembly in the GAR. The aforementioned information was mainly derived from the Medium Term Development Plans of the various assemblies and from the responses received during the workshop dated 17 November 2016.

Table 4.7: Status of Solid Waste Infrastructure and Services for all assemblies in GAR

Assembly	Status of Waste Infrastructure and Services
The Ga South MA	• Door to door refuse collection by waste management contractors. • Indiscriminate dumping in some public places still occurs.
The Ga West MA	• Proper management of solid waste is an issue.
The Ga East MA	• Approx. 385 tonnes of solid waste is generated monthly of which 261 tonnes (67%) is collected. • The remaining waste causes various backlog and health issues. • 81% of 261 tonnes is collected through door-to-door collection, with the rest being collected in containers placed at strategic points for collection.
The Accra Metropolitan Assembly	• 3% of plastic recycling and 80% of metals recycling is done by the informal sector. • The municipality generates approx. 3 000 tonnes of waste daily and is able to collect 2 500 tonnes, which leaves a huge backlog. • Five hundred and fifty thousand Ghana Cedis a month are needed to pay waste contractors and maintain the landfill site. The cost of payment being the highlighted problem facing the municipality. • 41% of households have been registered for the provision of a household bin, but only 33.4% have received the bins. • 10 new compaction trucks and 20 waste (Bola) taxis were acquired to lift solid waste as well as alleviate the financial burden of waste removal on the municipality. • The waste-to-energy project will transform waste to electrical energy. 60 000 tonnes of waste will generate 50MW of electricity and will be connected to the national grid.
The Adenta MA	• 28 200.48 tonnes of solid waste is generated annually, of which 17 801.28 tonnes (63.2%) is collected.

Assembly	Status of Waste Infrastructure and Services
	• Daily waste is at 83.93 tonnes of which 53.98 is collected. • The municipality generates mostly plastic waste which can be recycled, hence there is a need for a recycling plant in the municipal area.
Ledzokuku - Krowor MA	• Waste management was highlighted as a priority. • Waste management done by the Municipality together with Zoomlion Company. • High levels of crude dumping and burning which consists of 20% of solid waste disposal methods for households. • 67% and 46% of public schools and industrial sites use crude dumping. • Collected waste is sent to semi-controlled land fill sites outside the municipal area.
Ashaiman MA	• The assembly benefits from an organized system of refuse collection and there are pockets of refuse dumping sites in the municipality. Despite this, there is still a serious refuse disposal problem. • Waste includes plastics and household waste which is indiscriminately disposed of, as most communities lack a final disposal point. • Inadequate refuse containers. • Some residents dispose of waste through burning or burying.
Tema Metropolitan Assembly	• The assembly is privileged to have an Engineered Landfill Site constructed under the Urban Environmental and Sanitation Programmes in 2011 located at Kpone. • The facility serves many other districts in the GAR. It is overburdened to the extent that its life span is threatened. • The metropolis has a solid waste collection system which involves the private sector. • Solid waste is disposed of at the Waste Treatment Plant in Kpone. • Residents complain that refuse trucks do not come on time and are irregular. • Unemployed children called “boola-boola” go from house to house with wheel barrows to collect refused for an undefined fee. This system proves quite effective.
Shai-Osudoku DA	• The majority of households (34.6%) dispose of their solid waste through the burned by household method. • 31.2% of households use the public dump (open space) method. • 13.5% of households use public dump (refuse container) whilst 10.5% dump their solid waste indiscriminately. Only 5.5% of households have their solid waste collected.
Ada West DA	• Residents generate an estimated average of 0.2 Metric tonnes of solid waste daily which translates into 67.2 Metric tonnes annually. • Only 9.6% of households have their waste collected from their dwellings. • 29.7% of the households have their waste burnt, 39.4% use various household receptacles for storage which are sent to the designated public dump (open space). Incidentally, only 6.5% of the households send their solid waste to the public containers for disposal. • Data indicates that 3.3 % of households bury their waste while 10.5% of households dump at unspecified locations including drains, embankment of water courses and wetland. • The communal containers are inadequate. In most communities, they do not have access to well organised waste disposal and therefore many resort to indiscriminate solid waste disposal or sometimes burning.
Ga Central MA	• Solid waste collection is undertaken by private service providers. Only the waste of households who are registered with these service providers is

Assembly	Status of Waste Infrastructure and Services
	collected. - Refuse is dumped at the following dumping sites Adjen Kotoku, Pantan, Kpone (Tema). - There is a need for the assembly to initiate steps to identify and acquire land for the development of an integrated final disposal site for both solid and liquid waste. - The assembly has engaged the services of five private solid waste collection contractors, who use various types of equipment for the collection and transportation of solid waste. - Solid waste collected from the assembly is disposed of at a dump near the Pantang Hospital in the Ga East Municipality. This area is suitable but is poorly managed.
La Dade-Kotopon MA	- Lack of awareness of the negative impact of improper disposal of waste i.e. solid, liquid, e-waste on the environment. - Inadequate waste collection points, bins, vehicles, etc.
La Nkwantanang-Madina MA	No information available.
Kpone-Katamanso DA	- Residents dispose of solid waste mostly at the public dump (refuse containers). 32% of households use the public dump (container) to dispose-off waste. 29.2% of households also use the collection method and 5.2% dispose of their rubbish indiscriminately. - The district has a landfill site that currently serves the district, Tema Metropolis, Accra Metropolis and Ashiaman Municipality. - Even though the landfill site is situated in the District, the assembly has no control over it as it is managed by Tema Metropolitan Assembly and Zoomlion. - The assembly houses a myriad of industries and therefore has problems with industrial waste. - About 10% of these industries do not properly treat their waste before disposal
Ningo-Prampram DA	- Refuse and household waste are disposed of indiscriminately, with more than half of the population having no access to organised means of waste disposal. Waste continues to be dumped and burned. - Reasons for the decline is inadequate funds for heavy investment in sanitation management (refuse trucks and containers), inadequate and poor drainage systems and generally negative attitudes towards achieving a clean environment. - With the presence of Zoomlion and the gradual injection of waste collection equipment and trucks, it is hoped that the sanitation situation in the assembly will improve over time.
Ada East DA	Availability of public-private partnership in solid waste management such as Zoomlion and Eco-Brigade.

4.4.4 Results of Poor Solid Waste Management

The indirect negative effect of having poor solid waste management includes the following:

- Rotting or contaminated food exposed to the environment;
- Medical instruments not properly disposed of with an increased risk and spread of illness/disease;
- Uncontrolled waste dump site will attract insects like flies and vermin to these contaminated areas, this can pose serious health risks;
- Solid waste becomes a breeding ground for micro-organisms that have an adverse effect on human and livestock health;
- Water contaminated with solid waste can further degrade the water quality of existing river systems and pose a serious risk on human health;
- Improper management of solid waste reduces the aesthetics of the local area and pollutes the surrounding environment;
- Inherently the pollution of water resources results in the increase in cost in treating raw water;
- Insanitary conditions caused by the clogging of drains lead to water related diseases;
- Choked drains reduce the capacity of stormwater drains resulting in flooding during heavy rainstorms; and
- The projected increase in population in the GAR will result in the increase in solid waste production in the region. Solid waste management will need to be revised to accommodate increase solid waste production.

Ultimately if solid waste is adequately dealt with at source, the quality of water in streams, rivers, dams and the ocean will improve. This in turn will improve the health of the region, reducing water borne related diseases and reducing the impact of flooding during major rain events. (D6.1.2b Integrated Urban Water Management in Accra – SWITCH Report - 31st August 2010)

4.4.5 Sustainable Solid Waste Management

Sustainable solid waste management principles can be initiated in the GAR, through the interventions highlighted in the waste hierarchy pyramid. The figure below shows the waste hierarchy pyramid, extracted from “Examining Waste-To-Resources Potential From Municipal Solid Waste: Evidence From Pantang Dumpsite In Accra, Ghana” (2016)

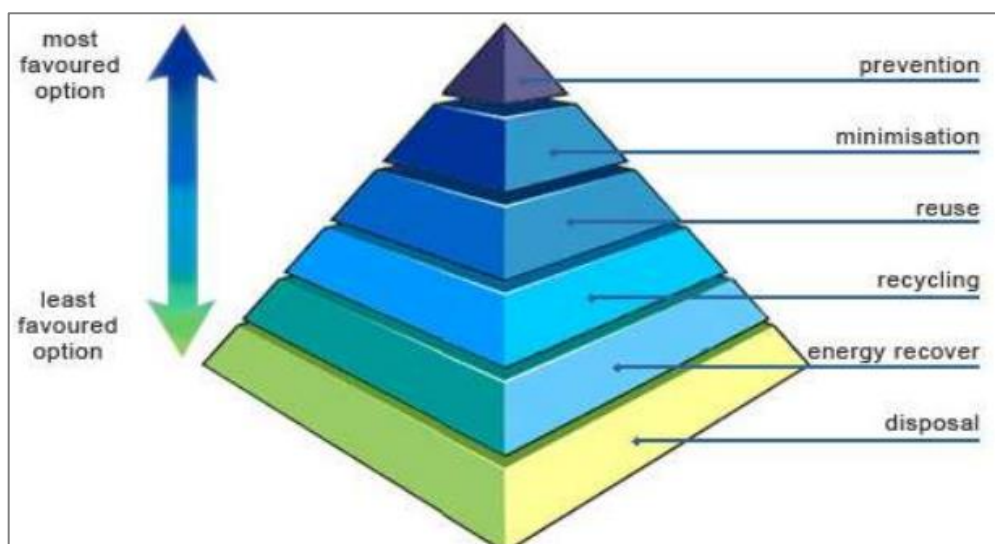


Figure 4.13: Waste Hierarchy Pyramid

The solid waste hierarchy is an international accepted guide for prioritising waste management practises. The aim is to eliminate waste being generated, then to optimize solid waste material before it is disposed of and lastly to dispose of unwanted waste in a cost efficient and environmentally friend way. Through these interventions the negative direct and indirect effects on the environment, surrounding infrastructure and human health is minimised, and in the process reduce resources and costs reserved for waste management.

4.4.6 Recycling

Recycling was highlighted as a priority by most of the assemblies primarily because of the high volumes of recyclable waste.

An initiative that is emphasised in the GAR is the Accra Compost & Recycling Plant (ACARP) that was established to receive, sort and produce high quality organic compost from municipal solid waste for agricultural purposes in Ghana and the sub region. The photos below provide some visual illustrations of the plant.



Figure 4.14: Accra Compost & Recycling Plant (ACARP)

ACARP is an integrated waste processing and recycling company established to collect, sort, process and recycle solid and liquid waste, and produce organic manure for agronomic purposes in Ghana and West Africa. The plant is operated by Zoomlion which is a public-private partnership with the government. One of the three waste recycle plants in the

country is situated in Accra. The waste recycle plant in Accra has an estimated daily capacity of 300 tonnes.

4.4.7 Estimated solid waste generation

The table below is based on the following assumptions:

- The waste generation rates were quoted from the Urban Development for the 21st Century (2016). Three different waste generation figures are quote in the reference document. All three rates were used in the table to illustrate the estimated range of waste that can be expected over the next 20 years.
- The population figures, reflected in Section 7 of this report, were used to determine the total solid waste generation in GAR.

Table4.8: Estimated Growth in Solid Waste Generation

GAR Population Growth vs. Solid Waste Generation			
Waste Generation Rates (kg/day/capita)	2017 (5 055 348)*	2027 (7 057 855)*	2037 (9 887 131)*
	kg/day	kg/day	kg/day
WRI 2007 (0.41 kg/day/capita)	2 072 692.68	2 893 720.55	4 053 723.71
MLGRD 1999 (0.51 kg/day/capita)	2 578 227.48	3 599 506.05	5 042 436.81
CHF International 2010 (0.81 kg/day/capita)	4 094 831.88	5 716 862.55	8 008 576.11

* Population Growth

Based on the high level estimated waste generation shown in Table4.8the table above and the estimated recycling taking place described in **Section 4.4.6**, it is evident that only a fraction of daily waste is recycled.

4.4.8 Main Findings – Solid Waste

The main findings pertaining to solid waste engineering services follow:



SOLID WASTE FINDINGS

- Due to sprawl and uncontrolled development in the urban areas refuse collection companies are finding it difficult to access many of the areas.
- Waste is mostly collected door to door by private waste management

contractors.

- Indiscriminate dumping occurs in public spaces.
- A substantial amount of waste is generated in each assembly with an approximate 60% collected, leaving a constant backlog.
- Disposal methods include dumping at designated landfill sites (formal and informal), crude dumping and burning.
- In some areas drainage facilities are choked with solid waste.
- Houses which are registered for waste collection receive priority.
- Access to informal settlements are limited, therefore waste collection is only sporadic.
- The net effect of poor solid waste management in the region is directly related to the pollution of water resources and the clogging of waterways and drains.
- Only a fraction of waste generated per day is recycled.

To improve living conditions and reduce the risk of contamination and spread of disease through lack of solid waste collection, the following should be considered:

- Strategic planning regarding waste disposal site locations. This should be done at a regional level.
- Ensure proper maintenance and operation of all waste disposal sites.
- Incorporate informal Waste Picketers as part of the recycling process, instead of marginalising these groups.
- Expand the recycling initiative for reusable items. This will significantly reduce the amount of waste ending up on landfill sites.
- Ensure waste collection is done on a routine basis, preventing bins overflowing and waste ending up in rivers, streams and drainage channels.
- Recycling should start at source. A collection of bins should be provided to communities to enable them to sort the waste in different categories before it is collected. Recycling is a lifestyle.
- Encourage communities to participate in cleaning up efforts in and around their own communities.

4.5 Communication Infrastructure and Services

4.5.1 Fixed and Mobile Telecommunication

The GAR is well serviced by fixed line telecommunication as well as mobile service providers. There is a greater presence of mobile service providers within the city centres compared to that in the outlying areas.

The mobile phone market in Ghana is one of the most developed in Africa. Most Ghanaians own a mobile phone and prefer mobile to fixed phone line or internet access.

Ghana is serviced by nine telecommunications operators. The majority of these are mobile operators with only two listed with fixed line capabilities.

Table 4.9: Ghana – Telecommunication Services Providers

Service Provider	Service
Airtel	Mobile
Expresso	Mobile
Glo Ghana	Mobile
Millicom Ghana (Tigo)	Mobile
MTN Ghana	Mobile
Vodafone (Ghana Telecom)	Fixed Line & Mobile
Teligent Wireless	Fixed Wireless Services
Mobile Choice	Mobile
Gateway	Fixed Line & Mobile

2G covers almost the majority of the country, including much of the Ghanaian countryside. 3G coverage is quite new in Ghana and seems to be limited to the main cities. MTN started with 4G LTE tests in Ghana with the aim of launching the service in the 3rd Quarter of 2017. According to MTN, 4G services are now available in every regional capital and some large towns. Vodafone initially indicated in June 2016 that they are not going to rush into the 4G market as yet. They later revised their stance indicating that they will be upgrading their systems to allow faster internet access. It is unclear if Vodafone has entered the 4G market

Ghana Telecommunications Company Limited, a telecoms company, provides mobile, fixed line, internet, voice and data solutions. The company was founded in 1974 and is headquartered in Accra. As of August 2008 Ghana Telecommunications Company Limited operates as a subsidiary of Vodafone Group Plc.

4.5.2 Fibre Optic Networks

Various International companies, consortiums and local companies are funding the installation and expansion of fibre optic cable within Accra. Google announced in 2015 that it was installing fibre optic in the Accra and Tema areas under a project called Project Link. Various other companies including the main Telecommunication Airtel, MTN, Glo Ghana and Vodafone have started introducing fibre optic networks throughout Ghana including Accra.

The Google program, “Project Link”, will consist of over 1000 km fibre. The figure below gives a high-level overview of the Google fibre network available in the Accra Region. (<https://www.google.com/get/projectlink/>)

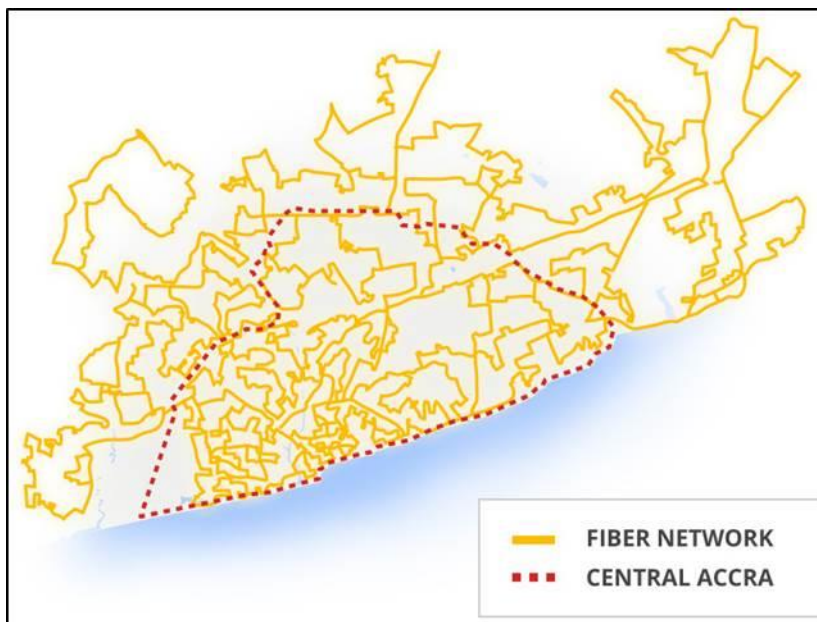


Figure 4.15: Google Optic Fibre Network - GAR

Vodafone, MTN and Glo Ghana have also embarked on installing fibre optic cables in and around Ghana inclusive of the Accra Region.

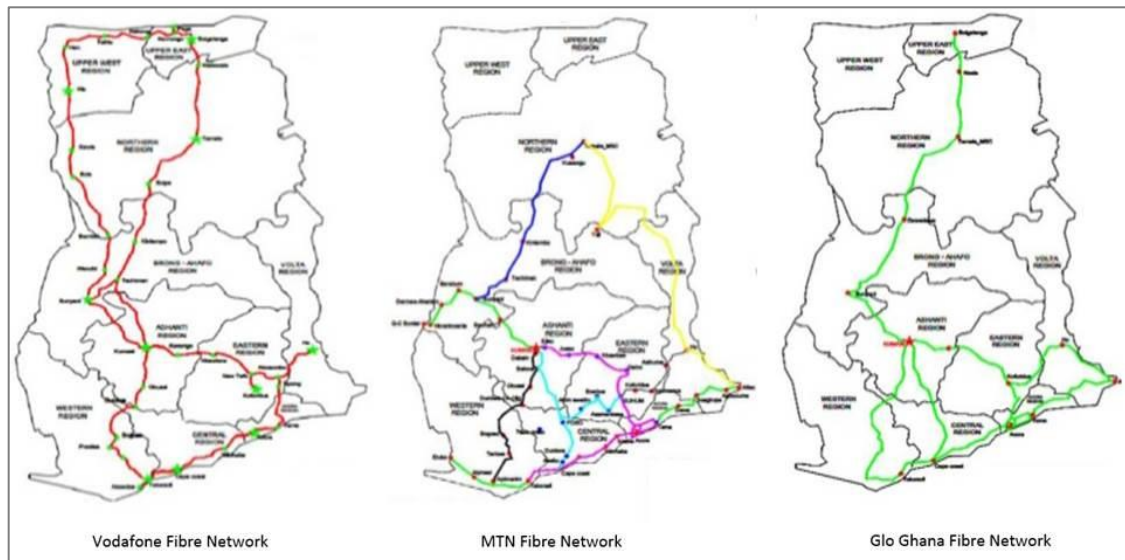


Figure 4.16: Vodafone, MTN and Glo Ghana Fibre Optic Networks (Wireless World Research Forum)

4.5.3 Submarine Internet Cables

The following submarine cables services are available in Ghana and the landing points are concentrated in Accra. The figure that follows gives an overview of the submarine internet cable routes in and around Ghana. (Global Bandwidth Research Service - www.submarinecablemap.com):

- West African Cable System (WACS)
- Glo-1
- SAT-3/WASC
- Main One
- Africa Coast to Europe (ACE)

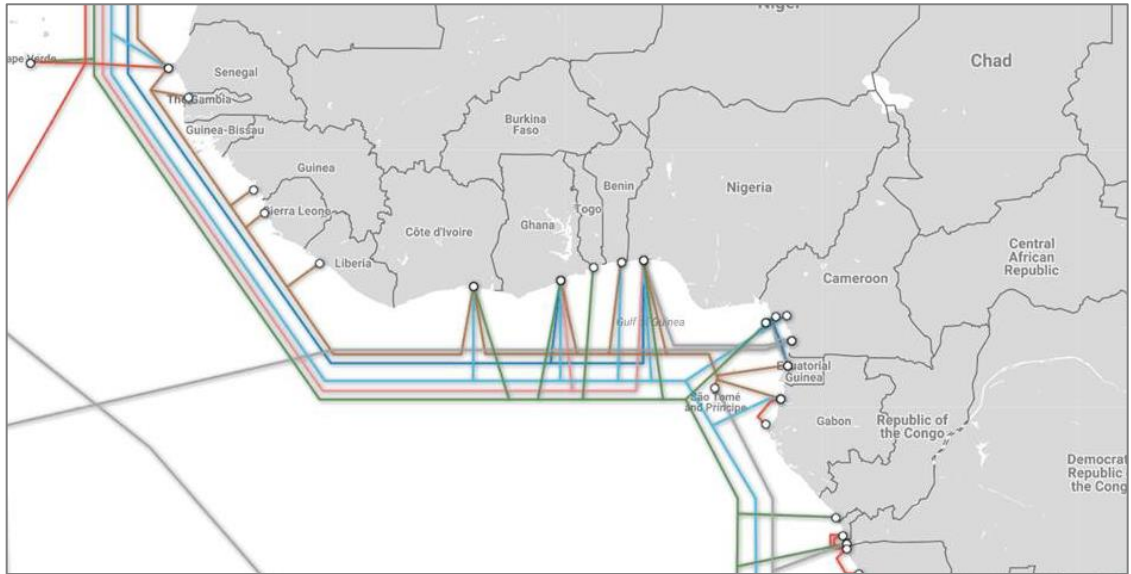


Figure 4.17: Submarine Internet Cable Network

4.5.4 Main Findings – Communication

The main findings pertaining to communication engineering services follow:



COMMUNICATION FINDINGS

- The GAR is well serviced by fixed line telecommunication as well as mobile service providers.
- The mobile phone market in Ghana is one of the most developed in Africa.
- 2G coverage is commonly available while 3G coverage is still quite new and limited to the major urban centres.
- 3G coverage is quite new in Ghana and seems to be limited to the main cities.
- Mobile technology is constantly advancing, expanding and increasing.
- Various International companies, consortiums and local companies are funding the installation and expansion of fibre optic cable within Accra. These companies include Google, Vodacom, Glo-Ghana and MTN.

4.6 Energy Infrastructure and Services

The scope of the electrical technical study is for the GAR only. Services covered only include bulk level services at main transmission level as well as some limited scope at bulk distribution level.

Although some limited information was collected at MV distribution level, it does not form part of the scope of the study.

Various meetings with stakeholders were held as part of the information gathering process. The minutes and attendance registers for these are included as part of **Appendix A**.

The aim of this status quo analysis was to:

- Discuss the method applied for information gathering;
- Discuss any information gaps and how to address them;
- Present data collected on existing services in the region;
- Present data and analysis of capacity and levels of service;
- Identify future electrical infrastructure plans within the region; and
- Make recommendations on the way forward.

The above six deliverables allow for the project team to determine a status quo profile of power and energy in the region, which will assist in defining infrastructure requirements / gaps with regards to the RSDF going forward.

4.6.1 Input Information Collection

The approach and methodology was based on inter alia:

- Literature reviews of information from various stakeholders within the power and energy sector (i.e. VRA, ECG, Energy Commission and GRIDCo).
- Various meetings with stakeholders and officials from the above mentioned stakeholders.
- Review of national strategic information and documents from stakeholder websites and databases.
- Input from fellow RSDF team members including the town planning documents.

4.6.2 Input Information Gaps

- Energy Commission (EC):
 - EC officials requested a letter to verify the GIBB appointment prior to releasing data and information. The required information has, as yet, not been received.
 - There is outstanding information from the Energy Commission that was promised yet still not sent, including licensed generation plants, locations and capacities. An

email requesting such was sent to appiahfk@energycom.gov.gh on 26 October 2016.

- The next Strategic National Energy Plan is due for publication in December 2016. GIBB team will follow up with EC to obtain this document.
- VRA (Volta River Authority):
 - No engagement with VRA as yet, permission from CEO to engage officials still outstanding. Once permission is obtained, the power & energy team can engage VRA officials.
- Energy Foundation (EF):
 - No engagement with EF as yet. No contact details available. Possibly Energy Commission officials (Mr FK Appiah) can be of assistance with referrals.
- Gaps arising from received information:
 - ENCLAVE POWER is a distributor only within Tema Freezones Area as well as DAWA Industrial Park. At some point it may be necessary to engage them.
 - Gas and petroleum supply and demand information may be necessary through the Energy Foundation and Energy Commission. Particularly if some proposed developments cannot be serviced via the electricity grid.

4.6.3 Network and Service Areas

The primary stakeholders within the power and energy sector are indicated in the accompanying figure. In particular ECG (The Electricity Company of Ghana) is the licensed distribution utility within the southern part of Ghana including GAR. NEDCo distributes to the remaining northern parts of the country.

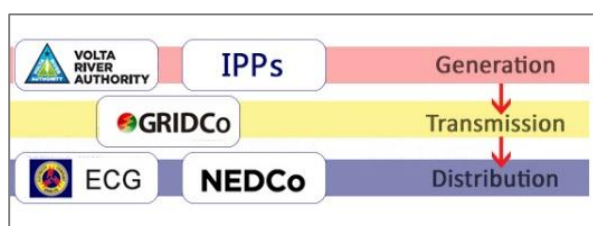


Figure 4.18: Illustration of Power & Energy Sector in Ghana
- source GRIDCo website

There are three main generation categories identified that supply the GAR namely Thermal, Hydroelectric and Solar Power Stations. At generation level, GAR has access to two hydroelectric plants and four thermal plants within the eastern Tema enclave. These generators are further complemented by thermal power plant generators in the western (Aboadze/Takoradi) enclave. No large scale grid connected PV plants were identified within the GAR. There is a large scale grid connected solar power plant just outside of Greater Accra Region providing 20MW directly into the local distribution network. This plant falls outside GAR.

The current system generators accessed by Greater Accra Region via GRIDCo transmission lines are as follows:

Table 4.10: 2016 Status Quo System Generators relevant to GAR as per GRIDCo data

Generator	Installed Capacity MegaWatt (MW)
Eastern Enclave (Tema)	
SAPP - Sunon Asogli Power Plant (161kV)	180
SAPP - Sunon Asogli Power Plant Phase (330kV)	360
Karpower (Tema)	225
Kpone Thermal (KTPP)	200
CENIT Energy Limited (Private)	110
Tema Thermal: 1 Power Plant	110
Tema Thermal: 2 Power Plant	20,50
Total	1205,50 MW
Eastern Hydro	
Aksomobo GS	1020
Kpong GS	160
Total	1180
Total Generation accessed by Greater Accra	2385,50 MW
Western Enclave (Aboadze/Takoradi)	
TAPCo	330
TICo	330
AMERI	250
Total Complement Generation	910 MW

It is important to note that although GAR has access to the above tabulated generation plants, the full capacity is not solely reserved for GAR but is shared with other regions nationally. There is no dedicated generation plant for GAR, but supply is shared nationally depending on location and demand among other factors. That means that at any single point in time the supply into GAR can be from one of the listed plants or a combination of them.

Plan 4.2 on the following page is a GIS layout indicating the GAR's generators and transmission lines as per **Table 4.10** above.

Plan 4.2: GIS Layout indicating the Generators as per Table 4.4

There were no large-scale solar *grid connected* PV plants identified within GAR. The Gomoa/Onyandze Solar Plant outside the eastern border of Greater Accra provides 20MW

directly into the ECG distribution network. The PV plant is connected to the ECG substation at the Winneba roundabout which falls outside the GAR region

The Energy Commission of Ghana maintains various solar powered facilities nationally. From the total list of 23 national facilities, 16 are within GAR. The GAR facilities only account for 14% of the total combined capacity across all facilities. The list of GAR solar power facilities as extracted from the Energy Commission's full list is included in **Table 4.11**.

Table 4.11: GAR List of Solar Powered Facilities (Extracted from Energy Commission's National list)

Sn.	Region	District Assembly	Institution	Locality	Installed Capacity	Latitude	Longitude	Date Installed
1.	Greater Accra	Accra Metropolitan Assembly	Ministry of Energy	Accra	50	05.5514N	000.2008W	1 Jan 1998
2.	Greater Accra	Accra Metropolitan Assembly	Energy Commission	Accra	4.25	05.5975N	000.1829W	1 May 2008
5.	Greater Accra	Ga-East	Valley View University	Oyibi	8.36	05.7974N	000.1224W	1 May 2010
6.	Greater Accra	Ga-East	Presby Women's Centre	Abokobi	4.18	05.7386N	000.2046W	1 May 2010
8.	Greater Accra	Accra Metropolitan Assembly	V. Attafuah - Residence	East Airport, Spintex Rd, Accra	4.18	05.6227N	000.1416W	1 May 2010
9.	Greater Accra	Accra Metropolitan Assembly	V. Adomako - Residence	Dzowulu, Accra	4.18	05.6154N	000.1950W	1 May 2010
10.	Greater Accra	Tema	S. Adjei - Residence	Tema	4	05.6431N	000.0151W	1 Sep 2011
12.	Greater Accra	Ledzokuku	Abdulai - Residence	Tesijriganor	3.29	05.6413N	000.1343W	1 Nov 2011
13.	Greater Accra	Ga-East	Trade Works Company Ltd (Office)	South Dome	10.575	05.6491N	000.2506W	1 Nov 2011
15.	Greater Accra	Adenta	O Asante - Residence	Fafraha-Ashyie	0.8	05.7357N	000.1465W	1 Dec 2011
16.	Greater Accra	Tema	Dr. George Puplampu Clinic	Sakumono	4	05.6304N	000.0751W	1 Dec 2011
18.	Greater Accra	Ningo Prampram	R. Marley - Residence	Prampram	4	05.7160N	000.1315E	1 Oct 2012
19.	Greater Accra	Tema	R. Tuffour - Residence	Sakumono	7.6	05.6306N	000.0564W	1 Oct 2012
20.	Greater Accra	Accra Metropolitan Assembly	Noguchi Mem. Institute, Uni. Of Ghana	Legon, Accra	315	05.6330N	000.1817W	1 Apr 2013
22.	Greater Accra	Accra Metropolitan Assembly	Residence installed by TW	West Legon	5.17			21 Jan 2015
23.	Greater Accra	Tema	Residence installed by TW	Emef Estates – Tema Mateheko	1.41			14 Dec 2015
TOTAL FOR GAR					430.995			

Plan 4.3 is an extract of Ghana's GRID map indicating all existing and planned generation plants and transmission line projects for Ghana including Greater Accra. Most of the transmission infrastructure is concentrated on the highly densified Accra and Tema load centres. This is further confirmed by the 2016 Electricity Plan which states that the national system peak demand for 2016 by customer type, indicates ECG demand constitutes 64% of the total system peak followed by Mines at 10%. VALCO potline represents 3%, NEDCO 8%, Exports to CEB (Togo/Benin) and SONABEL (Burkina Faso) 6%.

Plan 4.3: Ghana GRID Map

Similarly, **Plan 4.4** and **Plan 4.5** are geographical layouts of the ECG distribution network including bulk supply points (BSP's) based on the literature review of supplied information. ECG typically separates the eastern GAR (Tema) from the western GAR (Accra).

The ECG network layouts indicate a high concentration of services within and around Accra and Tema. Accra alone has two out of six bulk supply points for the region, with a further three more planned to the north, east and west of Accra. The bulk supply points form an east-west corridor along the Achimota, Mallam and Kasoa areas. These areas would be the easiest to service as high density zones due to their proximity to the grid bulk supply points. The high number of future planned substations (in blue) within an already large number of existing substations is continued proof of densification within Accra and Tema. Densification seems to favour the coast, which could prove costly and challenging from a services perspective if not strictly managed.

Areas in between Accra and Tema are not currently as intensely serviced with single BSP's covering larger areas. The green proposed future distribution lines are in support of the assertion by GRIDCo that demand projections will have a large component of the rural electrification projects and distribution expansion load centres.

Plan 4.4: ECG 33kV Geographical Layout of Accra East and West (Tema)

Plan 4.5: ECG 33kV Geographical Layout of Accra East and West (Accra)

4.6.4 Capacities and Levels of Service

(a) Supply and Demand

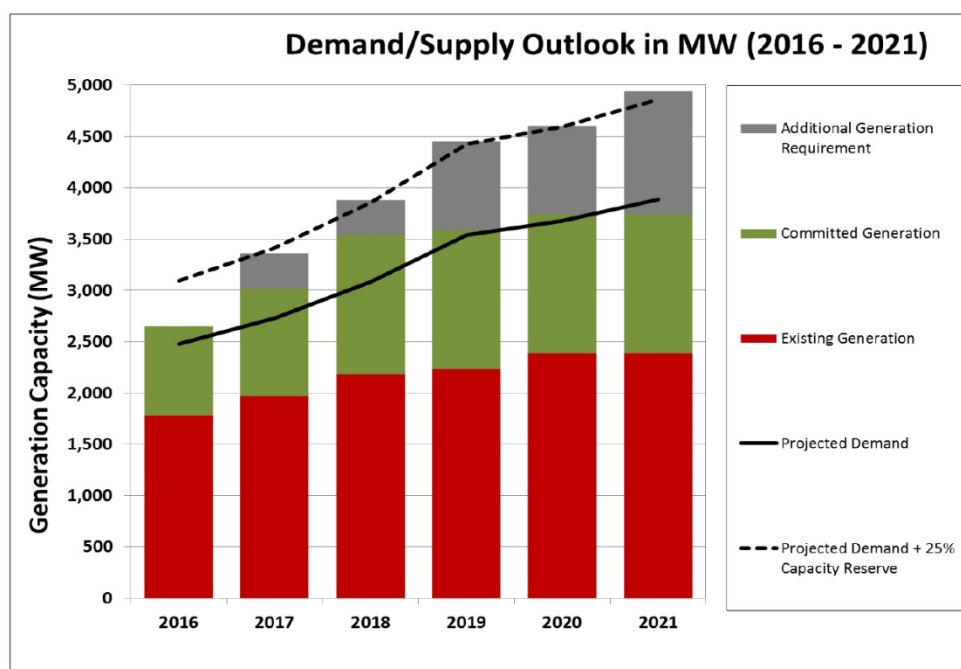
The 2016 Electricity Supply Plan for Ghana (ECG, GRIDCo & VRA, 2016:1) states: "The Ghana power system has been experiencing supply challenges since 2012. Efforts by government and stakeholders in the power sector have been made to resolve the power supply challenges."

In line with this, Karpowership Ghana Ltd. commissioned a 250MW power barge into operation in December 2015 while a number of additional generation projects are expected to come online early 2016. However, Akosombo hydroelectric generating station, which is the biggest generating station in the country, is recording very low reservoirs, which requires its output in 2016 to be limited.

Recalling that there is no dedicated generation plant for GAR and that generation infrastructure is shared nationally, it can be concluded that capacity challenges at the power plants listed in **Table 4.10** (Eastern Enclave and Eastern Hydro) translate into capacity challenges in the GAR.

- According to the 2016 Electricity Plan for Ghana (ECG, GRIDCo & VRA, 2016:1), the projected Base Case coincident peak demand for year 2016 is 2,477 MW, which represents an 8.5% growth over the 2015 projected peak demand of 2,282 MW. Assuming one potline operation at VALCO. The projected energy consumption for 2016 is 16,798 GWh, however only 16,448 GWh is expected to be supplied. The remaining 396 GWh would have to be shed mainly during the first two months because of expected supply deficit in 2016. The national challenges in supply capacity affect the supply capacities in the GAR since generation plants are shared across regions nationally.
- The Ghana power system will have a low reserve margin in 2016 which means when units are out for maintenance the system will be prone to inadequate supply.
- Total electricity consumption of the Ghana power system including exports to Togo, Benin and Burkina Faso, and Mali (from 2019) is projected to increase from 16,798 GWh in 2016 to 27,344 GWh in 2021 at a Compound Annual Growth Rate (CAGR) of 10.2%. The system peak demand is projected to increase from 2,477 MW in 2016 to 3,886 MW in 2021. The projections indicated a continued lag in supply relative to demand as shown in the graph below. (2016 Electricity Plan for Ghana; ECG, GRIDCo & VRA; 2016:1)

Graph 4.1: Demand/Supply Outlook 2016-2021 as per Ghana Electricity Plan



- The recommendations of the 2016 Electricity Plan for Ghana (ECG, GRIDCo & VRA, 2016:42) show that for power and energy to support development, continued

investment in additional generation and the associated transmission and distribution infrastructure must occur. If the new projects come online as planned from 2017-2021, and based on the expected generation and additional generation requirement, the power system would meet the minimum generation capacity reserve margin of 25% from 2017 onwards.

- “Load Flow analysis shows that the transmission network has just enough capacity to transmit the projected power generation from all generation stations to the load centres during normal operating condition(s).” (ECG, GRIDCo & VRA, 2016. “2016 Electricity Plan for Ghana”, Jan 2016:29)
- ECG data indicates that for each substation within the GAR, the installed capacity is 2x 20MVA. This presents GAR with the scenario as presented in the table below.

Table 4.12: ECG Network BSP Substation Data for GAR

	Quantity		Installed Capacity per Sub [MVA]	Existing Installed Capacity [MVA]	Existing Firm Capacity [MVA]
	Existing	Proposed			
Primary Substation -GAR West	42	7	2 X 20 MVA	1680	840
Primary Substation -GAR East	10	0	2 X 20 MVA	400	200
TOTAL SUPPLY CAPACITY FOR GAR				2080	1040

Further data from ECG indicates that most substations are already operating above firm capacity (with significant fluctuations), indicating a need to upgrade substations to improve redundancy. The average peak demand data indicated 60% of installed capacity (i.e. 120% of firm capacity). This translates to a 208MVA upgrade requirement for the region. This value will be higher in the case of poor power factor conditions.

Firm capacity in a power system is that capacity that the system can deliver after the primary component (usually a power transformer) fails and function is taken over by the back-up network component; it is in short the capacity that can be guaranteed. The scenario in **Table 4.12** is the ideal substation scenario where the installed capacity for GAR is 2080 MVA while the firm capacity (guaranteed supply) is 1040.

Redundancy is important in the event of a major equipment failure such as a transformer or substation. Without redundancy, the network will not be able to supply power until such equipment is fixed. All electrical equipment, including transformers are just as good as the manufacturer made them, and how they are treated by the operators and the environment. Failure of this equipment is inevitable. However, the mean time to this failure is a variable and may happen at any time. It is therefore crucial that redundancy is always maintained at acceptable levels to allow maintenance and repairs while guaranteeing supply.

From the above discussion it is concluded that demand in GAR is higher than the firm or guaranteed supply. This is not only a regional but a national issue. The demand-supply challenges permeate from generation level through transmission level and down to distribution.

- The 2014 Energy Outlook for Ghana (Supply & Demand), (Energy Commission Ghana, 2014:9) states that the key drivers of national electricity consumption are developments in the industrial sector and on-going national electrification schemes. This is further supported by the national power consumption data in the same report. The table that follows is adapted from the national consumption data in the report. The table illustrates how power consumption trends show a large percentage share from the industrial and residential demand sectors. The two sectors have a combined average of $\pm 86.65\%$ of total power consumption.

Table 4.13: National Power Consumption data for Ghana – 2014

YEAR	DEMAND SECTORS										
	Industry			Non Residential			Residential			Total	
	1000 GWh	% share	% Grow	1000 GWh	% share	% Grow	1000 GWh	% share	% Grow	1000 GWh	% Gr
2000	4.31	68.0%	0.0%	0.55	8.7%	0.0%	1.49	23.5%	0.0%	6.35	0.0%
2001	4.33	66.4%	0.5%	0.58	8.7%	5.5%	1.61	24.7%	8.1%	6.52	2.7%
2002	3.9	63.2%	-9.9%	0.6	9.8%	3.4%	1.67	27.1%	3.7%	6.17	-5.4%
2003	2.21	48.6%	-43.3%	0.62	13.6%	3.3%	1.73	38.0%	3.6%	4.56	-26.1%
2004	2.03	44.8%	-8.1%	0.66	14.6%	6.5%	1.78	39.3%	2.9%	4.47	-2.0%
2005	2.54	49.2%	25.1%	0.7	13.6%	6.1%	1.92	37.2%	7.9%	5.16	15.4%
2006	3.59	55.1%	41.3%	0.79	12.1%	12.9%	2.13	32.7%	10.9%	6.51	26.2%
2007	2.7	48.3%	-24.8%	0.8	14.3%	1.3%	2.1	37.6%	-1.4%	5.6	-14.0%
2008	2.97	48.2%	10.0%	0.93	15.1%	16.3%	2.27	36.9%	8.1%	6.17	10.2%
2009	2.94	47.2%	-1.0%	0.88	14.1%	-5.4%	2.41	38.7%	6.2%	6.23	1.0%
2010	3.16	46.1%	7.5%	0.97	14.1%	10.2%	2.74	39.9%	13.7%	6.87	10.3%
2011	3.9	48.9%	23.4%	1.31	16.4%	35.1%	2.76	34.6%	0.7%	7.97	16.0%
2012	4.15	51.2%	6.4%	1.15	14.2%	-12.2%	2.8	34.6%	1.4%	8.1	1.6%
2013	4.22	47.1%	1.7%	1.53	17.0%	33.0%	3.23	36.0%	15.4%	8.98	10.9%

(Source: Adapted from Energy Commission Ghana, "The 2014 Energy Outlook for Ghana (Supply & Demand)", 2014:9)

- The demand projection for GAR in 2016 was as per the table below.

Table 4.14: ECG Network Demand Projection Data for GAR (2016)

Region	GAR West	GAR East	TOTAL GAR
2016	689.4 MW	278.9 MW	968.2 MW
As % of National Demand	28%	11%	39%

Demand is expected to continue increasing nationally as per the 2016 Electricity Plan for Ghana (ECG, GRIDCo & VRA, 2016:8). The report lists factors which are projected to contribute to the growth in demand as:

- Significant increase in spot loads. The most prominent nation-wide developments are detailed in the table below.

Table 4.15: Top Seven Developments with Prominent Spotload increase in Ghana – 2016

Description	Expected Demand [MW]	As % of National Estimate
Western Diamond Cement – (ECG, Takoradi);	7	7%
Ghana Water Company- Kpong	25	25%
Enclave Power Authority - Tema Free Zone	42	43%
Asanko Gold - Ashanti Region	17	17%
Rice Factory - Nyankpala	2.5	3%
GWCL - Wa	3.5	4%
Aluminium Company - Tamale	1.5	2%
Nationally	98.5	100%

(Source: Adapted from ECG, GRIDCo & VRA, “2016 Electricity Plan for Ghana”, 2016:8)

The table lists all nation-wide developments with prominent spot load increase. It is evident that the highest single spot load increase in the country is within GAR (Enclave Power Authority in Tema) and constitutes 43% of the total national bulk spot load increase. This confirms the assertion that development is highly concentrated around the Tema and Accra load centres in GAR as well as the significant influence that GAR’s development has on the country as a whole.

- The network expansion works and initiatives aimed at improving the quality of distribution services by ECG are also expected to allow the connection of new loads. This is expected to result in an increase in demand in the residential, commercial and industrial sectors.

The numerous rural electrification projects earmarked for commissioning in 2016 are expected to lead to further demand increases on the ECG distribution networks.

In fact ECG data shows that demand is expected to increase between 2016 and 2020 at an annual growth rate of 8% for GAR West (includes Accra) and 7.5 % for GAR East (includes Tema).

(b) Level of Service

(i) Fuels and Risks

One crucial requirement for reliable power supply is the availability of required quantities of fuel and funds to purchase the fuel in a timely manner. A sustainable energy mix is thus very critical in promoting and supporting development.

There is an inherent risk that comes with each type of generation technology. It is thus important to have balanced mix that caters for any shortfalls of each technology.

There is hydro risk due to low elevations at Akosombo generation station, 3 units will have to be operated throughout the year in order to prevent a situation where elevations below 235 ft. will be recorded prior to the onset of the rains. This scenario will significantly limit generation capacity.

Light Crude Oil (LCO), natural gas, diesel and Heavy Fuel Oil (HFO) are the types of fuel that will be required for firing thermal generating plants on the Ghana power system. Low supply, fuel rationing, large amounts of imported fuels and fuel prices are some of the risks associated with thermal plants.

Renewables are thus a critical element to the energy mix that may provide the balanced risk management plan required to sustain development.

(ii) Current Supply

The Energy Commission Ghana, “The 2014 Energy Outlook for Ghana (Supply & Demand)”, (2014:14) asserts that: “With the new tariff announcement in early 2014, average commercial and industrial tariffs in Ghana are now far higher than in South Africa, Nigeria, Ethiopia, Libya, Kenya and Namibia. Simply put, the price of electricity in Ghana is expensive. As such it is concluded that the use of renewables has a vital role to play in sustaining viability of services in future.”

The report further states that: “... it would be cost competitive to encourage mass deployment of solar electricity currently having a feed-in tariff of 40.21 pesewas per kWh (15.12 US cents per kWh equivalent⁵⁷) equivalent for commercial applications like lighting in stores, water pumping or shaving off consumption in the commercial and services sector during peak hours, but also as an energy conservation measure.” (*Energy Commission Ghana, The 2014 Energy Outlook for Ghana (Supply & Demand)*, 2014:20)

The 2016 Electricity Plan for Ghana (ECG, GRIDCo & VRA, 2016:28) states that improved geographical positioning of generation plants has significant impact in maintaining lower

system losses. Analysis in the report has shown that system losses are lower with maximum generation at the West (Aboadze Enclave) compared with having maximum generation at the East (Tema Enclave). This should be considered when planning where and how future development should occur. As well as the planning of future generation plants in the GAR.

“The transmission system has inadequate firm transfer capability to some of the major load centres (of Accra, Kumasi, Tarkwa, etc.) mostly at peak. This situation results in low voltages, overloading of lines and increase in transmission system losses. A significant percentage of network loads are islanded in the event of outage on some radial lines.” (*2016 Electricity Plan for Ghana by ECG, GRIDCo & VRA, 2016:40*). This further affirms the need to invest in expansion projects in order to maintain a reliable network and services in GAR.

The 2016 Electricity Plan for Ghana (ECG, GRIDCo & VRA, 2016:41) further states: “Voltages at Kumasi, Accra and surrounding areas are low because of poor customer end power factors.” This typically creates a domino effect of increasing system losses supply efficiency, thereby increasing overall consumption.

(iii) Planning and Development Considerations

ECG substation data indicates consumption levels at 120% of the guaranteed supply. This value varies significantly. Site visits around GAR indicate that typical residential stands in the slums and compounds have service connections with no limiting device per customer (i.e. lack of individual customer service breakers). This means a single stand can accommodate a fairly large number of customers and is in turn detrimental to the network as a whole. The number of customers per stand also varies between stands and among different areas.

Unmanaged densification imposes uncontrolled variations in demand on the power system and makes services planning a challenge. Excessive densification within the same limited space poses problems with lack of servitudes for services and creates a concentration of unsightly electrical installations within the same area.

Optimised development planning must incorporate clear and deliberate services planning based on land use zoning and must limit maximum demand allowable per stand. This must be followed up with demand side management strategies that allow for network monitoring and control at customer level.

Power factor correction incentives and penalties may be incorporated and enforced as part of industrial and commercial development frameworks to improve quality of supply. Metering, service breakers are also some of the initiatives that form part of a larger scale demand side management program that may be implemented for residential and commercial customers.

Careful application of densities and zoning can thus be used as a means to prevent overloads and poor voltage levels.

(iv) Areas of Concern

The 2016 Electricity Plan for Ghana (ECG, GRIDCo & VRA, 2016:27) shows that the transmission network has just enough capacity to transmit the projected power generation from all generation stations to the load centres during normal operating condition(s) for some sections of the networks.

The report states however, that there are some critical lines for which a single contingency will put the power system in alert state, resulting in overloading of adjacent line circuits, low NITS voltages and in some cases, severe system disturbances. These are:

- Lines in the Volta – Accra East Achimota corridor;
- Achimota-Mallam line;
- Aboadze–Tarkwa line;
- Tarkwa – Prestea line;
- 330 kV Aboadze –Volta line etc.

(c) Planned Projects that Impact the RSDF

Refer to **Plan 4.3: Ghana GRID Map** indicating the location and connections for all planned generation and transmission infrastructure.

- **Committed Generation**
 - There are a number of projects that are under discussion and may be developed. However it is unclear whether or not any of those projects will be commissioned. Therefore in this analysis only projects under construction were considered. As a result, apart from new generation projects considered for the 2016 power supply, two new projects were also considered as committed projects, these being:
 - 180 MW Sunon-Asogli (Phase 2 Stage 2) - This is the second phase of the 360 MW combined cycle project. 180 MW was assumed to be available in 2016 and the second 180 MW is assumed to be online in 2017.
 - 340 MW Cenpower Project – Construction for this project has commenced and based on the project timeline, the plant should be commissioned by fourth quarter of 2017. However in this analysis the plant is assumed to be available from January 2018.
- **National Transmission Projects:**
 - In order to address the above network constraints, GRIDCo recommends the implementation of the following projects:
 - Upgrading of transmission lines in the Volta-Accra East Achimota corridor from 213 MVA to a 488 MVA. This would increase the evacuation capacity from Tema generation hub to the load centre of Accra. This is especially necessary to ensure the evacuation of generation from the new thermal power plants in Tema, namely Karpower (225 MW), Sunon-Asogli Phase-2 (180MW) and the Kpone Thermal Power

Plant (KTPP - 200 MW).

- Fast tracking the ongoing construction of Aboadze-Prestea-Kumasi 330kV line. This would improve upon bus voltages in Kumasi and adjacent substations and consequently reduce overall system losses.
- Upgrade of Achimota–Mallam 161 kV transmission line conductor from 170 MVA to 488 MVA, to improve bus voltages at Achimota and adjacent substations. It would also reduce overall transmission losses and lines loading on the NITS. This project has already been awarded on contract.
- Construction of A4BSP 330kV substation with a 161kV, double circuit twin bundle (364x2 MVA) link to Mallam BSP. This would increase the reliability of supply to Accra and increase transfer capacity between the generation hub of Aboadze and Tema to the load Centre of Accra.
- Future Transmission projects specifically for the GAR as planned are as follows:

Table 4.16: Greater Accra Planned Projects

Future Transmission Projects
25.7km; 488VA; 161kV double circuit Twin-Tern conductor upgrade of the Volta -Achimota lines
12km; 488VA; 161kV double circuit Twin-Tern conductor upgrade of the Achimota – Mallam lines
161 kV Collector Substation to be located in Tema.
161 kV Accra Central Gas Insulated Substation located in Accra.
330/161 kV Accra Fourth Bulk Supply Point (A4BSP) Substation located at Pokuase
10km;161kV double circuit Mallam-A4BSP Transmission line
330kV Dawa Collector Substation in Dawa.

Source: GRIDCo Supplied DATA, 2016

4.6.5 Main Findings – Energy

The main findings pertaining to energy engineering services follow:



ENERGY FINDINGS

The Ghana power system has been experiencing supply challenges since 2012, this includes Greater Accra where some of the most significant supply challenges in the country have been identified. Ongoing efforts by government and stakeholders in the power sector have been made to continue to resolve the power supply challenges. There are a number of projects that are under discussion and may be developed. For

GAR the main findings are:

- The national projected energy consumption for 2015 was beyond supply capacity in the region. This was still the case during 2016 which was estimated at 16,798 GWh and supply was only 16,448 GWh. The remaining 396 GWh would have to be shed mainly during the first two months because of expected supply deficit in 2016. Projections show a continued lag in supply relative to demand well into the year 2021.
- Akosombo hydroelectric generating station, which is the biggest generating station in the country is recording very low reservoir elevations which required its output in 2016 to be limited. Hence full generation at the power station was not possible.
- The transmission system has inadequate firm transfer capability to some of the major load centres (of Accra, Kumasi, Tarkwa, etc.) mostly at peak. Hence even if the power stations could generate the required capacity to meet demand – the grid system simply does not have the capability to transmit the full required supply. Some intervention and investment is required.
- The transmission network has just enough capacity to transmit the projected power generation from all generation stations to the load centres during normal operating condition(s) for some sections of the networks. However, there are some critical lines for which a single contingency will put the power system in alert state, resulting in overloading of adjacent line circuits, low NITS voltages and in some cases, severe system disturbances. These lines are all primarily located within Greater Accra.
- Low supply, fuel rationing, large amounts of imported fuels and fuel prices significantly influence power supply levels.
- The Ghana power system functions on low reserve margins in 2016 and therefore when units are out for maintenance the system is prone to inadequate supply.
- Renewables are a critical element to the energy mix of future regional developments. This will provide the balanced power & energy portfolio that mitigates low reservoir elevations and low fuel supplies for the thermal power stations. Future developments must have renewable energy as part and parcel of its core development organisation.
- Improved network typology and architecture must form part of new development going forward to avoid network loads that are islanded in the event of outage on some radial lines.
- Unmanaged densification poses uncontrolled and unpredictable demand on the system. Excessive densification within a limited space poses problems with capacity, space for services and a concentration of unsightly installations that take away from the natural visual character of the urban space.

-
- It is therefore evident that continued investment in energy generation, transmission and distribution projects forms a critical element of development planning considerations for the region.
 - For Greater Accra, sustainable development means that there will always be a requirement for additional generation and supply investment – particularly if the grid system is to function with adequate reserve margins.

5 *Man-made Environment – Road Infrastructure and Transportation*

5.1 Stakeholder Participation

During the week of 24 to 28 October 2016 a number of stakeholder interactions took place. The main aim thereof was to understand the road and transport environment of the GAR and to gather data/information related to roads and the transport system as a whole. The information obtained was the main source for the preparation of this report.

Meetings were held with officials/representatives of:

- Ministry of Transport on 26/10/2016;
- Ministry of Roads and Highways on 25/10/2016;
- Ghana Highway Authority on 26/10/2016;
- Department of Urban Roads on 26/10/2016;
- Department of Feeder Roads on 25/10/2016; and
- Town and Country Planning Department on 25/10/2016.

Attendance registers and details pertaining to the meetings are included in **Appendix A**.

Attempts were also made to secure appointments with the Ghana Port and Harbour Authority and Ghana Airports Company Limited. The ministry of Transport provided information regarding these two sectors and indicated that they could be of assistance to arrange meetings in future should the information provided be insufficient or if more clarity be required.

5.2 The Road Network

5.2.1 Current Road Network

In the Greater Accra Metropolitan Assembly (GAMA) the roads are classified as Trunk, Urban or Feeder Roads. These are the basic administrative classifications. Currently GAMA's road length is estimated at 7 591.8km (trunk: 146.6km, urban: 6 892.1km and feeder: 553.1km).

There are three agencies under the Ministry of Roads and Highways (MRH) responsible for the construction and maintenance of roads. They are the Ghana Highways Authority (GHA), the Department of Urban Roads (DUR) and the Department of Feeder Roads (DFR).

(a) **GHA (Ghana Highway Authority)**

The GHA controls major national roads.

- Trunk road: National/International wide road (e.g.: N1~N6);

- Highway: Toll booths within the same area (e.g.: Kanda Highway); and
- Motorway: Only one (e.g. Accra-Tema Motorway).

(b) DUR (Department of Urban Roads)

This department controls all other roads except roads controlled by the GHA and DFR.

- Roads within main cities.

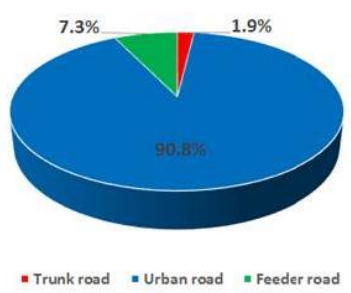
(c) DFR (Department of Feeder Roads)

- Roads that connect towns and villages to the Trunk road;
- Names that have the origin and destination of the road; and
- Urban roads cover 90.8% of Accra, taking the largest share of the total road network while trunk roads account for the least coverage, taking only 1.9% of the total regional road network.

The table and chart below show the current composition of both national and GAMA's road network.

Table 5.1: GAMA's Road Network

Classification	Length (km)	Proportion (%)
Trunk road	146.6	1.9
Urban road	6,892.1	90.8
Feeder road	553.1	7.3
Total	7,591.8	100.0



Source: Road surface condition report 2013. GHA

The figure that follows shows the existing GAR road network. The road network consists of trunk roads (shown in red, under jurisdiction of GHA) which connect the various regions, regional capitals and neighbouring countries; feeder roads (shown in orange, under jurisdiction of DFR), while the remainder are urban roads.

After studying the District Medium Development Plans, the following was observed:

- Trunk roads are surfaced and generally in good condition;
- Surfaced feeder roads are also generally in good condition;
- Most of the feeder roads are not surfaced and conditions vary from fair to poor. Problems are especially encountered during the rainy season;

- Unsurfaced roads requires continuous maintenance which poses problems for the Assemblies; and
- Some rural assemblies listed the lack of access to proper roads as a problem. Some farming and fishery communities find it difficult to transport their goods for this reason.

In order to obtain an indication of accessibility to the road network by the assemblies, a crude measurement index was developed. The surface area of the assembly was compared with the length of road within that assembly. The results of this measurement are indicated in the table below.

Table 5.2: Road Accessibility Index

District/Assembly	Trunk Roads (km)	Feeder Roads (km)	Urban Roads (km)	Total (km)	District Area (km ²)	Index (km/km ²)
Accra Metropolis	22.5	54.5	1713.0	1790.0	137.0	13.1
Ada East	29.9	152.9	85.8	268.6	291.0	0.9
Ada West	36.9	135.7	83.8	256.3	324.0	0.8
Adenta	5.1	57.2	837.2	899.4	140.0	6.4
Ashaiman	9.1	10.0	7.7	26.8	45.0	0.6
Ga Central Municipal		19.0	727.0	746.0	103.0	7.2
Ga East	11.3	35.3	1171.3	1217.9	96.0	12.7
Ga South	33.6	156.1	844.9	1034.5	502.0	2.1
Ga West	25.4	185.7	658.5	869.5	405.0	2.1
Kpone Katamanso	34.1	75.0	1313.4	1422.5	294.0	4.8
La Dade Kotopon	1.6	13.2	333.0	347.8	50.0	7.0
La Nkwantanang Madina	24.3	27.5	908.2	960.0	75.0	12.8
Ledzokuku / Krowor		11.7	574.0	585.8	50.0	11.7
Ningo Prampram	99.6	154.0	1069.8	1323.4	750.0	1.8
Shai Osu Doku	100.0	281.2	19.2	400.4	971.0	0.4
Tema Metropolis	10.1	37.5	678.6	726.1	121.0	6.0

From the analysis it can be seen that Accra Metro is the most accessible and Shai Osu Doku the least.

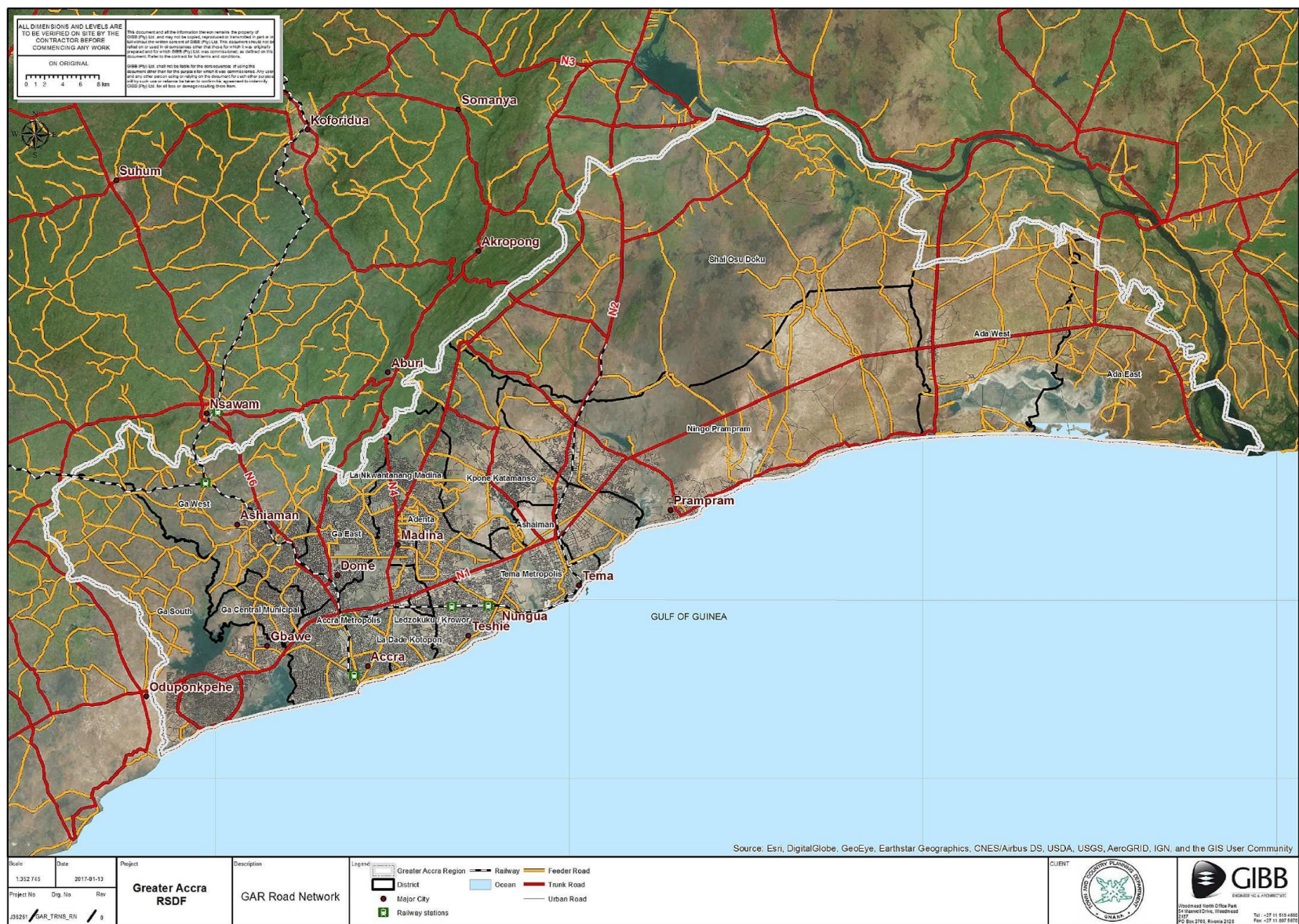


Figure 5.1: Current Road Network in GAR

The only source of information that could be accessed which provides data on road capacity and level of services was the Transport Master Plan Project in Greater Accra Region report dated August 2016 which is for GAMA. This report expresses the level of service in term of travel speed. It is generally accepted that travel speed is a good indication of current road capacity and level of service.

The report reveals that the level of service for arterial roads in GAMA is poor. The lowest travel speeds were surveyed in Accra where 37% of the surveyed routes recorded unacceptable levels of service of speeds less than 15km/h during the peak hour. Only 24% of the routes surveyed operated at acceptable levels of service of greater than 30km/h. The figure below illustrates this.

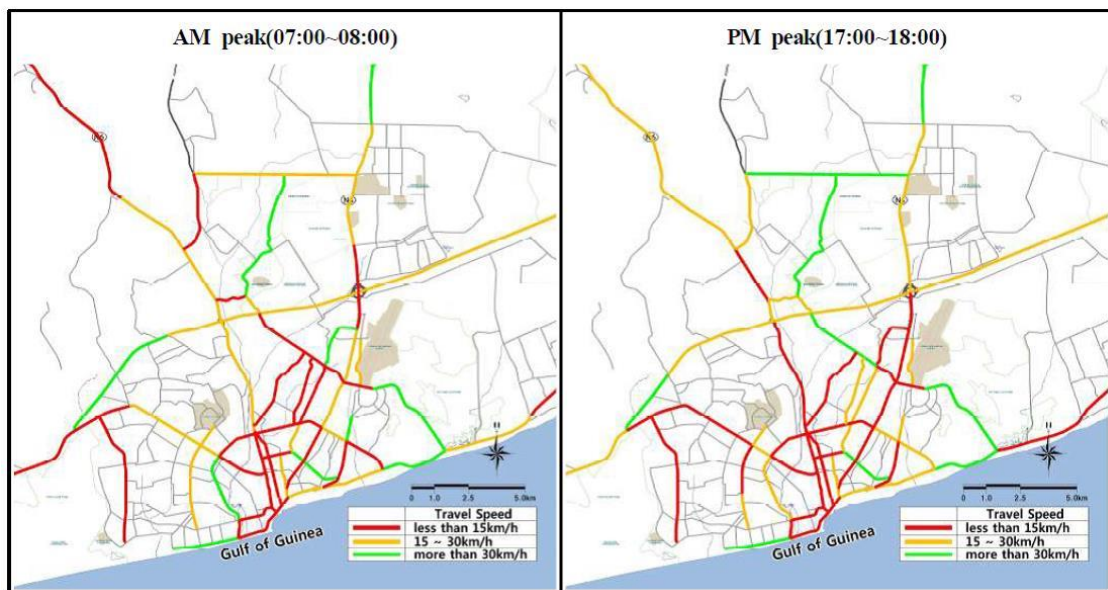


Figure 5.2: Travel Speed by Road

Source: Transportation Master Plan Project in GAR, 2016

5.2.2 Future Road Network

The existing road plan in GAMA has 25 projects which include major road constructions, current road expansions and interchange improvements. The planned length of road network is 400.8km in total. The total length of road network in GAMA will be 7 992.6km after the implementation of the 25 projects.

Among the 25 major projects, 15 are in process while there is no indication when the other 10 will commence.

- On-going projects (15 projects): 142.2km
- Not started projects (10 projects): 258.6km
- Total road projects (25 projects): 400.8km

Apart from the road network plans, there are 2 interchange improvement projects, 1 flyover and TSM (under UTP, 74 spots) projects. The 2 interchange improvement projects are the “Kasoa Interchange and Related Works” and “Kwame Nkrumah Interchange Project” and the flyover project is called the “Flyover Over Tema Motorway at Teshie Link”. The table below presents details pertaining to the future road network development plans in GAMA.

Table 5.3: Future Road Networks in GAMA

No.	Road Project	Length (km)	From	To	Target year	Comp (%)
1	Giffard Road	5.7	37 R.A	La Beach Rd	2015	100
2	Buma Camp Road Ph I	4.7	Giffard Rd	Spintex Rd	2015	100
3	Buma Camp Road Ph II	5.7	Burma Camp	Teshie Link	2015	100
4	Spintex Road Bypass	2.6	Spintex Rd	Airport Bypass Rd	2015	100
5	La Beach Road Project	7.5	Cold Store	Titanic Beach	2015	100
6	Dadeban Road in the North Industrial Area	4.0	Feo eyeo	2 nd Palace Link	2016	30
7	Kasoa-Amasaman	33.0	Oboom Jxn	Nsawam Rd	2017	38
8	Awoshie-Pkuase Road (Section I)	3.0	Awoshie	Anyaa	2015	100
9	Awoshie-Pkuase Road (Section II)	12.1	Anyaa	Pokuase	2015	100
10	Achimota-Afonkor	5.7	Achhimota	Ofankor	2015	100
11	Rehabilitation of Dome-Kitase Road	20.0	Aburi Rd	Dome Rd	2017	20
12	Madina-Pantang	5.6	Madina	Pantang	2015	100
13	Tetteh Quarshie-Madina	4.6	Tetteh Quarshie I.C	Madina	2015	100
14	Boundary Road Gulf House Link	4.0	America house Jxn	Madina Social Welfare	2015	100
15	Western by-pass Road	24.0	Bortianor Jxn	Sapato Jxn	2016	62
16	Tema Beach Road Development Project	31.0	Independence Square	Meridian Rd	-	Not Started
17	Ring Road Development Project in Accra	20.7	Labadi Rd	Obetsebi Lamtey Circle	-	Not Started
18	Accra Newtown Road Development Project	7.8	Nsawam Rd	Achimota Rd	-	Not Started
19	Dansoman Highway Development Project	2.5	Sakaman	Damsoman R.A	-	Not Started
20	Rehabilitation of Haatso-Atomic Rd	6.8	St. Johns Rd	Legon E Rd	-	Not Started
21	Pokuase-Ritz Jxn-Tema Motorway	23.0	Nsawam Rd	Tema Motorway	-	Not Started

No.	Road Project		Length (km)	From	To	Target year	Comp (%)
22	Ashaiman-Oyibi		19.8	Dodowa Rd	Tema Motorway	-	Not Started
23	Hospital Road Development Project		21.5	Tema Motorway	Kraku	-	Not Started
24	Accra-Tema Motorway Project		19.5	Tetteh Quarshie I.C	Tema I.C	-	Not Started
25	Accra Outer-Ring Road Development		106.0	Accra-Capecoast Rd	Dawhenya	-	Not Started
26	Kasoa Interchange and Related Works		I C	-	-	2017	45
27	Kwame Nkrumah Interchange Project	Akasanoma (Phase I)	Flyover	-	-	2015	100
		Nsawam (Phase I)	Flyover	-	-	2015	100
		Ring Road (Phase II)	Flyover	-	-	2016	52
28	Flyover Over Tema Motorway at Teshie Link		Flyover	Spintex Rd	East Legon	-	Not Started
-	TSM (Under UTP)	Batch I	60 Spot	Accra (Airport residential East Legon La)		2016	19
		Batch II	14 Spot	Tema Ga West Adenta		2016	13

Source: Transportation Master Plan Project in GAR, 2016

5.3 The Abidjan-Lagos Highway Corridor

Transit transport is a major challenge for Ghana given its favourable position in serving intra-regional trade (east-west and north-south) including overseas trade of landlocked countries. Main achievements in terms of infrastructure development involve:

- The east-west, Abidjan-Lagos corridor (Highway corridor);
- The north-south routes from Tema to landlocked countries (Burkina Faso, Mali, Niger) including a 795 km rail link to provide a connection with Burkina Faso; and
- Accra to Lagos through Lomé and Cotonou by rail.

At a continental scale, the most relevant on-going infrastructure development is the Trans-African Highway (TAH). The

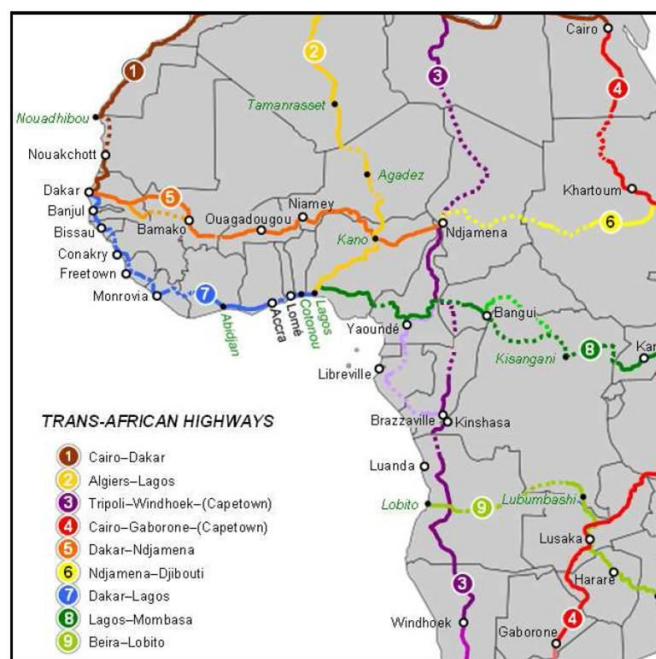


Figure 5.3: Trans-African Highway (Ghana ITP 2011-2015)

TAH network is made of 9 continental corridors, within which, the corridor TAH 7 (Abidjan-Lagos corridor) links Ghana to other African countries on an east-west axis, as shown in the accompanying figure. The TAH 7 leads from Dakar to Lagos, passing through Accra. It continues as TAH 8 Lagos-Mombasa and forms in total a 10 269km east-west crossing of the continent. This highway joins with TAH 1 to form an additional north-south route around the western extremity of the continent.

At the Africa scale, the TAH is a project developed as part of the UN support to the African Union (AU) and Program (New Partnership for Africa's Development (NEPAD), with funding from the African Development Bank. At a Sub-regional scale, the project is supported by the Economic Community of West African States (ECOWAS), which drives the development and maintenance of TAH 5 and 7.

The whole highway is two-lanes, with the exception of short four-lane sections in the eastern third of the route, including Ghana.

The *Ghana National Spatial Development Framework (2015-2035); Executive Summary; February, 2015* also recognises this TAH 7 (Abidjan-Lagos corridor) project and indicatively indicated an alignment to the north of the Greater Accra Area. This approach is supported and will be incorporated in the development of the Greater Accra Region Spatial Development Framework.

5.4 The Rail Network

5.4.1 Current Rail Network

The Ghana Railway Company Limited (GRC) currently operates two Diesel Multiple Units (DMUs) and one Diesel Hydraulic Locomotive train. Apart from the two DMUs which are relatively new, the Diesel Hydraulic Locomotive train is more than 28 years old and is not in a good condition.

(a) Railway Lines

GRC currently operates commuter rail services on two routes which form part of the so-called Eastern Line. The lines are the Accra-Tema and Accra-Nsawam Lines, as shown in the figure that follows. These lines are the only functioning lines on the Eastern Railway Line network and each line currently supports a maximum axle load of 16 tonnes.



Figure 5.4: Current Railway Network in GAMA

Source: Transportation Master Plan Project in GAR, 2016

Both railway lines support only passenger transport even though the Accra-Tema Line passes through Tema Port. Together, the lines only serve a few passengers in the GAR, those who live along the railway lines.

Future development of the railway should consider implementing a train service that supports intermodal transport of goods and people from the port to inland areas in Accra and Ghana. The table below shows the characteristics of the two main railway lines.

Table 5.4: Characteristics of Eastern Line

Line	Length (km)	Gauge (mm)	No. of Trains	Average Speed (km/h)	Maximum Axle Load (tonnes)
Accra-Tema	30.2	1,067	2	65	16
Accra-Amasaman (Accra-Nsawam)	24.9 (40.6)	1,067	1	55	16

Source: Ghana Railway Company Limited

A long period of neglect has virtually collapsed railways as a public mode of transport. Government withdrew the subsidy for the rail subsector in 1997 causing serious decline of the rail sub-sector. Government ought to renew its effort in railway development to improve intermodal transport in Greater Accra region.

(b) Railway Facilities

(i) Railway Tracks

Ballasted tracks with wooden sleepers constitute the rail track network in the Eastern Line and, in fact, all railway tracks in the country. The condition of railway tracks in the GAR leaves much to be desired. Tracks have deteriorated, some even buried beneath ground level as the sleepers and ballasts are no longer visible, as a result of years of non-maintenance and partly due to the climatic conditions.

During the wet season, grass takes over some of the rails and most of the wooden sleepers have decayed in those conditions. Also encroachment has occurred along the railway line in areas such as Batsona and Agbogloshie, where an informal food market has been established very close to the railway line.

(ii) Train Stations and Halts

The table below shows current train stations (main stops) and halts (minor stops) along the Eastern Railway Line. Existing train stations have buildings and small waiting areas for passengers though they do not meet international standards. Most of them are poorly equipped with safety and signalling equipment.

Halts generally do not have any physical building facilities; they are open areas where passengers wait for the train. There is still considerable patronage of train services at these halts.

There are 7 stations and 6 halts along the Accra-Tema line, and 7 stations and 13 halts along the Accra-Nsawam Line, as shown in the following table. The Accra-Nsawam line, being longer, services a larger number of passengers than the Accra-Tema line.

Table 5.5: Main Stations and Halts along the two Railway Services

Accra-Tema Line		Accra-Nsawam Line	
Station	Accra	Accra	Station
Station	Circle (Odaw)	Circle (Odaw)	Station
Station	Achimota	Achimota	Station
Halt	Achimota Overhead	Achimota Overhead	Halt
Halt	Dzorwulu	Aloboshie	Halt
Halt	Shangrila (Airport)	Dome	Station
Station	Batsonaa	Taifa	Halt
Halt	Adegonor	Abuom	Halt
Halt	Queensland (Nungua)	Ofankor Barrier	Halt
Station	Asopochona	Pokuase	Halt

Accra-Tema Line		Accra-Nsawam Line	
Station	Tema Harbour	Amanfrom	Halt
Halt	Newtown	Fise	Halt
Station	Tema (Community I)	Amasaman	Station
		Opah	Halt
		Kotoku	Station
		Abaman	Halt
		Papase	Halt
		Shinto	Halt
		Lantei	Halt
		Nsawam	Station

Source: Ghana Railway Company Limited

(iii) Railway Operation

Only commuter services operate in the GAR on the Eastern Line from Accra-Tema and Accra-Nsawam. Accra-Tema trains start their operations from Tema, and the Accra-Nsawam trains from Nsawam.

GRC does not operate a non-stop train service throughout the day or week. They operate from Monday to Friday between the hours of 05:45 and 19:00 at specific scheduled times. The two tables that follow below indicate the train service schedules for Accra-Tema and Accra-Nsawam Lines. The Accra-Tema trains complete one round trip each on weekdays and do not operate on weekends.

Table 5.6: Accra-Tema Train Schedule

Schedule	Train 1		Train 2	
Weekdays	Accra - Tema	Tema – Accra	Tema – Accra	Accra – Tema
	06:30 – 08:00	17:40 – 19:10	06:30 – 08:00	17:40 – 19:10

Source: Ghana Railway Company Limited

Table 5.7: Accra-Nsawam Train Schedule

Schedule	Train 1	
Weekdays	Nsawam - Accra	Accra - Nsawam
	05:45 – 07:45	10:25 – 12:25
	Nsawam - Accra	Accra - Nsawam
	12:50 – 14:50	15:50 – 17:30
Saturday	Nsawam - Accra	Accra - Nsawam

Schedule	Train 1	
	05:30 – 07:30	11:00 – 13:00

Source: Ghana Railway Company Limited

It follows, therefore, that there is a decline in operational capacity of GRC, most likely due to long periods of under-investment by Government and poor management of the railway service by GRC Management.

Government should accordingly prioritise the railway sector to promote intermodal transport in the future so as to ease the pressure on road travel demand.

The trains for these two lines usually travel at low speeds of 55 and 65 km/h respectively due to the poor nature of the railway tracks. This results in the long travel times on both lines.

(iv) Railway Fares

GRC runs a shuttle service with a flat rate to all destinations, i.e. the same fare regardless of the distance travelled. The fares for the train services along the various routes are summarized in the table below.

Apart from the Nsawam-Accra service where the train has first class coaches, the two DMUs are all ordinary class coaches. The first class coach fare is 50% higher than the fare of the ordinary class coaches. Tickets are purchased at the main stations and they are inspected by Ticket Examiners as passengers get on the train for their destinations. Currently, there is no advance ticketing or booking of the train service at GRC.

Table 5.8: Train Fares for Accra-Tema and Accra-Nsawam Lines

Line	Class	Fare (Gh¢)
Accra – Tema	Ordinary	2.00
Accra - Nsawam	Ordinary	2.00
	First Class	3.00
	Break Van (Luggage Area)	1.00 minimum

Source: Ghana Railway Company Limited

5.4.2 Future Rail network

(a) Railway Master Plan of Ghana

Ghana Railway Development Authority established the Railway Master Plan of Ghana which includes GAMA in 2013. The Government of Ghana has given prior importance to the necessity for the rehabilitation, extension and development of the entire national network to take into account the necessities of northern Ghana, the bordering countries and the objectives of ECOWAS, identifying a plan for a new railway network.

The Rail Master Plan identified 6 Phases for the rehabilitation and extension of the network. In the 1st Phase, 668km of the original narrow gauge line is to be rehabilitated and in the following 5 phases the network is to be extended by a further 3 340km of new lines and the 1st phase will be converted to standard gauge. In 33 years a total of 4 008km of lines will be realised for an investment of US\$21,508 million.

The proposed upgrades to be implemented during the six phases of the Rail Master Plan are shown in the following figure and the phases are discussed thereafter.



Figure 5.5: Railway Rehabilitation and Extension Plan

Source: Rail Master Plan of Ghana, 2013, Ghana Railway Development Authority

(i) 1st Phase: Rehabilitation of the Existing Lines

- Only two of the three existing lines are rehabilitated: the Western Line (Takoradi-Awaso-Kumasi) and the Eastern Line (Accra-Tema-Kumasi) for a total of approximately 668km including branches to Awaso and Prestea). The Central Line is not very attractive for freight and passenger traffic, which should be substituted in successive phases by the foreseen Coastal Line.

-
- The lines remain narrow gauge, but will be modernised and adapted to the new technical standards for all infrastructure, but with sleepers conditioned for the subsequent transformation of the lines to standard gauge.
 - The Western Line has a higher potential for freight traffic, and in particular that of the mines, whereas the Eastern Line is more suited for passenger transport.
 - Based on the surveys and verifications carried out, repairs should be done on the limited number of current rolling stock fleet that could still technically be rehabilitated, without purchasing any new vehicles, thus avoiding any unnecessary expenses in view of the future changeover of the lines to standard gauge.

(ii) 2nd Phase: Extension of the Central Corridor

- Doubling of the track of the two lines rehabilitated in the 1st Phase and the conversion to standard gauge of the previously modernised track, thus creating two modern lines with double track on the routes with a high demand for freight and passenger traffic.
- Construction of the new standard gauge single track line that runs from Kumasi to Tamale and Paga in the North.
- This phase covers approximately 1 161km.

(iii) 3rd Phase: Extension of the Transversal Links

- Construction of transversal links, always with standard gauge single tracks, for Tamale-Yendi, Fufulsu-Sawla, Techiman-Kwadwokurom and Nyinahin-Kumasi covering a total length of approximately 484km.

(iv) 4th Phase: Extension of the Trans-ECOWAS Line

- This is mainly a coastal line, with standard gauge single track, that runs from Aflao (near the border with Togo) westwards to Tema-Accra-Cape Coast-Takoradi-Tarkwa-Omanpe for a total of approximately 498km.

(v) 5th Phase: Extension of the Western Line

- Extension northwards of the original Western Line to reach and connect the future mines.
- The line starts from Dunkwa-Awaso and extends towards Techiman, Sawla and Hamile for a total of approximately 729km.

(vi) 6th Phase: Extension of the Eastern Line

- This is the new route to the East of Ghana, near the border with Togo, which from Tema reaches the river port of Akosombo and then heads towards Ho and Yendi to the North, for a total of approximately 468km.

(b) Transport Master Plan - GAMA Rail Network Plan

The Transport Master Plan (TMP) recommends 2 north-south axes and a west-east axis network. The Rail Master Plan of Ghana (MP) 2013 proposes a Coastal Line from Accra to Asoprochona (Labadi Corridor, towards Tema). It is proposed that the Rail Master Plan's (MP) new line should be changed from Labadi corridor to Kwame Nkrumah Motorway corridor.

In the short-term, a side track should be installed with 2 stations and 4 halts to increase the number of train operations. In the long-term, a new line should be constructed from Adenta Station to Accra Station to cover Liberation corridor, and all existing tracks should be improved to standard double tracks.

The GIBB Team are in agreement with these recommendations.

The table below and figure that follows show the TMP GAMA Rail Network Plan.

Table 5.9: Railway Network Plan

No.	Line	Length (km)	Project	Track	Remarks
1	Accra-Amasaman (Accra-Amasaman-Kunasi)	24.9 (328.0)	Rehabilitation	Single	Rail MP
	Accra-Amasaman (Accra-Amasaman-Kunasi)	24.9 (300.0)	Expansion	Double	Rail MP
2	Achimota-Asoprochona	23.7	Rehabilitation	Single	Rail MP
	Achimota-Tema (Accra-Tema-Aflao Line)	30.2 (185.0)	Expansion	Double	Change of Rail MP
3	Achimota – Ksoa (Accra-Capecoast-Takoradi)	25.8 (212.0)	Construction	Double	Change of Rail MP
4	Accra-Airport-Adenta	21.9	Construction (subway)	Double	New
-	Circle, Achimota, Dzorwulu, Shangrila, Adegonor and Queensland Station	6 stations	Station Re-building	Double	New

Rail MP: Railway Master Plan of Ghana 2013, Ghana Railway Development Authority

Source: Transportation Master Plan Project in GAR, 2016

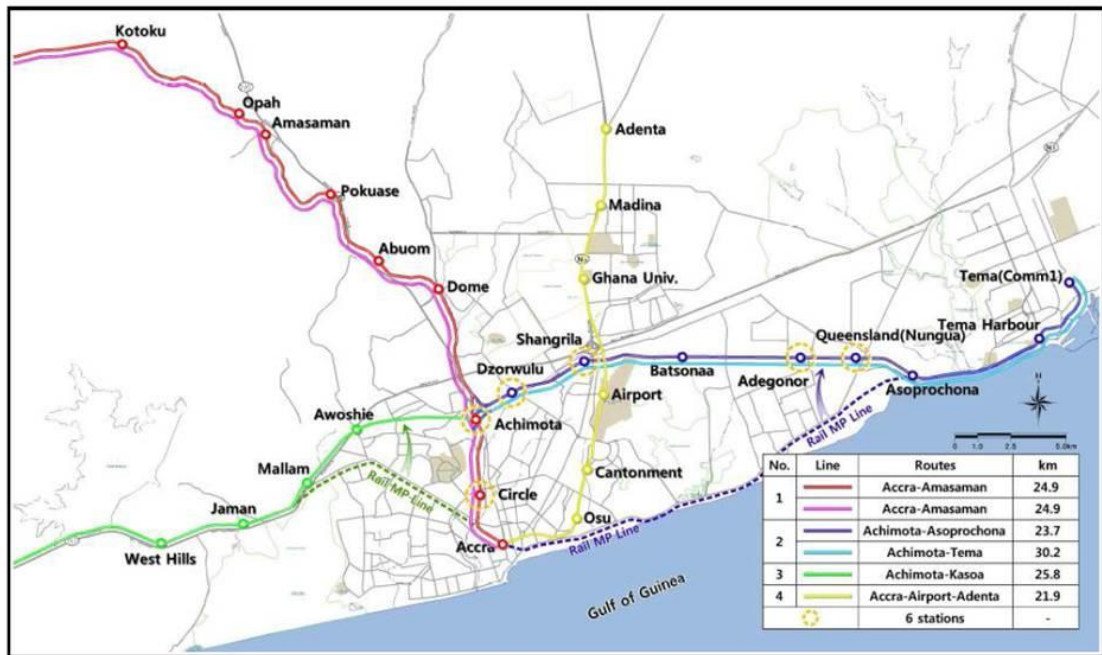


Figure 5.6: Railway Network Plan

Rail MP: Railway Master Plan of Ghana 2013, Ghana Railway Development Authority

Source: Transportation Master Plan Project in GAR, 2016

(c) Transport Master Plan - GAMA Rail Network Implementation Plan

The Transport Master Plan (TMP) recommends the following implementation Plan:

- GAMA's urban railway length to be extended from 55.1km to 127.7km in the future.
- The Rail MP suggests that both lines need rehabilitation in the short-term period and they both need expansion from medium-term to long term.
- In the short-term period, a side track could be installed at 2 stations and 4 halts, resulting that the number of train operations would be increased.
- If the 2 new lines were added to the current railway network and the Accra-Tema Line were connected from the Dzorwulu halt to Achimota station directly instead of the switch-back, AMA area will be served by circular railway line as follows: Accra station-Osu station-Shangrila station-Achimota station.
- The TMP team recommends that the suggested line between the Adenta and Accra stations should be constructed as a subway because of the traffic condition.

Table 5.10: Implementation Plan for Railway

Improvement		Short-Term	Middle-Term	Long-Term	Total
Railway	Line	Accra-Amasaman (Rehabilitation) Achimota-Asoprochona (Rehabilitation)	Accra-Amasaman (Expansion) Achimota-Tema (Expansion)	Achimota-Kasoa (Construction) Accra-Airport-Adenta (Construction_Sub way)	4 lines
	Length	(24.9km) (23.7km)	(24.9km) (30.2km)	25.8km 21.9km	47.7km (103.7km)
Station		Circle, Achimota, Dzorwulu, Shangrila, Adegonor and Queensland station	-		

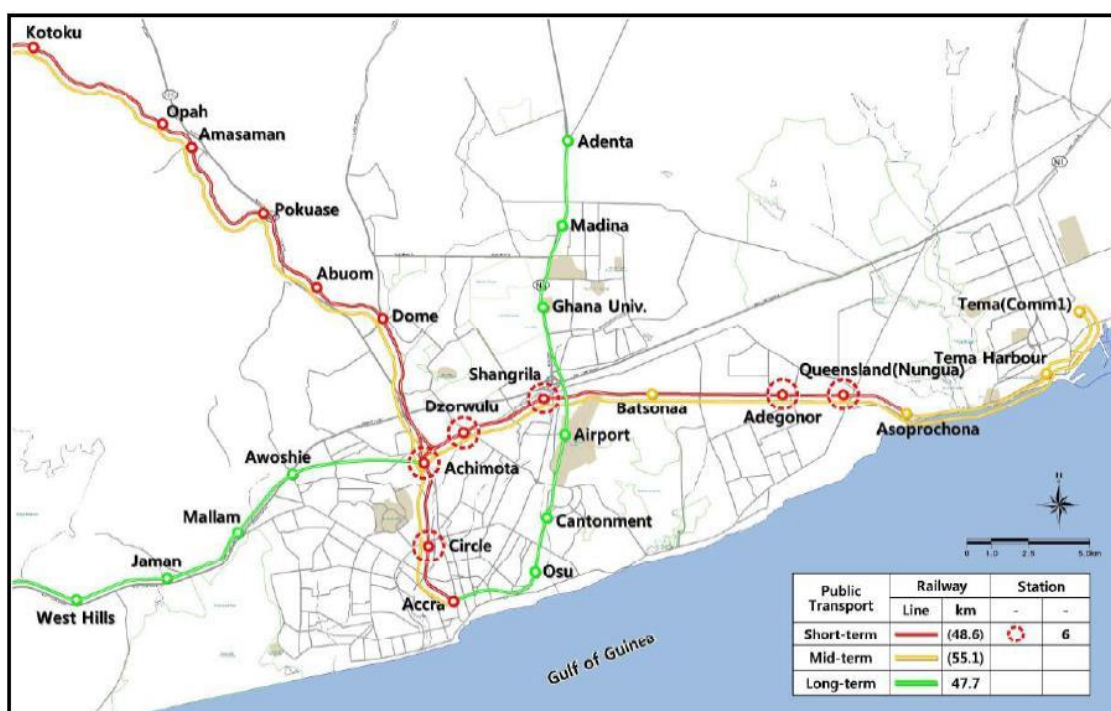


Figure 5.7: Implementation Plan for Railway

Source: Transportation Master Plan Project in GAR, 2016

5.5 Aviation Infrastructure

5.5.1 Existing Aviation Infrastructure

Aviation in Ghana is regulated by the Ghana Civil Aviation Authority (GCAA). However, the Ghana Airports Company Limited (GACL) was formed in 2006 to manage flights in all airports and airstrips of Ghana. Therefore, GACL manages the only international airport in Ghana, the Kotoka International Airport (KIA).

(a) Terminal Facility

KIA has 2 passenger terminals, Terminal 1 and Terminal 2 as well as a military and Very, Very Important People (VVIP) terminal for special uses, making it 4 terminals in total. Terminal 1 handles domestic and regional flights and Terminal 2 handles international flights. The two terminals are connected by an internal walkway. The military and VVIP terminals are used for military and diplomatic flights only.

(b) KIA Operations

In 2013, KIA ranked 3rd in West Africa based on the number of passenger visits to Accra. The airport is served by about 30 international airlines, of which 12 (40%) are from Africa, 17% or 5 are from the West, 3 (10% each) are from both South and East and 1 from the East (3%).

Seven Cargo airlines serve the airport with various destinations in Africa and Europe and four cities in Ghana are served by the Kotoka International Airport.

There are four domestic air transport operators at the Kotoka International Airport: Africa World Airlines (AWA), Starbow Airlines, Arik Air and Antrak Air. These companies provide internal flights within Ghana from KIA to major cities such as Tamale, Sunyani, Kumasi and Takoradi.

(c) KIA Performance

(i) International

The table below shows the performance of KIA from 2007 to 2013 in terms of international aircraft movements (flights), passenger travels and freight movement.

Generally, flights and passenger travel have been rising since 2007. Freight transport generally declined from 2007 to 2009, reaching 45,693 tonnes in 2009. It increased to 50 260 tonnes between 2010 and 2011, before starting to decline in 2012 and 2013, reaching 43 688 tonnes in 2013. The reason for this fluctuation is likely due to poor economic performance between the periods which resulted in a lack of business confidence.

Table 5.11: Aircraft, Passengers and Freight Movement in GAR

Year	Flights	Passengers	Freight Tonnage
2007	15.723	1,065,998	59,510
2008	17.481	1,186,557	55,513
2009	17.301	1,204,786	45,693
2010	21.072	1,387,741	45,960
2011	22.284	1,585,602	50,260
2012	22.082	1,726,051	46,577
2013	23.437	1,669,603	43,688

Source: GACL (Ghana Airport Company Limited)

(ii) Domestic

The following table summarises domestic flights from KIA over a period of 3 years. Both Aircraft and Passenger Movements have been on the rise since 2011 and have peaked at 18 497 flights and 778 466 passengers at the end of 2013.

Table 5.12: Domestic Aircraft and Passenger Movement at KIA

Year	Air Craft Movements			Passengers		
	Arrival	Departure	Total	Arrival	Departure	Total
2011	4,483	5,608	10,091	87,638	111,438	199,073
2012	7,176	7,176	14,352	249,766	293,613	543,379
2013	9,248	9,249	18,497	380,921	397,545	778,466

Source: GACL (Ghana Airport Company Limited)

5.5.2 Kotoka International Airport Development Plan / Strategy

Since Kotoka International Airport is currently the only point of entry via air to Ghana, the focus of development shall be concentrated on Accra. It is vital for the whole system that this airport runs profitably, provides the necessary capacity and delivers the required level of service while maintaining a high standard of safety and security.

Kotoka International Airport, holding a license to direct flights to the USA, will remain the main international aviation hub for the country and gateway to Africa. The airport will serve all domestic airports in Ghana and therefore become an efficient transfer centre for all international passengers traveling to other airports in the country. The airport has huge potential to extend its market position in West Africa offering world-class passenger transfer services and to become a regional West African Hub.

(a) Airside Development

Considering the air traffic forecast for Kotoka, a potential runway capacity bottleneck in the future was identified, depending on the aircraft mix, the load factor, overall passenger development and phase shifting between domestic and international traffic.

Runway capacity constraints will have a huge impact on nationwide transportation performance as well as the West African aviation industry: international air carriers will search for reliever airports in neighbouring countries affecting negatively all expected positive impacts of increasing and improving aviation and adjacent industries in the whole of Ghana.

Bottom line: airports, all its facilities, service provision and its service quality, compete with each other in the same market. Missing runway capacity is a serious matter with major

negative implications for the competitiveness of an airport – especially for international airports with the ambition to develop a hub scenario.

Hence, all endeavours must focus on operational measures such as de-peak strategies, or extension of airport operation hours but also on regulatory measures such as increasing landing fees for small aircraft types in order to increase load factors and decrease the total amount of aircraft movements. The parameter settings for the calculation of all design values for Kotoka International Airport imply the above mentioned strategies and display correspondently sufficient runway capacity for the planning horizon of this study.

Since the available land at the existing airport site does not allow for an independently operated second runway, it is recommended to reorganize the timetables and flight schedules in order to optimise the use of the runway and the associated taxiway system. Improvement on airside infrastructure including aircraft moving and parking areas will help to increase the maximum number of aircraft movements using the single runway.

However, it must be noted that one day beyond the horizon of this study the constraints at existing Kotoka International Airport will generate the need of a second runway to maintain the growth and economic development of Ghana's most important airport. Hence, it is recommended to start an airport development programme for a Greenfield reliever airport that will provide enough capacity to support the demand of the future.

Due to the current passenger fee structure in Ghana and the outstanding economic performance of Kotoka International Airport, it is not advisable to develop a competing international airport based on a Public Private Partnership.

(b) Terminal Development

The international terminal (Terminal 2) at Kotoka International Airport has sufficient landside area to cope with current passenger volumes. The airside, in particular immigration, is lacking space and equipment, causing delays in passenger and baggage handling and hindering the amount of flights to be operated during peak hours.

The building itself is partly renovated and will be extended in future. The departure concourse has been equipped with additional check-in desks and can easily accommodate domestic departure passengers.

The domestic passenger operation requires additional capacity. A temporary tent structure in front of the domestic terminal building currently provides extra gate hold capacity at landside. By moving departing domestic passengers into the international terminal the domestic terminal can accommodate an appropriate domestic arrivals area.

The increase of both international and domestic passenger volumes and the provision for transfer capacity require the international terminal to merge with the domestic terminal. It is

assumed that there is sufficient land available for the passenger terminal to grow in spatial proximity to additional aircraft stands.

An efficient airside connection between international and domestic areas has to be established to enable passengers to transfer from international to domestic flights and vice versa.

A first extension of a combined international/domestic terminal could be constructed south of Terminal 2 by 2020 and provide additional landside and airside terminal capacity (Terminal 3) spatially related to additional apron areas and newly constructed aircraft stands.

“The first phase for the construction of Terminal ‘3’, which involved prequalification of interested firms for the construction, has been done and awaits approval, after which the next phase; an invitation for technical and financial proposals would be implemented. The contract will be awarded to the successful candidate, based on approval by the national procurement board.

The design built concept is expected to be completed by August 2016 and international departures would be moved to the new terminal while major rehabilitations works are done on the existing terminal building.”ⁱ

The total additional terminal area to be constructed until 2020 is 30 000sqm and includes additional terminal area and better equipment for both international and domestic passengers. Domestic passengers would benefit from additional self-check-in facilities, two new security control units including scanners, four new gates, two new 35 m baggage reclaim belts and 700sqm new airside retail and F+B. Passenger experience for international passengers would be improved by larger proportion of self-check-in facilities to reduce queuing, two additional security control units, ten new gates, three additional baggage reclaim belts (2 nos. of 35m belts and 1 no. of 70m belt) and 500sqm additional Airside retail and F+B in addition to the already existing airside offer.

Additional lounges shall be agreed with airlines and would add to the total terminal area.

Also included in the CAPEX plan is the extension of the baggage handling system.

(c) Landside Access

The connectivity of the airport has already proven to be a substantial risk for its operation. Heavy congestions caused by commuter traffic in the morning and afternoon hours impede the accessibility of Accra’s airport. Close collaboration with authorities including the Ministry of Roads & Highways, the Ministry of Transport and Municipalities is necessary to establish a long-term sustainable ground access strategy. This includes consideration of cars, taxis and buses but also a light railway system and possibly radical new forms of transport such as a Monorail system.

An airport like Kotoka International has to be a multimodal hub with easy and convenient transfer to hotels and emerging Airport City. The road concept of Airport City provides only very narrow corridors between the buildings which create potential for a very high risk that the proximity of the Airport City will turn into a fundamental traffic jam that further obstructs the airport's accessibility from the city.

It is within the airport's responsibility to take care of the passenger traffic arriving and departing at the airport. Sufficient parking capacity and a well-designed access road system shall allow for efficient landside traffic flow.

The following table shows the development stages and associated upgrades for the Kotoka International Airport.

Table 5.13: Development Stages of Kotoka International Airport

Facility	Phase 1 2015-2020	Phase 2 Design Year 2030	Phase 3 Design Year 2035
Airside Facilities	Additional exit and RETs, approx. 40,000 sqm. Perimeter road to be paved (approx. 50,000 sqm)	Additional 3 code letter C and 1 code letter E aircraft stands, approx. 9,000 sqm apron area, TWY connections approx. 24,000 sqm, RWY extension: approx. 1,600 m	Additional 5 code letter C and 2 code letter E aircraft stands, approx. 6,000 sqm, TWY connections approx. 5,000 sqm
Landside Infrastructure	Additional 1,000 parking lots, approx. 25,000 sqm	Additional 1,500 parking lots, approx. 37,500 sqm. Curbside for new terminal, approx. 2,500 sqm	Additional 1,700 parking lots, approx. 42,500 sqm.
General Infrastructure	Drainage improvement, power network	Complete supply and disposal network for New Terminal	-
Terminal Buildings	Domestic Terminal: - No further check-in desks, 8 new CUSS 2 new security control units including scanners 4 new gates 2 new 35m baggage reclaim belts 700 sqm new airside retail and F+B International Terminal: - No further check-in desks or CUSS 2 additional security control units 10 new gates 3 additional baggage reclaim belts (2x 35m,	Domestic Terminal: - No new check-in desks, 4 new CUSS (possibly replace check-in desks with CUSS) - No further security control units - No further gates - No baggage reclaim belts 200 sqm additional airside retail and F+B International Terminal: - No new check-in desks, 8 new CUSS (possibly replace check-in desks with CUSS) - No further security control units 3 new gates	Domestic Terminal: - No additional check-in desks, 8 new CUSS 2 additional security control units 2 gates 1 additional baggage reclaim belt 500 sqm additional airside retail and F+B International Terminal: - No additional check-in desks, 17 new CUSS 2 additional security control units 13 additional gates 2 additional baggage reclaim belts

Facility	Phase 1 2015-2020	Phase 2 Design Year 2030	Phase 3 Design Year 2035
	1x 70m band) 500 sqm additional Airside retail and F+B Presidential Terminal: - It is assumed that no major extensions are required.	1 additional 35m baggage reclaim belt 700 sqm additional airside retail and F+B Presidential Terminal: - It is assumed that no major extensions are required.	1,100 sqm additional airside retail and F+B Presidential Terminal: - It is assumed that no major extensions are required.
Other Buildings	-	-	-
Special Airport Systems	-	Complete communication, security system, baggage handling system (BHS)	-

Source: National Airport System Plan 2014

5.6 Maritime Infrastructure

5.6.1 Existing Maritime Infrastructure

Tema Port, the only port in GAR, serves Ghana and other landlocked countries such as Burkina Faso, Mali and Niger. It is managed by the Ghana Ports and Harbours Authority (GPHA). The Port's performance from 2009 to 2013 is summarised in the table below.

Table 5.14: Vessel Calls and Cargo Traffic for Tema Port 2009-2013

Year	2009	2010	2011	2012	2013
Vessel Calls	1,634	1,787	1,667	1,521	1,553
Cargo Traffic (Tonnes)	7,406,490	8,696,951	10,748,943	11,468,962	12,188,615

Source: GPHA (Ghana Ports and Harbours Authority)

From 2009 to 2010 the number of vessel calls increased to 1 787, yet declined in 2011 to 1 667. A further decline occurred in 2012 when only 1 521 vessel calls were recorded. The number of vessel calls finally rose in 2013. Generally, cargo traffic has risen since 2009 and has reached 12 188 615 tonnes in 2013. The fluctuating number of vessel calls and increasing cargo traffic suggest that larger capacity vessels were calling at the port for the period.

5.6.2 Tema Port Upgrades

In response to growing maritime trade demands in Ghana and the sub-region, Ghana Ports and Harbours Authority (GPHA) is upgrading and expanding the Ports of Ghana.

Projects completed in Tema Port in 2016 include:

- A 450m long by 50m wide bulk jetty capable of berthing four vessels at the same time. The facility has increased the port's berthing capacity from 14 to 16 berths.
- A new dedicated 840 point reefer terminal which includes offices for regulatory stakeholders within the reefer clearance chain.

-
- A new revenue Centre for one stop processing of all port payments this is located strategically by the customs long room to make it easier for port users.
 - A concrete net mending wharf with a solar lighting system to facilitate the activities of local artisanal fishermen as part of the Port Authority's Corporate Social Responsibility Initiatives

The expanded port will have a 1.4km quay with four deep berths equipped with sophisticated container handling gantry cranes and Terminal Operating Systems. Its capacity to accommodate cargo ships will consequently be four times greater than its current capacity. Tema Port will then be able to handle some of the world's biggest container ships, carrying up to 18,000 containers

5.6.3 Fishing

As this region has a very long shore line, fishing activities play a vital role in the localised economies of some villages close to the sea. This is common theme identified in the Medium Term Development Plans of the District and should receive attention. The following was raised in the Medium Term Development Plans which need attention:

- Provision of landing beaches/fishing harbours;
- Cooling storage facilities at the landing sites;
- Space for processing fishing products;
- Assistance with acquisition of safe fishing vessels and outboard motors for boats; and
- Road connectivity from these villages to the major road network.

It is important to have good road connectivity from these villages to the major road network for transportation of their goods and access to the villages.

No evidence could be found, from all information gathered, that any sea transport passengers services exist or are rendered. This is in-line with general practices throughout the world. Sea transport services generally provided for cross-water transport and not along the coast line. The main reason is the cost of infrastructure. Purpose-built landing-site infrastructure must be provided and boats/ferries that will be used for these services must adhere to very stringent safety requirements. Competing services by land are also generally faster, cheaper and with shorter journey times. It is therefore recommended that this mode not be considered as a commuter service for the people of GAR.

The Mid-year Project Implementation Report of 31 July 2015 of The Ministry of Fisheries and Aquaculture states that the Ministry decided to develop six landing sites in Ghana of which the following 3 are located in GAR, namely:

- James Town;
- Teshie; and
- Anloga

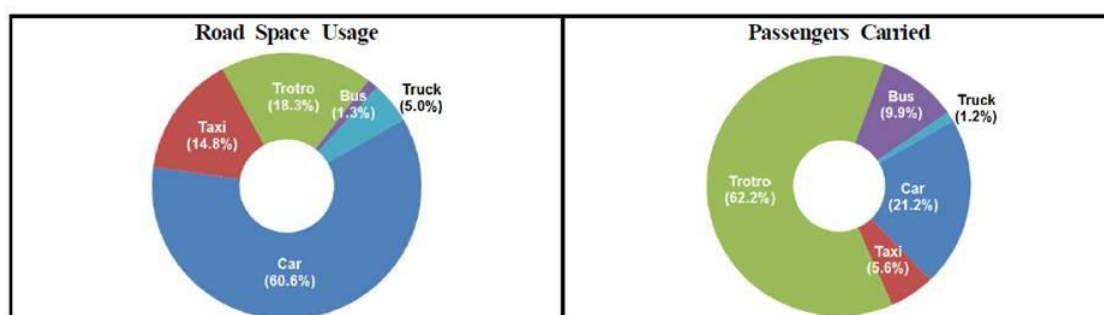
It further states that the projects are delayed due to design and procurement issues and that the Environmental and Socio Impact Assessments are ongoing.

The same Mid-term review endorsed the repair of the slipway at the Tema Boatyard.

5.7 Road Based Public Transport

In GAMA, public transport is operated largely by informal transport service operators with a mix of vehicles, including mini-buses with capacities ranging from 15 to 23 passenger seats, popularly known as “trotro”. In GAMA, trotros account for the largest modal share of over 62.2%, making it the most patronized mode of transport. Even though trotro mode of transport is the most widespread, trotro road space usage is rather low. Trotros use a mere 18.3% of road space, as shown in the figure below.

Chart 5.1: Modal Split of Vehicles on Arterial Roads in GAMA



Source: Transportation Master Plan Project in GAR, 2016

5.7.1 Troto Operations

Trotros became widespread in Ghana and Accra following the failure of the Omnibuses Service Authority (OSA) and Government’s move to privatise public sector transport undertakings in 1996. Today, there are some 11 195 registered commercial vehicles in GAMA, as shown in the following table, of which the trotro is presumed to be the largest in terms of numbers.

Table 5.15: Number of Registered Trotros

District	Number of Holograms	
Total	11,195 (100.0%)	
Accra Metropolitan Assembly (AMA)	2,599 (23.2%)	AMA 2,599
Tema Metropolis (TMA)	772 (6.9%)	TMA 772
Adenta (ADMA)	752 (6.7%)	ADMA 752
Ga East (GEMA)	763 (6.8%)	GEMA 763
Ga West (GWMA)	430 (3.8%)	GWMA 430
		GSMA 658
		GCMA 578
		LANMMA 432
		LEKMA 857
		ASHMA 1,950

Ga South (GSMA)	658 (5.9%)	
Ga Central (GCMA)	578 (5.2%)	
La Nkwantang-Madina (LANMMA)	432 (3.9%)	
Ledzokuku-Krowor (LEKMA)	857 (7.7%)	
Ashaiman (ASHMA)	1950 (17.4%)	
Kpone-Katamanso (KKDA)	826 (7.4%)	
La Dade-Kotopon (LADMA)	578 (5.2%)	

Source: Number of hologram 2015, GAPTE

Trotro operations are generally confined to terminals from their origin to their destinations. Unfortunately, there are still some instances of ‘floating drivers’, that is, drivers who do not operate from any terminal. These drivers pose a great risk to public transport in the region and so a concerted effort has been made to eliminate this problem. Drivers usually belong to unions, associations or cooperatives. Drivers bound for the same route are grouped at one location within the terminal. The association rules state that trotros located at the terminals must be filled to capacity before they can leave the terminal. Generally, trotros operate along registered routes in accordance with the route operating permit given to the association under which the trotros operate. Drivers may not use other routes except when they divert courses to avoid traffic congestion.

In general, trotros do not operate on any schedule or timetables and most of these vehicles operate on the "fill and go" method, even though trotro services operate between the hours of 04:00 and 22:00 throughout the week. At terminals, there are no timetables and most station masters use a board to track the departure turns due for vehicles.

Road Traffic Regulations in Ghana (LI 2180) require all private transport service operators to form unions for better management and regulation by the assemblies in accordance with the provisions of LI 1961, in terms of which Transport Departments within the Assemblies were created to regulate transport activities within their jurisdictions. As such almost all commercial trotro operators belong to or form unions such as the Ghana Private Road Transport Union (GPRTU), Progressive Transport Owners Association (PROTOA) or other associations and cooperatives. By far, GPRTU is the largest union in Ghana and is said to control about 60% of private road transport in the country. Most trotros belong to GPRTU. There are some 565 registered trotro and taxi unions in Greater Accra alone as of 2014, even though the number may have changed by now.

Legislative Instrument (LI) 2180 of 2012 requires all public transport service operators or entities to belong to recognized unions that are registered with the various MMDAs who regulate public transport operating within their jurisdiction in accordance with the provisions of the District Assembly (now Urban Passenger Transport (UPT)) By-law of 2009, which are vested in the MMDAs by the Local Government Act, Act 462 of 1993. Therefore, all public commercial vehicles must belong to unions, associations or cooperatives registered under

the relevant MMDA and or department before they can operate commercial passenger transport services.

Trotro operators are currently registered with a type-A route operating permit which is renewable once a year. This permit is issued to operators who have met the basic transport quality requirements set by the respective assemblies. While type-B permits are issued by the various assemblies in Ghana, it is subject to specified conditions ranging from investment in new and larger capacity buses to high quality service delivery and terminals including stops. This operating permit is renewable every 3 years upon satisfactory performance.

Currently, the quality of trotro vehicle services in Accra is not satisfactory. Most passengers have to be content with trotro vehicles that pose health and safety risks to them. Although passengers may be satisfied with trotros, they often complain about crowding as most trotros are low occupancy vehicles with very little or no space for passenger comfort and easy movement. Most of the seat belts are dysfunctional, especially for the passengers. This increases the fatalities when crashes occur.

(a) Trotro Routes

- According to survey data of AFD (Mapping Accra's Jitney Network with Smartphones 2015), trotros only operate on 315 routes among the 580 registered routes in AMA.
- Apart from the normal routes, there are 150 "ghost routes" in Accra.

(b) Route Connections

- The average variation of trip length is 17%.
- Operators speed is on an average of 43% more time needed in driving in one direction than the other and passengers are charged the same amount for both trips.
- One direction is more fluid than any other on any arterial road in Accra.
- Every day in Accra, there is directional peak hour traffic. Passengers travel towards the city centre in the morning and migrate back to residential areas in the evening.
- In an attempt to avoid congested links, trotro drivers resort to alternative itineraries and drive through back streets, construction sites and empty lots.

(c) Route Network

- The trotro route network, shown in the figure below, is denser in central locations and thins out on the fringes.
- Some places appear to be underserved while a few corridors attract most competition between operators.
- There should be a system of cross-subsidy where part of funds obtained from the most travelled corridors finance operations on the less used segments.

- There are two patterns for grouping trotro stops. The first one consists of stops gathered around a strategic point especially near a terminal. Examples of these trotro stops are the stops at Kaneshie, Kwame Nkrumah Circle, Lapaz and Makola. The second pattern of points-grouping can be observed along highly travelled corridors like along Abeka Road, Oxford Street and Dansoman High Street.



Figure 5.8: Troto Routes in AMA

Source: Mapping Accra's Jitney Network with Smartphones 2015, AFD Transportation Master Plan Project in GAR, 2016

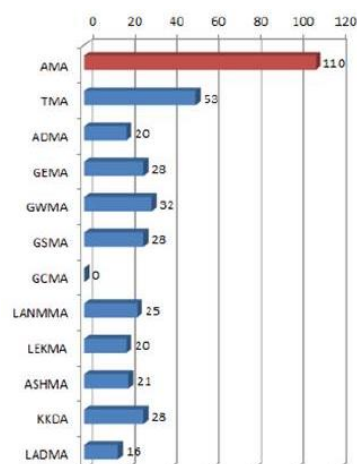
(d) Terminals

(i) Locational Characteristics of Terminals

- The table below and figure that follows summarise the list of terminals in the Greater Accra Metropolitan Area (GAMA). It is clear from the table that AMA has more terminals than any other area in GAMA. AMA alone has about 28.9% of the terminals with Tema having the second highest at 13.9%.
- In terms of terminal share by mode, it is observed that trotro terminals have the largest share of terminals for all areas within GAMA. This suggests that trotros and taxis are the main mode for urban passenger transport in GAMA.

Table 5.16: Terminals in GAR

District	Number of Terminals
Total	381 (100.0%)
Accra Metropolitan Assembly (AMA)	110 (28.9%)
Tema Metropolis (TMA)	53 (13.9%)
Adenta (ADMA)	20 (5.2%)
Ga East (GEMA)	28 (7.3%)
Ga West (GWMA)	32 (8.4%)
Ga South (GSMA)	28 (7.3%)
Ga Central (GCMA)	0 (0.0%)
La Nkwantang-Madina (LANMMA)	25 (6.6%)
Ledzokuku-Krowor (LEKMA)	20 (5.2%)
Ashaiman (ASHMA)	21 (5.5%)
Kpone-Katamanso (KKDA)	28 (7.3%)
La Dade-Kotopon (LADMA)	16 (4.2%)



Source: Transportation Master Plan Project in GAR, 2016

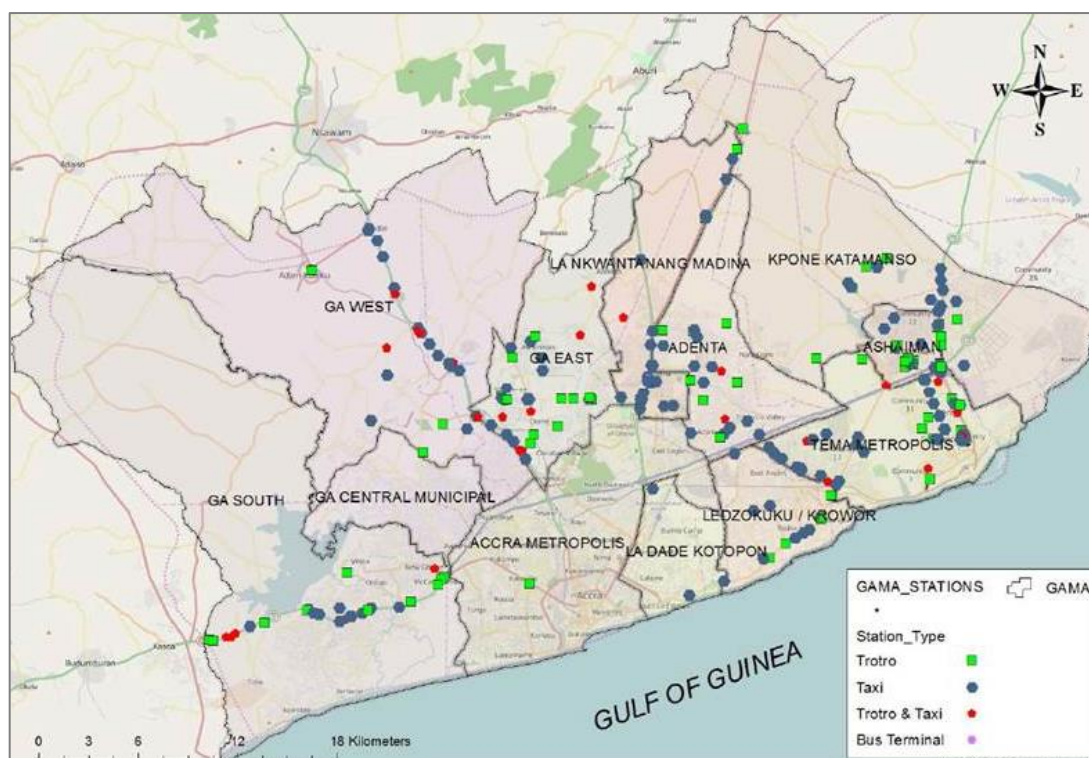


Figure 5.9: Terminals in GAR

Source: Transportation Master Plan Project in GAR, 2016

(ii) Operations

- The conditions at the various terminals are very bad. The areas are mostly littered and very unclean because there are no or limited dustbins to be found. Moreover, they are dusty in the dry seasons and muddy during the wet seasons leaving the passengers to endure the conditions.
- The majority of terminals have no places of convenience for both drivers and passengers. In other terminals passengers have to pay to use the few available wash rooms. Since there are no chairs and shaded areas, passengers stand in queues enduring the weather to wait for a bus. There are petty traders that sell their wares in and around the terminal.
- No information about trotro and their destinations are provided for passengers.
- Passengers have very limited space at the terminals. For this reason, during peak hours, there is congestion at the terminals. Passengers have to squeeze and push to provide space for the trotros to park on arrival at the terminal.
- On average, each passenger spends at least 22.6 minutes at the terminal before the bus leaves to its destination. Waiting time is generally high during peak periods and low during off peak periods.

(iii) Fares

On average trotro fares are nearly 2 times higher than MMT fares due to a waiver on the state-operated transport services. Trotro fares tend to correlate with the distance travelled and are usually adjusted by the Ghana Road Transport Coordinating Council (GRTCC) when fuel prices increase.

5.7.2 Taxi

(a) Taxi Operations and Routes

Most taxis move freely along roads or through busy areas looking for passengers. Passengers can stop and hire one to take them to a destination. This is called “dropping”. Other taxis usually operate from terminals called taxi ranks. Passengers can visit these taxi ranks and take “dropping” to their destination. The destinations for taxis that operate from taxi ranks may be fixed or flexible.

Some taxis operate from the same terminals as trotros. These taxis usually have a fixed route and operate a shuttle service between the terminal and a specific destination and charge a flat fare for any destination along that specific route.

Taxi operations may be limited to the specific area that the taxi’s union is registered for. This may be within a district or across other districts. However, most taxis occasionally, travel to other areas outside their operating area. Thus taxi routes are more flexible than trotro routes. No intercity taxi routes currently exist.

As with trotros, taxi operations are regulated by the relevant district assembly. Some taxi unions are part of the Ghana Private Road Transport Union (GPRTU), others are part of Progressive Transport Owners Association (PROTOA) and the rest may belong to various local associations and cooperatives.

(b) Taxi Vehicle Conditions

Generally most taxis do not have functioning air-conditioners and those that do generally do not use them. Consequently, most taxis run with windows lowered, exposing the passengers to air pollution and other breath-related sicknesses.

By and large most taxis also do not have good interior and exterior looks due to poor maintenance by owners and / or drivers.

(c) Taxi Fares

Taxi fares are negotiable between the passenger and the taxi driver. However, many taxi drivers will only accept fares proportionate to the distance of the passenger's destination. Taxis that operate on fixed route(s) from a rank or terminal usually have fixed fares.

5.7.3 Bus

(a) MMT Bus

Metro Mass Transit Limited (MMT) was created in 2003 to provide state-operated public transport services and so the government is a majority shareholder in MMT, holding approximately 45% of shares. The rest (55%) is held by the private sector including amongst others Prudential Bank, National Investment Bank and Social Security and National Insurance Trust.

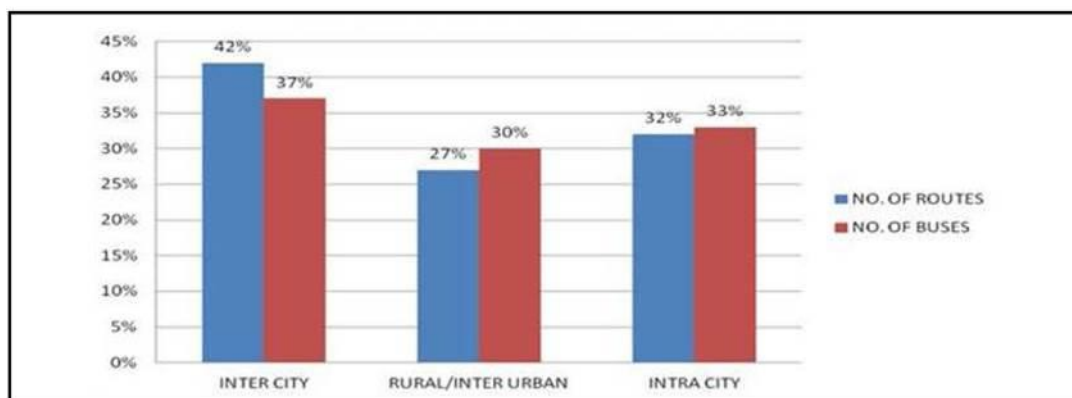
(b) Operations

There are some 1 049 MMT buses servicing both intra-city and intercity areas from Accra. The main terminals for MMT are located in Accra from where they serve major areas in the Accra Metropolis. The Ministry of Transport is the supervisory body for MMT and therefore makes important regulatory and operational decisions for the service. As is the case with most state-owned public transport systems, the quality of MMT operations is not as good as expected. Most of the buses do not have functional air conditioning and have worn interiors due to lack in maintenance and poor management.

(c) MMT Bus Routes

The graph below summarises the current composition of MMT routes in Accra and Ghana. The intercity bus service accounts for the largest number of routes as well as the number of bus fleets. This service accounts for 42% and 37% of routes and bus fleet respectively. Rural or inter-urban service accounts for the least number of routes. MMT serves only 27% of the rural or urban areas, though the percentage of bus fleet is 3% higher than the route coverage. The figure below compares the bus service with the route coverage. Popular destinations for MMT bus fleet are Kumasi, Tamale, Nkwanta, Sunyani and other urban areas.

Chart 5.2: Comparison of MMT Bus Service Types and Routes



Source: Transportation Master Plan Project in GAR, 2016

(d) Fares

MMT currently waives fares for school children on weekdays. The MMT fares are, however, around 50% lower than other private intercity bus services.

5.7.4 Private Bus

(a) Operations

A number of private bus operators exist in GAR. These operators run their fleet as transportation companies, and so most of them only operate intercity services and have a higher quality fleet than MMT. Their buses are air-conditioned and more comfortable, and have relatively better service conditions and for this reason they also command higher fares for their destinations. There is no discount on fares as these companies do not receive any subsidy from government. These buses generally operate on a Type B Permit. Popular private bus operators in the Region include VIP, O.A Travel and Tours Limited and Great Imperial Transport Limited.

(b) Private Bus Routes

Private bus routes consist of 90% intercity and about 10% intra-city routes as some private bus operators offer a tour service for hire in and around the country. Routes range from within Ghana to other countries such as Nigeria and Benin. Popular routes from Accra include major urban areas such as Kumasi, Takoradi, Sunyani, Tamale, Aflao, and regional capitals throughout the country.

(c) Fares

On average the fares for private bus companies are about 50% (or more) more than those of state-operated services such as MMT. Some companies operate first class bus services which cost more than a regular service. Most of the private bus companies have provisions for vehicle booking and ticket reservation for their clients and they also have fares for luggage.

5.8 Future Public Transport Strategy

5.8.1 Strategy

As the economy grows and GDP improves citizens require a higher level of service. In the urban areas, there is the need to restructure the public transportation system in order for commuters to reach their destination within an hour. Therefore, changing the current ineffective and dilapidated public transport environment should be a top priority. The objective is to enhance public transport-based mobility and accessibility to ensure the sustainable development of GAMA.

At present, trotros dominate other modes. In the near future, Bus and BRT will have to cover the current trotros position and to do that, BRT should play a pivotal role. The public transport improvement strategy is shown in the figure below.

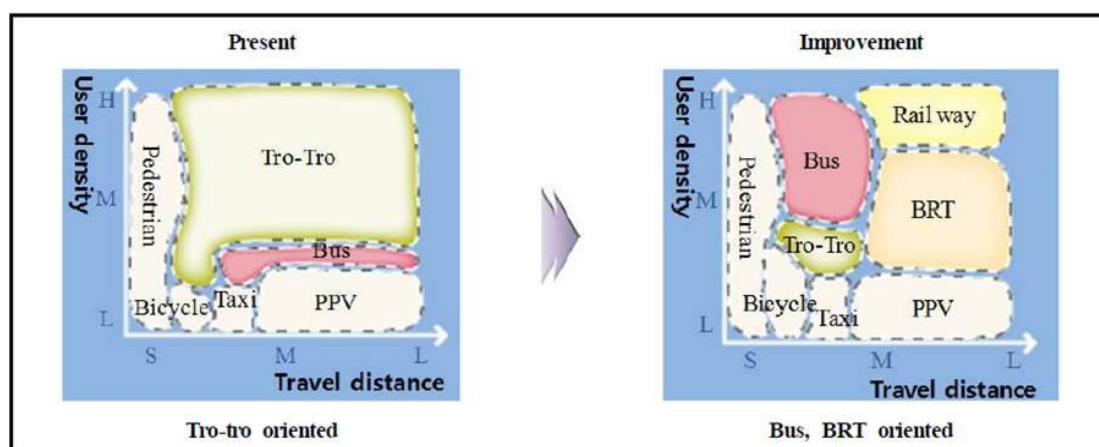


Figure 5.10: Improvement Strategy in the Public Transport Sector

Source: Transportation Master Plan Project in GAR, 2016

In the short-term the new bus system like the arterial buses will operate on the radial arterial roads. In the mid-term the bus-oriented system would be operational and in the long-term the vision is to have the railway system as the primary mode of transport.

5.8.2 Taxi Improvement

In GAMA low-capacity and worn-out trotros and taxis are the main mode of public transport for citizens, instead of high-capacity bus transport. Taxis in GAMA do not function properly due to poor service, safety issues and irregular fare collection. Based on analysis of current problems, taxi management and fare collection systems will be structured in order to provide differentiated services for users.

In order to improve overall taxi operating systems in GAMA, installing taximeters and introduction of call taxis will be established for better convenience between taxi drivers and users. Improvement plans are shown in the table below.

Table 5.17: Improvement Plan

Content	Plan
Traffic Safety	Establishment of vehicle operation duration and maintenance standard
	Setup administrative system for taxi operation
Service Improvement	Installation of taximeter
	Introduction of call taxi

Source: Transportation Master Plan Project in GAR, 2016

5.8.3 Bus System - Arterial Bus Network

The TMP proposes the implementation of an Arterial Bus Network. Considering the fact that most commuters use trotro terminals, major trotro terminals can be the "Hub", and bus stations and small-sized terminals on the roadside or in residential areas would be the "Spoke" system. Refer to the figure below which illustrates the concept of a bus network.

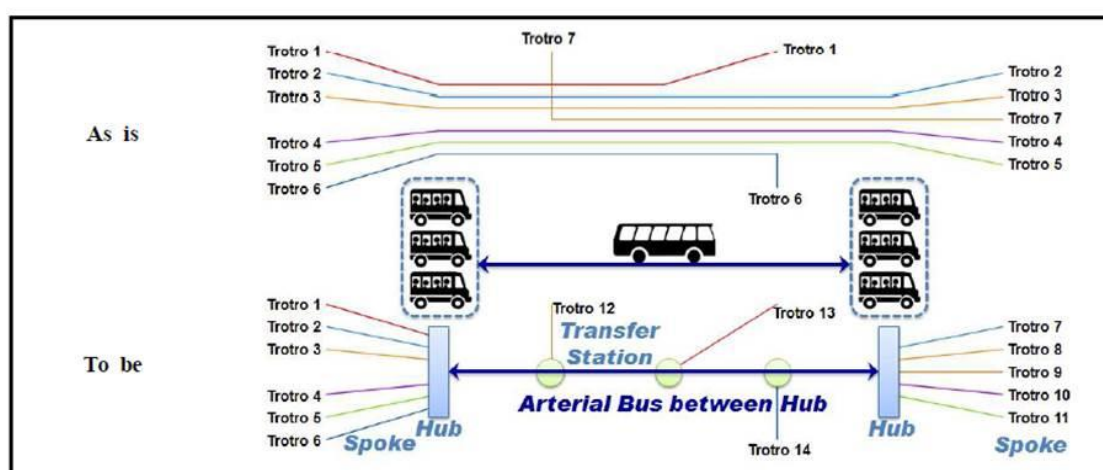


Figure 5.11: Concept for Bus Network

Source: Transportation Master Plan Project in GAR, 2016

There are 5 major arterial roads in AMA. These are Winneba Road, Nsawam Road, Liberation Road, Motor Way and Labadi Road. Almost all trotro routes are concentrated on these arterial roads, with 14 trotro routes operating on the Winneba Road. Labadi Road shows a lower density of trotro routes than other arterial roads because it is too lean and close to the beach.

The high density of trotros on some arterial roads causes severe traffic problems such as competition between trotro drivers, traffic congestion, passengers' inconvenience for accessing their destinations and excessive travel time.

The trotro routes should be totally reformed to solve these problems. The modern big bus called 'Arterial Bus' should cover the arterial roads and trotros should connect these 'Arterial

Bus' routes from residential areas. The bus reform is not easy to implement because there are so many stakeholders. Nevertheless, it is necessary to reform GAMA's trotro system to catch up with other cities having competitive public transport systems and making this Region more functional.

A total number of 12 'Arterial Bus' Networks are needed in GAMA instead of the trotro system. The 'Arterial Bus' will be a major public transit mode in the medium-term period. Almost all arterial roads will be served by the 'Arterial Bus' rather than the trotro. Arterial Bus routes are chosen according to standards of selection viz.:

- Number of operating trotro routes;
- Travel demand; and
- Road condition.

Similar route numbers are to be assigned for 'Arterial Bus' routes operating on the same corridor. There will be 2-3 Arterial Bus routes on the same arterial road since travel demand tends to increase close to CBD.

The suggested length of 'Arterial Bus' routes is 292.4km (round trip: 584.8km). The longest route is 39.0km of Line 4-1 (Tema-Sakaman). The shortest route is 19.7km of Line C-3 (Sakaman-Ringroad). Introducing the BRT system on these Arterial Bus networks would be considered later. Refer to the figure below which shows the Arterial Bus Network Plan.

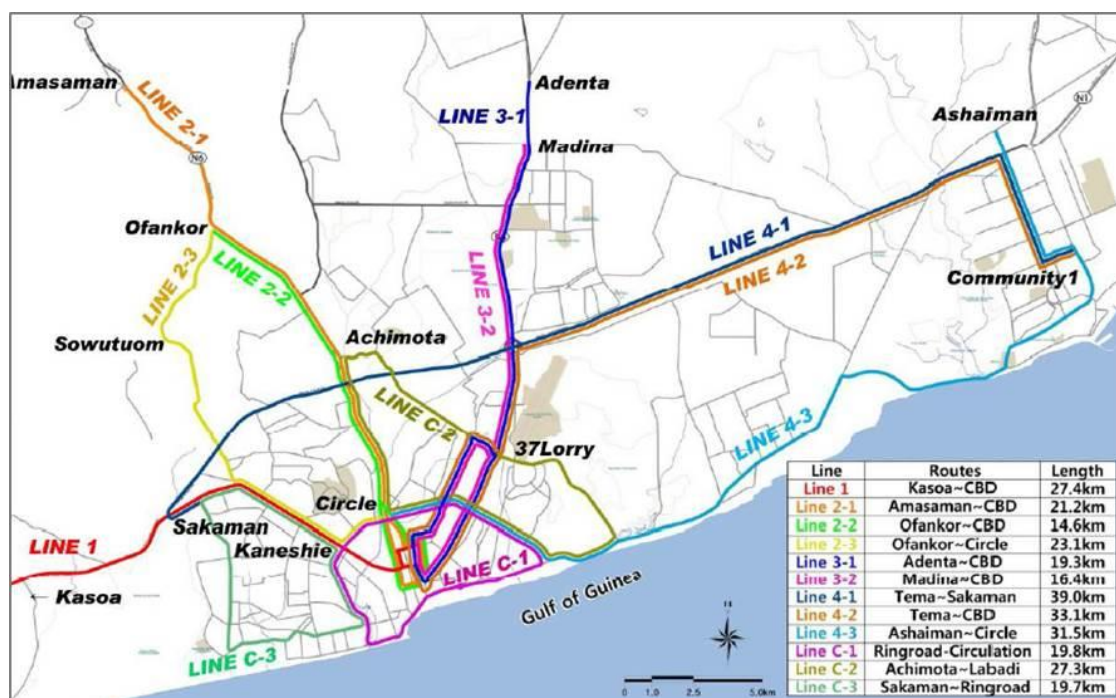


Figure 5.12: Arterial Bus Network Plan

Source: Transportation Master Plan Project in GAR, 2016

5.8.4 Bus Rapid Transit (BRT)

BRT is the most dominant method among the transit priority strategies. The BRT system of GAMA has been studied for 15 years.

The previous project suggested 6 BRT routes in GAMA. The first pilot BRT route was recommended on the Winneba Road but it has not been implemented to date. The figure below summarises the proposed BRT implementation routes in GAMA.

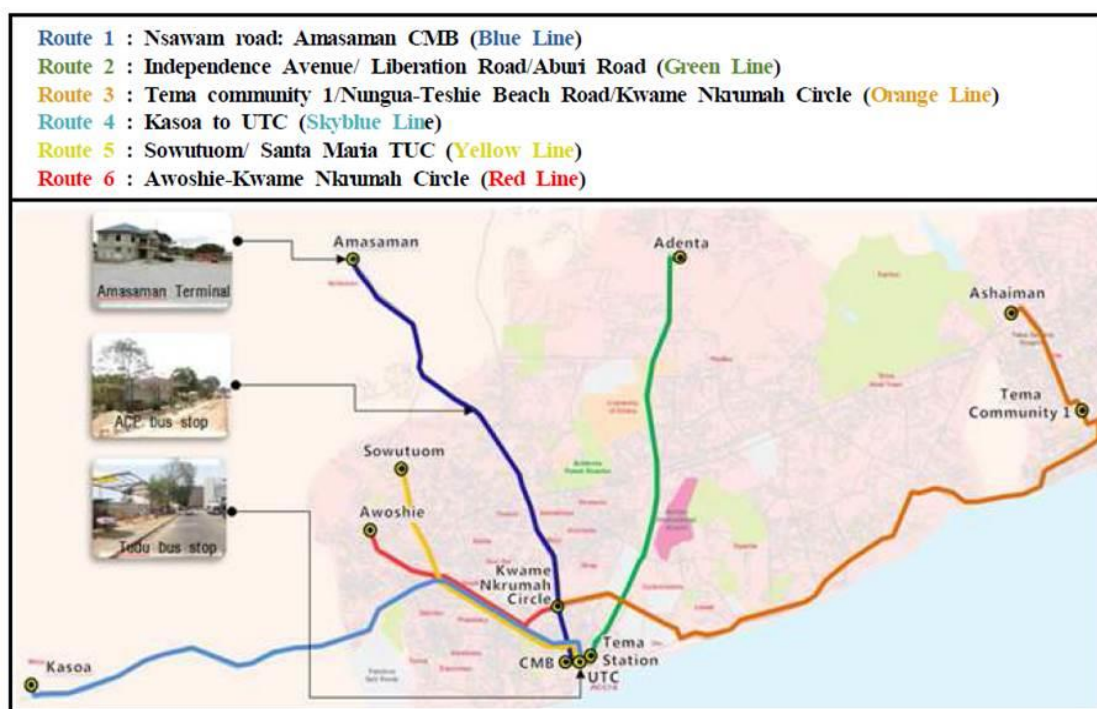


Figure 5.13: Proposed BRT Plan

Source: Transportation Master Plan Project in GAR, 2016

5.9 Existing Non-Motorised Transport (NMT)

Historically, most of the transport policies in GAMA have focused on traffic flow and the improvement of public transport rather than the expansion of NMT facilities such as sidewalks and bicycle-related facilities.

The results of a survey on the prevalence of existing NMT infrastructure indicated that 21.4% of the roads, whose capacity amounts to that of collector roads or more (about 155km), have sidewalks and bicycle lanes. This means GAMA does not have adequate Non-Motorized Transport (NMT) infrastructure.

The majority of major arterial roads in GAMA have sidewalks but pedestrians face interruption as the sidewalks are frequently disconnected. Furthermore, most of the roads whose capacity amounts to that of minor arterial roads or less have no sidewalks. Sidewalks at markets and surrounding areas are occupied by street vendors who hinder pedestrian

movement. In general, all existing sidewalks have poor pavement conditions. The Tetteh Quarshie-Madina section on Legon East Road has bicycle-pedestrian shared lanes.

The existing NMT network is shown below.



Figure 5.14: Existing NMT Network

Source: Transportation Master Plan Project in GAR, 2016

5.10 Future NMT Strategy

5.10.1 Strategy

The strategy for improving the NMT infrastructure in GAMA focusses on the following:

- Establishment of an NMT network.
- Provision of space designated for pedestrians.
- Enhancing connectivity between NMT and public transport.

The strategy is summarised in the table below and discussed thereafter.

Table 5.18: Strategy for Improving NMT in Ghana

Current Conditions and Prospect	Improvement Strategy
• Disconnected NMT Network - Disconnected NMT Network on major arterial roads - Halted construction of pedestrian overpasses - Lots of roads which require crosswalks	• Establishment of NMT Network - Connecting disconnected NMT Network - Improving fundamental conditions for pedestrians
• Poor Pedestrian Conditions for NMT - Most of the local roads don't have separate	• Provision of the Space Designated for Pedestrians - Improving conditions for pedestrians

Current Conditions and Prospect	Improvement Strategy
- space for pedestrians. - The verge of the roads is occupied by waiting and parking vehicles and is heaped with materials - No pedestrian-only lanes	- in residential areas - Implementing traffic calming project in areas with heavy pedestrian traffic
• Poor Connectivity between NMT and Public Transport - Poor accessibility for passengers of trotros - Small waiting space for passengers of public transport	• Enhancing Connectivity between NMT and Public Transport - Establishing networking plans which take into consideration public transport - Improving conditions of the areas surrounding public transport facilities
• Lack of Comprehensive NMT Plans	• Establishment of Comprehensive NMT Plans

Source: Transportation Master Plan Project in GAR, 2016

5.10.2 Improvement of NMT Infrastructure

(a) Establishment of NMT Network

- Most of the major arterial roads in GAMA have sidewalks but many are disconnected. Most of the minor arterial roads and roads on the outskirts of Accra do not have sidewalks.
- No bicycle lanes exist except for the Tetteh Quarshie-Madina section on Legon East Road. This means low trafficability of bicycles and higher chance of accidents.
- Connecting disconnected sidewalks along major arterial roads is a top priority. The TMP also identifies projects to construct sidewalks along major arterial roads, minor arterials roads and roads in residential areas.
- Bicycle lanes should be built along sidewalks, if there is adequate space, for the convenience of cyclists.
- The NMT Master Plan comprises the NMT Network for arterial roads and the NMT Link for connecting arterials roads. The NMT Network seeks to build sidewalks and bicycle lanes whilst the NMT Link seeks to build sidewalks.
- For continuous expansion and implementation of the NMT Network, the NMT Master Plan should cover every region in GAMA like in the case of the Tema Metropolitan District. A design manual is necessary for consistent installation of facilities via standardized infrastructure for NMT.
- There are plans to develop the “NMT Master Plan” and the “NMT & Safety Manual” in 2016 in order to implement NMT projects under the 2016 TMP.

(b) Provision of Space Designated for Pedestrians in Areas with Heavy Pedestrian Traffic

- Markets and terminals in GAMA are congested with people. Osu and James Town are congested with pedestrians and vehicles, increasing the possibility of collisions between pedestrians and vehicles.
- Street parking and materials piled in heaps on roads occupy pedestrian spaces and poorly maintained ditches compromise their safety. There is a lack of space for pedestrian facilities given the huge number of pedestrians.
- Areas with heavy pedestrian traffic and tourist destinations should guarantee safer and more convenient conditions for pedestrians, since pedestrians should have a higher priority over vehicles.
- The following projects are to guarantee safety and more pleasant conditions for pedestrians in the areas with heavy traffic:
 - Installing facilities to separate pedestrians from vehicles if the width of the road is adequate.
 - Categorising roads as vehicle-pedestrian roads or pedestrian-only roads if the width of the road is not adequate.
 - Securing enough space for pedestrians by introducing one-way streets.
 - Installing facilities to prevent parking on sidewalks, and installing and expanding crosswalks.
 - Building small parks and resting places in areas with heavy pedestrian movement.
 - Nine areas/streets including those around markets and terminals and Oxford Street in Osu and James Town which have heavy pedestrian traffic and are very symbolic of GAMA are designated as traffic calmed areas/streets. These areas/streets will serve as the bases for pedestrian traffic and will be connected with the NMT Network for seamless movement of pedestrians.

(c) Improved Connectivity between NMT and Public Transport

- Current road conditions in GAMA hinder easy access of NMT to public transport. As a result, plans have been established to integrate NMT with Bus Rapid Transit (BRT) and Transportation System Management (TSM). The plans for implementing better integration with public transport are as follows:
 - Building sidewalks (including side streets approaching arterial roads) on the areas where public transport facilities can be established.
 - Installing bus shelters, bus bays, and bicycle stands.
 - Installing devices to prevent illegal parking around public transport facilities and tightening laws on illegal parking.
 - Building sidewalks and adjusting locations of sidewalks near public transport stations.

The NMT Network Plan is shown in the following figure.



Figure 5.15: NMT Network Plan

Source: Transportation Master Plan Project in GAR, 2016

5.11 NMT Implementation Plan

NMT implementation plans are based on the projects aimed at improving connectivity of roads (as short/mid-term projects) and on the considerations for the current conditions in GAMA including traffic volume and regional symbolism. The table below and figure that follows show the NMT Implementation Plan for GAMA.

Table 5.19: NMT Implementation Plan

Type	Short-term	Mid-term	Long-term	Total
NMT Network	34.9km	51.7km	47.9km	134.5km
NMT Link	18.5km	72.6km	60.0km	152.0km
Traffic Calming Projects	Three areas/streets	Three areas/streets	Three areas/streets	Nine areas/streets
Improved Connectivity with Public Transport	Integrated with improved connectivity of roads			-
NMT Master Plan	Development of NMT Master Plan NMT & Safety Manual		Continue	-

Source: Transportation Master Plan Project in GAR, 2016



Figure 5.16: NMT Implementation Plan

Source: Transportation Master Plan Project in GAR, 2016

5.12 Freight Transport

Road transport is by far the most important means of moving freight in Ghana and is the sector that requires the greatest consideration. Roads carry 95% of passengers and 98% of the country's freight.

From all documents, reports and studies very little is mentioned about freight transport and heavy vehicles. The Transport Master Plan Project in Greater Accra Region 2016, contains traffic count results which were done on most of the major roads in and around Accra, refer to the figure below. The counts that were done over a 24-hour period contain results for a class vehicle classified as "Trucks".



Figure 5.17: 24-Hour Traffic Count Positions

Source: Transportation Master Plan Project in GAR 2016

On average the trucks constitute 5% of all traffic which is a general expected norm. The composition of trucks varies throughout the network with the links with the highest number indicted in the table below.

Table 5.20: Truck Traffic

Link No	No of Trucks (veh/day)	% Truck Traffic
1	3 247	5.8
2	3 260	5.1
3	1 951	4.3
4	6 581	10.6
5	3 564	7.7
8	6 723	9.6
9	2 990	4.7
11	2 999	4.9
12	2 679	3.9
17	2 188	4.1
18	2 223	4.1
19	1 916	4.1
27	1 709	6.1
28	2 734	7.0

These results clearly indicate that the major roads are used by truck traffic and that these routes must be planned and designed accordingly, to avoid congestion forcing trucks onto smaller roads.

5.13 Main Findings – Road Infrastructure and Transportation

The main findings pertaining to roads and transportation follow:



ROAD INFRASTRUCTURE AND TRANSPORTATION FINDINGS

Road Infrastructure

- In the morning demand for transportation is inbound (towards Accra) at 62% of the trips.
- Roads are highly congested with 37% operating at unacceptable service levels of less than 15km/h and only 24% above acceptable levels of more than 30km/h throughout the day.
- Roads are classified according to ownership, viz.:
 - Trunk Roads under the jurisdiction of Ghana Highway Authority;
 - Urban Roads under the jurisdiction of Department of Urban Roads; and
 - Feeder Roads under jurisdiction of Department of Feeder Roads.
- Authorities have embarked on a road improvement programme with 15 ongoing projects and a further 10 projects still to commence.
- The planned Trans African Highway 7 (TAH7), Abidjan-Lagos Corridor passes through Accra. Alignment of this corridor will have to be considered in the development of the Spatial Development Framework

Rail Infrastructure

- The Ghana Railway Company Limited (GRC) currently operates commuter rail services on two routes which form part of the so-called Eastern Line. The lines are the Accra-Tema and Accra-Nsawam Lines with 3 train sets.
- Accra-Tema service operates 2 trains each making 2 trips a day.
- Nsawam-Accra service operates 1 train making 4 trips a day.
- The Transport Master Plan (TMP) recommends 2 north-south axes and a west-east axis network. The Rail Master Plan of Ghana (MP) 2013 proposes a Coastal Line from Accra to Asoprochona (Labadi Corridor, towards Tema). It is proposed that the Rail Master Plan's (MP) new line should be changed from Labadi corridor to Kwame Nkrumah Motorway corridor.

Aviation

- Aviation is regulated by the Ghana Civil Aviation Authority (GCAA). The Ghana Airports Company Limited (GACL) manages flights in the airports and airstrips of Ghana. GACL manages the only international airport in Ghana, the Kotoka International Airport (KIA) situated in Accra.
- In 2013, KIA ranked 3rd in West Africa based on the number of passenger visits to Accra. The airport is served by about 30 international airlines, of which 12 (40%) are from Africa, 17% or 5 are from the West, 3 (10% each) are from both South and East and one is from the East (3%).
- Current KIA constraints include runway capacity in future, terminal capacity especially the domestic terminal, integration between International and the Domestic Terminal, and Land side access.
- Initiatives (projects) have been identified to develop KIA which if implemented will be sufficient till 2035 should they be implemented.

Maritime Infrastructure

- Tema Port is the only port in the GAR. It serves Ghana and other countries such as Burkina Faso, Mali and Niger. It is managed by the Ghana Ports and Harbours Authority (GPHA).
- Performance indicated that although the number of vessels decreased slightly overall tonnage has increased.
- In response to growing maritime trade demands in Ghana and the sub region, GPHA is upgrading and expanding the Ports of Ghana.
- After the upgrades, schedule to be completed before end 2019, the capacity of Tema Port to accommodate cargo ships will be four times greater than its current capacity. Tema Port will then be able to handle some of the world's biggest container ships carrying up to 18,000 containers.
- Truck congestion is a challenge at the landside.
- As this region has a very long shore line, fishing activities play a vital role in the localised economies of some villages close to the sea. From a transportation point of view it is important that good road connectivity from these villages to the major road network be created for transportation of goods and access to the villages.
- No evidence could be found that any sea-transport passenger services exist or are rendered.
- Due to the high cost of purpose-built infrastructure and adherence to stringent

safety requirements it is not recommended to pursue sea-transport passenger services as a mode of commuter transport.

- The provision of land transport along the coast line is supported as this is more cost effective and results in shorter journey times.

Transportation

- Road-based public transport is operated largely by informal transport service operators with a mix of vehicles: mini-buses with capacities ranging from 15-23 passenger seats, popularly known as “trotro”. Trotros account for the largest modal share (over 62.2%) making it the most patronized mode of transport.
- Trotro operations are generally confined to terminals from their origin to their destinations.
- In general, trotros do not operate on any schedule or timetables, but commonly operate between the hours of 04:00 and 22:00 throughout the week, and most of these vehicles operate on the "fill and go" method.
- The quality of trotro vehicle services in Accra is not satisfactory.
- Road Traffic Regulations in Ghana (LI 2180) require all private transport service operators to form unions for better management and regulation by the assemblies.
- Trotros operate on 315 routes although there are 580 registered routes.
- Apart from the normal routes there are 150 “ghost routes” in Accra.
- Trotro fares tend to correlate with the distance travelled and are usually adjusted by the Ghana Road Transport Coordinating Council (GRTCC) when fuel prices increase.
- Most Taxis move freely along roads or busy areas looking for passengers.
- Taxis also service trotro terminals fulfilling a sort of feeder service.
- On average, most taxis do not have good interior and exterior looks due to poor maintenance by owners and or drivers.
- Taxi fares are negotiable between the passenger and the taxi driver.
- The bus service operated by Metro Mass Transit Limited (MMT) was created in 2003 to provide state operated public transport services. The government is a majority shareholder in MMT, holding about 45% shares, while the rest (55%) is held by the private sector, including Prudential Bank, National Investment Bank and Social Security and National Insurance Trust are shareholders.
- These busses carry less than 10% of all road-based passengers.
- MMT busses service both intracity and intercity areas from Accra and the main

terminals are located in Accra from where the busses operate.

- MMT currently waives fares for school children on weekdays. The MMT fares are around 50% lower than other private intercity bus services and Troto fares.
- A number of private bus operators exist in Greater Accra. These operators operate their fleet as transportation companies. Most of them operate only intercity services and their fleet and bus quality is generally higher than that of MMT. Their buses are air-conditioned and usually more comfortable and have relatively better service conditions than state operated services and for this reason they also command higher fares for the various destinations.
- Routes range from within Ghana to other countries such as Nigeria and Benin.
- The need was identified to restructure the public transportation system in order to provide a better quality service.
- The present troto-dominated service will in the near future make way for Bus and BRT. Current trotros will play a minor role. It is proposed for BRT to play a pivotal role
- A "Hub and Spoke" type system is being proposed with an arterial bus network operating between the hubs and the trotros feeding the hubs. Major troto terminals can be the "Hub" and bus stations and small sized terminals on the roadside or in residential areas would be the "Spoke" system.
- BRT is the most dominant method among the transit priority strategies. The BRT system of GAMA has been studied for 15 years.
- The previous project suggested 6 BRT routes in GAMA. The first pilot BRT route was recommended on Winneba Road, but it has, as yet, not been implemented.
- Historically, most of the transport policies in GAMA have focused on traffic flow and improvement of public transport, rather than the expansion of Non-Motorised Transport (NMT) facilities such as sidewalks and bicycle-related facilities.
- Existing NMT infrastructure indicated that 21.4% of the roads, whose capacity amounts to that of collector roads or more (about 155km), have sidewalks and bicycle lanes.
- The strategy for improving the NMT infrastructure in GAMA focusses on the following:
 - Establishment of an NMT network
 - Provision of space designated for pedestrians
 - Enhancing connectivity between NMT and public transport
- From all documents, reports and studies obtained very little is mentioned

about freight transport and heavy vehicles.

- On average trucks make up 5% of all traffic which is a general expected norm. The composition of trucks varies throughout the network.
- Major heavy vehicles and truck routes/networks will have to be identified during the development of the spatial development framework.

6 Man-made Environment – Regional Built Environment

6.1 Spatial Structure

GAR is made up of 16 districts, each with its own character, composition, development potential and constraints. The 16 districts are governed individually but to plan for the region requires a holistic view over the entire area. Therefore while coming to understand the regional spatial structure; how it works, what the dynamics are and how areas inter-relate, a broad assessment of the entire area was made.

As alluded to in Section 2 (Spatial Structure of the Region) and as illustrated in the figure below, the urban core of the region centres on the two primary towns of Accra and Tema. These are the administrative and economic heartland of the region, they have become specialised in their own right and are the driving force of the GAR. Supporting the office, business and industrial centres are vast residential areas. These epitomise the urban environment, reflect different densities and have different abilities to deal with increased and continuing urban influx and population growth.

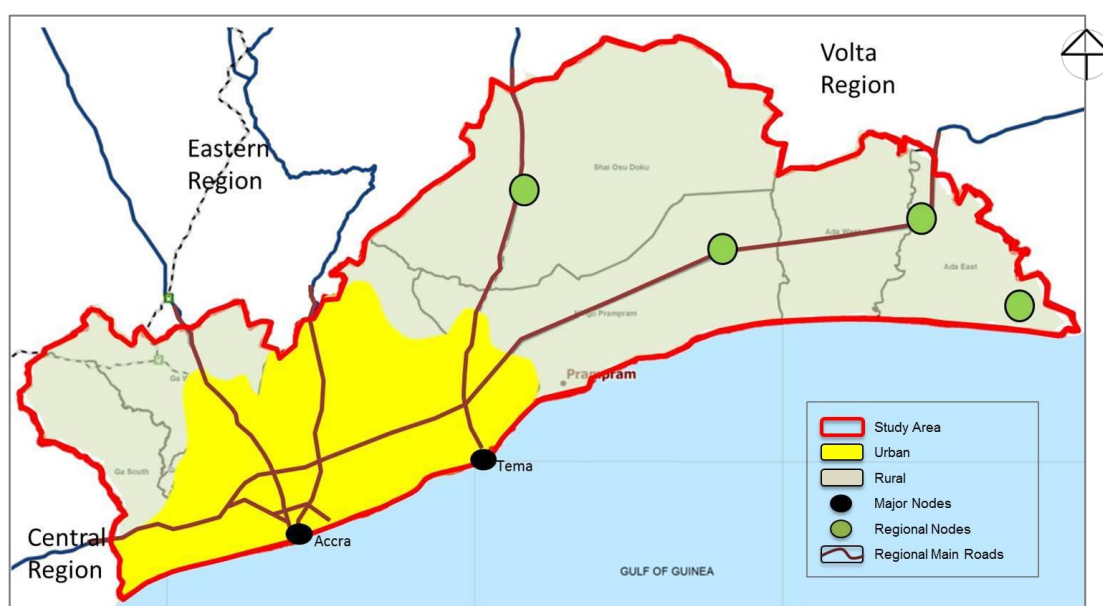


Figure 6.1: Broad Spatial Structure

Beyond the area of urban concentration, primarily encompassing the eastern portion of the region is a rural zone. The rural area comprises a range of land uses, including mining activities, forestry and forests, natural protected / conservation areas, agricultural production (formal and sustainable farming) areas and other natural features. What makes them rural, in comparison to the urban areas, is the population densities.

6.2 Land Cover Analysis

Major land use changes in the GAR are due to the rapid population growth and influx, which is manifested in urban sprawl and extended residential development and its associated uses.

The land cover analysis, as shown in **Plan 6.1** on the following page, reveals tremendous growth and sprawl. Urbanisation has therefore, been profound over the last 26 years. However, the density profile of the region might not show this, because the land area of many assembly areas have been changed / increased and so the increased population in that area cannot be appropriately rated. Even so it is clear from the analysis that much land transformation has occurred over the last 26 years and that such is prominently concentrated around the primary urban centres of Accra and Tema.

Plan 6.1: Built-up Areas from 1991-2017

Source: Esri, Digital Code, Geo Eye, Earthstar, CNE/Airbus

The plan clearly indicates the above findings graphically and would suggest that the main regional transport routes from Accra and Tema have played an important role in creating the built-up form within the urban context. This principle also applies to the rural areas with the N1 playing a prominent role. As indicated on the plan the urban area has increased by approximately 590km², from 447km² in 1991 to 1036km² in 2017, which equates to an increase of 132%. This indicates significant growth over the last 26 years. Personal surveillance shows that the bulk of this growth is made up of residential and residential support services.

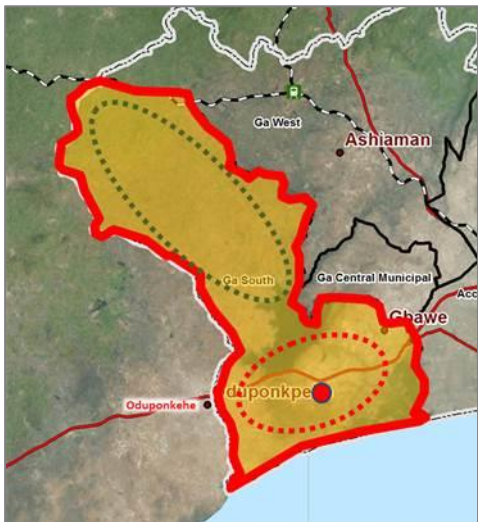
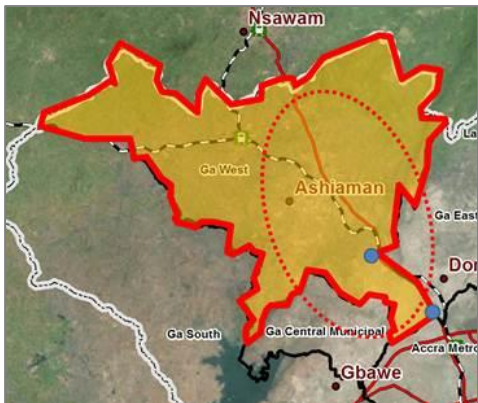
If the present spatial growth pattern is not managed, curbed and planned for, the doubling up of the 2017 spatial footprint could occur in the next 20 years, which will have dramatic impacts on the future functioning, health and service delivery ability of the GAR.

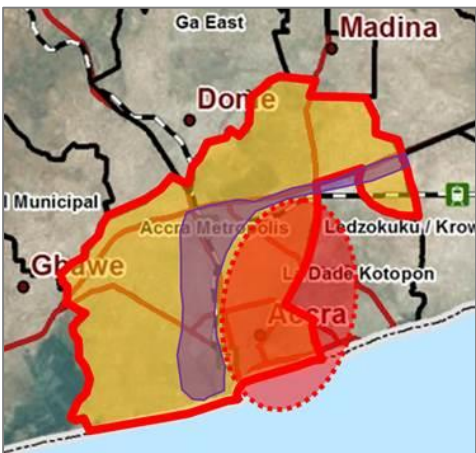
6.3 Land Use Composition per District

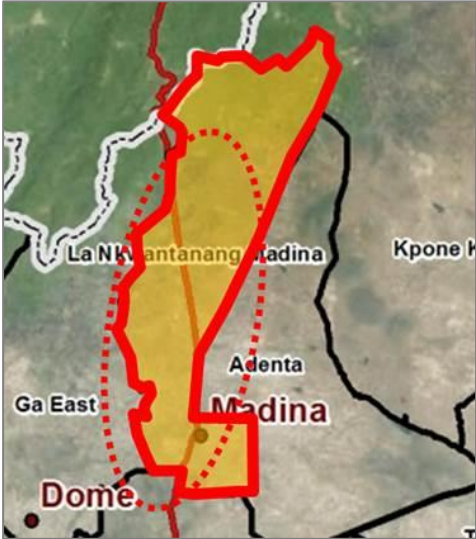
The following table and included diagrams indicate the primary land uses per sub-region / district. The land use categories are rather broad and essentially indicate the urban footprint of the sub-region as well as the primary functions within the study area.

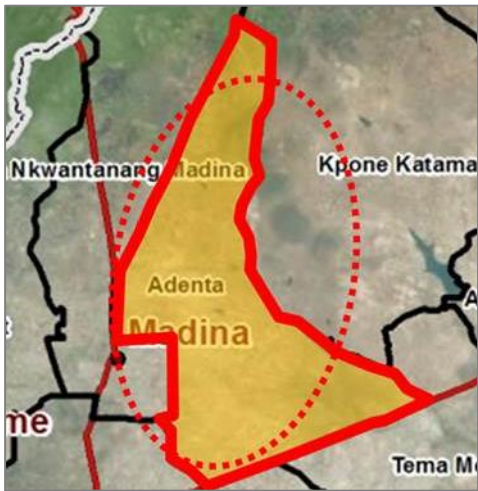
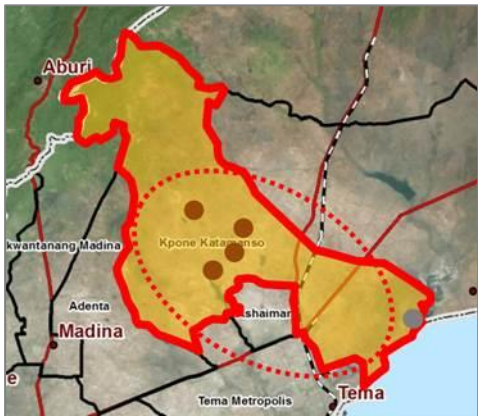
The above information was mainly derived from the Medium Term Development Plans of the various municipal assemblies.

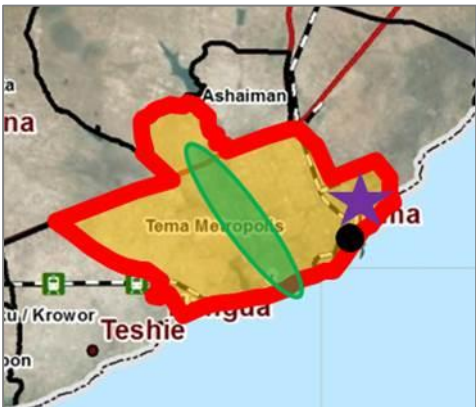
Table 6.1: Land Use Pattern per District

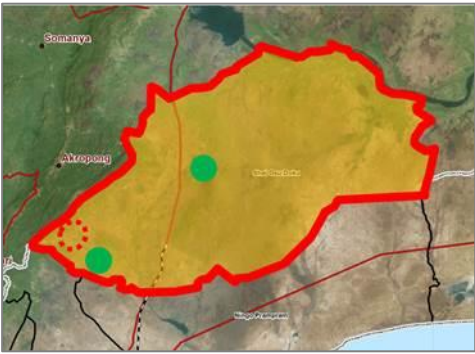
Land Use Pattern	
GA SOUTH	
	• Growing in a north-eastern direction. • Centre and periphery mostly rural and agro based settlements. (green dashed circle) • Southern part is experiencing rapid urbanisation and the majority of settlements are unplanned. (red dashed circle) • Arable land is turned into residential estate development. • Peri-urban areas are characterised by unauthorised development. • Losing farmlands to sand winners. • Absence of agricultural storage and processing facilities. • Biggest mall in West Africa. (blue dot) • Pambros salt industry. • Strong links with Odumponkpe.
GA WEST	
	• 50% urban, 30% peri-urban and 20% rural. • Southern area have higher level settlements with the necessary urban functions. • Rural communities are located at the periphery and lack social facilities. • Agricultural sector is stagnant. • Losing farmlands to sand winners. • Experience a growth in estate development (private housing projects). • The fisheries sector has not seen any significant growth – due to over exploitation of this resource. • Industrial sector is growing. • Various manufacturing companies (especially mineral water companies). • The major marketing centres are Achimota and Ofankor. (blue dot) • Operational cold storage facilities and commercial warehouses.
GA-CENTRAL	
	• Most towns are concentrated at the south-eastern part of the municipality. • Western part is sparsely settled. • Peri-urban areas are developing into urban settlements. • The municipality serves as a dormitory area. • Characterised by haphazard and unplanned

Land Use Pattern	
	developments. - Lies in an area not suitable for agriculture. - Losing remaining farm lands to residential and other economic developments. - Lack social services. - In addition to existing markets, a new market is constructed at Anyaa. - Have a few manufacturing factories but no processing industries.
GA-EAST	
	- Experiencing a migration from the rural areas to the main urban and peri-urban closest to AMA. - Majority of the population resided in urban areas (82%). - The Dome area boasts various industrial developments (i.e. Phyto Riker Pharmaceuticals, Royal Aluminium Company, etc.). - Dome is the major market centre. - Service sector is the fastest growing sector. - Housing developments are taking place in the Ashongman and Abokobi areas. - Farming is the major economic activity for 55% of the economic active population.
ACCRA	
	- Regional CBD; - Major centre for manufacturing, marketing, finance, insurance, transportation and tourism. - Home to approximately 400 major industrial establishments. - Home to national and regional government departments, Central Bank, approximately 30 financial institutions (with more than 200 branches), insurance companies, 12 insurance brokerage firms and a host of real estate developers. - Houses arrange of income groups, from high

Land Use Pattern	
	income well planned areas, to unplanned low income informal settlements. Fishing is predominant along the coast.
LA NKWANTANANG MADINA	
	- Dominant use is residential plus support services (social). - Northern section (20%) rural.
LA DADE KOTOPON	
	- Characterized by sprawl; inner city decay and slum formation; piecemeal development by private developers and informal dwellers; gated communities and enclave developments; the migration of core services industries to city suburbs; and sprawling informal settlements on the peripheries. - Uneven and unplanned urban development. - Informal settlements are sprawling into low-lying wetlands and flood plains. - Agricultural sector is shrinking. - Home to the Kotoka International Airport which provides domestic and international air transportation services, various international diplomacies and embassies and the Ghana International Trade Centre. ★ - Two major malls: Marina and Accra Shopping Mall. ● - Various hospitality areas. - Good beaches.
ADENTA	
	- Mainly urban with a few unplanned and partly planned areas. - Home to various dams built by individuals

Land Use Pattern	
	and institutions to facilitate farming and agricultural activities. • Losing farm land due to urbanisation. • Limited land for large scale farming. • Virtually no green areas in the municipality. • Encroachment on road reserves and government land.
LEDZOKUKU-KROWOR (LEKMA)	
	• Strategically located between Accra and Tema. • High-income zones are characterized by well-defined sector layouts, high taxable property values and good neighbour infrastructure. • Low income zones are mostly unplanned with poor or no infrastructure. • The commerce, manufacturing and finance sectors are experiencing growth. • Spintex road is the most important commercial zone, followed by the zone along Teshie-Nungua Road. • Home to three markets: Nungua, Tsuibleo and Lascala.
KPONE KATAMASO	
	• Majority of the population resides in urban areas. • Majority of the communities are partially planned and just a few are well planned. • Most rural settlements are fast developing into semi-urban and urban settlements. • The rural communities are sparsely populated and have limited access to socio-economic facilities. • There is no functional market in the municipality. • Crop farming is predominant in the northern parts and in the south parts, fishing dominates. • Stone quarrying activities are carried out at Kpone.

Land Use Pattern	
	Sand winning activities at Santeo, Zeenu, Katamanso and Appolonia. ●
ASHAIMAN	
	- No rural settlements. - Experiencing rapid urban growth and a housing shortage. - Haphazard, uncontrolled and uncoordinated development. - There is no integrated urban development and the linkages between the urban and rural areas are weak. - There are two main markets (Central Market and the Nii Adjor market) and seven major markets. - Industrial activities cover textile industries, production of agricultural inputs and block making machines as well as small scale aluminium industries that produce cooking utensils.
TEMA	
	- Tema is largely urbanized, some areas which exhibit rural characteristics like Bankuman, Adjei Kojo and Ziguichor lack basic services. - There are over five 500 industries in the Metropolis and thus the Metropolis serves as the industrial hub of the country. - The built up area of the Metropolis is made up of the well planned communities, beach fronts and the industrial area. - Residential areas (planned and unplanned) form 60% of the total land area with industrial and commercial areas making up the remaining 40% of land cover. - The country's biggest Port and Harbour facilities are situated in Tema and it serves as an entry point for the flow of a wide range of goods to- and -from other parts of the country as well as neighbouring countries like Togo, Benin, and Nigeria and beyond. ● - The Free-Zones Area near the port is for the production of goods, 70% of which are for export and 30% for local consumption. ★ - The squatter settlements are usually found in areas such as Tema Manhean, parts of Community 1, and the industrial areas. - Residential areas in the CBD are gradually giving way to commercial activities.

Land Use Pattern	
	- Some houses have been constructed in the waterways. - The low density areas are dominated by high income earners. - Almost all communities have market centres. - There is a Bulk Breaking Market at Community 9 where big trucks and Lorries off-load to avoid entering the city centre. - Cold stores and fish markets are located near the sea. - The service activities in the metropolis are concentrated in the CBD and other dotted in the township. - Farming activities in the Metropolis are mainly done around the Ramsar site and inner city gardening. - There are two functional abattoirs in Tema. - Tourist attraction sites: The Meridian Stone, The Greenwich Meridian, the Tema Harbour, Tema Manhean and Sakumono beach.
SHAI OSUDOKU	
	- The district is rural in character and Dodowa is the capital. - There are about 145 settlements which are mainly along the major road corridors. - The central part of the district is devoid of settlements as well as a road network. - The central portions of the district are devoid of communities and have few roads. - The district has the following factors to its advantage: - Relatively good trunk road linking the district and Accra/Tema. - A strategic economic location in relation to Accra and Tema. - Vast relatively flat lands for real estate development to serve as dormitory towns for the Accra Tema conurbation. - The inland settlements such as Dodowa and Doryumu have potential for inland tourism due to their proximity to the Dodowa forest, Chenku Falls and sightseeing at the Shai Hills area. - The district lacks large-scale industrial establishments. Currently the most important industrial activities are those related to quarrying.

Land Use Pattern

NINGO PRAMPRAM



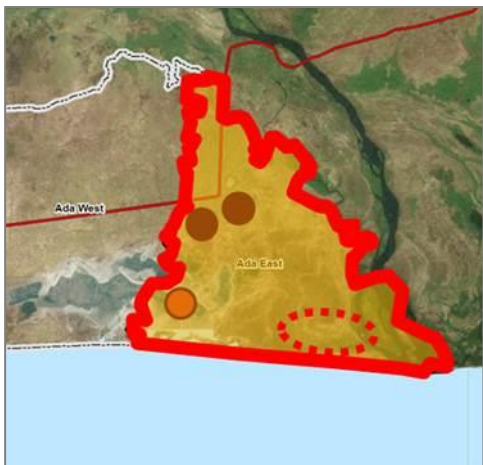
- The district has a rural character.
- The coastline provides opportunities for the fishing industry.
- There are 172 settlements in the district – of which the majority have less than 200 people.
- The major urban centres are located along the coast and along major arterial roads.
- There are no functional markets in the district.
- Urbanisation is threatening agriculture.
- The predominant industries relates to the fishing industry, salt production (at the Djangé and Mumu lagoons), sand winning (concentrated in the Ningo areas) and gravel winning (mostly in the Dawhenya areas).
- Major projects in the district:
 - 5000 housing units being developed at Seglemi.
 - Hope City Project – a technology park and one of the towers will become Africa's largest building.
 - Proposed new International Airport (to ease the pressure on the Kotoka International Airport). 60 000 acres has been acquired at Tsopoli-Nigbenya.



ADA WEST



- Predominant rural area (70% of the population are living in rural areas).
- Most communities are located between the Gulf of Guinea and the lagoon – causing congestion and insanitary conditions.
- Lack of access roads.
- Most of the physical structures are unplanned.
- There are no major manufacturing activities in the district.
- Rate of destruction of the natural environment supersedes the intervention for restoration of the land and its environment to its original state.
- An attempt should be made to spread investments to settlements like Bornikope, Matsekope and Lolonya among others to offload the pressure in Sege.

Land Use Pattern	
ADA EAST	
	• Mostly rural in nature with a few urban settlements. • Agriculture from the backbone of the district. • Well-endowed with a large deposit of salt. • Sand wining areas include Tamatoku, Amlakpo and Kewunor. ● • Over concentration of services in the District Capital, Ada-Foah and two other settlements namely Big-Ada and Kasseh. • The Songhor Salt Project is the major mining sector of the district. Located on the Songhor Lagoon, the project covers a total land area of about 12,500 acres. ● • The District holds a large number of tourism potentials which could be adequately harnessed. With respect to the Hospitality Industry, there are 23 hotels and restaurants currently available in the district.

Source: Gibb ex, 5-year MMDAs

From the above and supported by a more in-depth land use analysis follows the regional land use description as shown in **Plan 6.2** which follows.

6.4 Regional Land Uses

This section pertains to **Plan 6.2** on the following page.

Plan 6.2: Land Use Map

Source: Esri, Digital Code, Geo Eye, Earthstar, CNE/Airbus

6.4.1 GAR Urban Areas

The urban areas of the GAR as indicated in **Plan 6.2** consist of land uses in support of the primary economic and employment areas (Accra and Tema), and include residential development, retail, office development, health and educational facilities and public services required to achieve sustainable urban life. The urban areas are densely populated and include planned and unplanned developments. However, informal/unplanned urban development occurs mostly along the coastline of Accra and Tema, with the largest informal development area located along the coastline of Ledzokuku.

To illustrate density differentiations between the different districts the table below has been compiled. Listed as districts with the highest density to the lowest density the table reveals that Accra has the highest density followed by Ashaiman, Ledzokulu Krowor and then La Dade Kotopon. Thereafter follows Tema, Ga-East, La-Nkwantangan Madina and Ga Central. Ranging with urban densities from 15-60 dwelling units per hectare, these areas are highly

urbanised. Urban areas experience many development pressures and need the full scope of engineering and social services to render healthy, liveable and sustainable living environments.

Table 6.2: District Densities and Urban / Rural Classification

District	People / Hectare (p/Ha)	Categories p/Ha
Accra	150	>60
Ashaiman	58	40-60
Ledzokuku Krowor	56	
La Dade Kotopon	45	
Tema	29	15-39
Ga East	21	
La-Nkwantanang Madina	18	
Ga Central	15	
Ga South	11	6-14
Ga West	7	
Adenta	7	
Kpone Katamanso	6	
Ada East	3	1-5
Ada West	2	
Shai Osu Doku	1	
Ningo Prampram	1	

Source: Gibb ex Census, 5-year MMDAs and Gibb GIS 2016)

Ga-South, Ga-West, Adenta and Kpone Katamanso have densities of between 6-14 dwelling units per hectare, which in the context of GAR is neither urban nor rural. These areas may have an emerging urban form but still relate to the rural hinterland and form an area of transition. Population densities do not warrant the provision of high intensity social, health, emergency and civil engineering services and so only primary services exist. It evidences from the analysis that the higher densities areas are nearer to the urban edge while the lower densities are nearer to the rural hinterland.

Ada-East, Ada-West, Shai Osu Doku and Ningo Prampram located towards the eastern periphery of the GAR have the lowest population and settlement density, intercepted by vast rural lands. With densities ranging from 1-5 dwelling units per hectare, these areas are undoubtedly rural and experience no urban pressures. Formal service provision in these areas is difficult and costly and so the rural areas have basic service provision only. To gain access to secondary and tertiary services necessitates traveling to the urban centres. The

only exception to this is Ningo Prampram which renders a very low density owing to the actual size of the district.

The figure below indicates the density distribution of people per hectare throughout the study area. The Accra metropolitan area has an exceptionally high density of 150 people per hectare, whereas the rural areas have densities of between one and five people per hectare

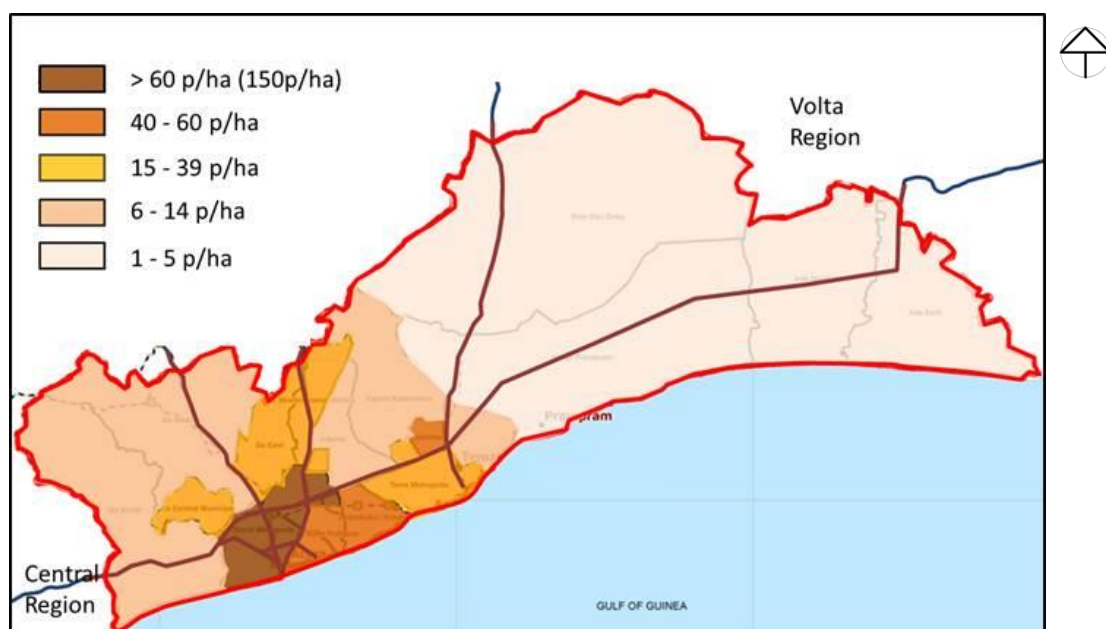


Figure 6.2: Density Distribution across the GAR

To comprehend the densities it is valuable to include some density comparisons. Below follows a table of global cities with higher, lower and similar densities. This provides a gauge of where the towns in GAR find themselves.

Table 6.3: Interesting Density Comparisons

District	People / Hectare (p/Ha)	Global Ranking
Mumbai (India)	296	1
Lagos (Nigeria)	181	4
Taipei (Taiwan)	152	7
Chennai (India)	143	8
Shanghai (China)	134	10
Rio (Brazil)	68	35
London (Britain)	51	43
Paris (France)	35	69
Rome (Italy)	29	83

Source: Citymayors.com/statistics/largest-cities-densities

The comparison includes cities from other developing countries, which experience the same development issues as GAR and also world-class cities which are quite different but provide a benchmark of what Ghana aspires to, wanting to be the gateway to West Africa.

6.4.2 CBD's and Related Uses

The core business areas in the GAR are concentrated in the CBDs of Accra and Tema. In Accra, business activities are taking place mainly towards the south of the Ring Road and along the N4. The area to the south of the Ring Road is the economic, administrative and cultural centre of Accra, hosting government ministries, hotels, businesses, and financial institutions. Liberation Road forms an extension of the CBD and has developed into a mixed use corridor connecting Kotoka International Airport and Accra CBD. To expand the commercialisation of the airport business portfolio the Kotoka International Airport precinct is being develop as an Airport City including high value land uses such as corporate head offices, apartment blocks, hospitality functions and retail malls.

The implications are that the concentration of CBD-land uses in this confined space and the expansion thereof in the CBD and now at the Airport causes tremendous influx of people on a daily basis, which causes associated traffic congestion. This continuous centralisation of economic activity is working towards a point where the functionality of the CBD is severely threatened.

The major land use changes related to the CBD have led to the development of Airport City and Liberation Corridor link.

6.4.3 Industrial and Related Uses

Industrial development in the GAR is concentrated in the CBD of Accra, in Tema around the harbour and along the N1 (the area to the west of Ledzokulu). The industrial activities in Tema are mainly concentrated around the harbour, the railway line and the area south of the N1, west of Kpone Street, south of Valco Road and east of Steel Works Road. In Accra industrial development is predominantly taking place south of Ring Road West, west of Otublohum Road and East of Graphic Road.

6.4.4 Open Space

The open space in the urban areas mainly relates to natural watercourses and wetland areas. These appear to be under threat from settlement encroachment and high levels of pollution. As far as active recreation and sport facilities are concerned, these are mainly located in the Accra metropolitan area (in and around the CBD).

6.4.5 Rural Land Uses and Settlements

The north-western and eastern parts of the GAR are rural in nature with rural settlements concentrated along the main roads. Land uses in the rural settlements are centred mainly on agricultural activities and include limited retail, and health and educational facilities. Areas

identified as rural residential and rural settlements include the following districts: Ga South, Ningo Prampram, Shai Osu Doku, Ada West, Ada East and portions of La Nkwantanang Madina. Although the character of Ningo Prampram is mainly rural residential in nature a major housing development is taking place at Seglemini. This region was also identified as the ideal location for the new international airport and the Hope City Project.

6.4.6 Cultural and Historic Sites

There are several noteworthy cultural and historic sites in the GAR. Some sites are dated and the buildings old originating from a bygone era. These have been and should continue to be preserved for their historic value and symbolism, as a reminder of the past and as an effort to build national worth for the people. Other sites are newer and modern but also play a cultural role in affirming national value.

Notably the majority of sites are found along the coast and in the characterful quarters of Jamestown and Ussherstown which today is generally known as Old Accra. This is simply so because Accra is one of the oldest places in Ghana having been the port of arrival of colonial expeditions.

Below follows a brief overview of the most relevant cultural and historic sites in the study area.

(a) Osu Castle

Osu Castle, also known as Fort Christiansborg or the Castle, is a fort located on the coast in Osu, Accra. It was first built in 1660 by Denmark-Norway, though it changed hands between Denmark, Portugal, the Akwamu, Britain, and finally post-Independence Ghana. In the process it was rebuilt numerous times. For most part, the castle has been the seat of government and also serves as the resting place of late president John Atta Mills who is buried in a bird sanctuary overlooking the Atlantic Ocean.



Figure 6.3: Osu Castle

As the seat of government the castle accommodates 2,100 employees. The most important functions are carried out in the castle itself, but other buildings are also used. Many international dignitaries have visited the castle, including U.S. Presidents Richard Nixon, Bill Clinton, and Barack Obama and German Chancellor Gerhard Schröder. Additional rooms

were built in order to accommodate Queen Elizabeth II's visit in 1961, one year after Ghana became a republic.

The present castle has an unorthodox shape owing to the many additions made to the building. It has many facilities for the use of employees, including a clinic, cafe, shopping centre, and a post office. It also still accommodates a permanent garrison. It has extensive gardens which are used for the president's outdoor receptions and parties. The castle is not open to the public, and photography of it is restricted.

(b) Kwame Nkrumah Memorial Park

The Kwame Nkrumah mausoleum and memorial park is located in downtown Accra. It is dedicated to the prominent Ghanaian leader Kwame Nkrumah, who together with his wife, is buried there. The design is meant to represent an upside down sword which in the Akan culture is a symbol of peace. The mausoleum is clad from top to bottom with Italian marble, with a black star at its apex to symbolize unity. It is further surrounded by water which is a symbol of life. Its presence conveys a sense of immortality for the name Nkrumah and shows that even in death he lives on in the hearts and minds of generations here and generations yet to come.

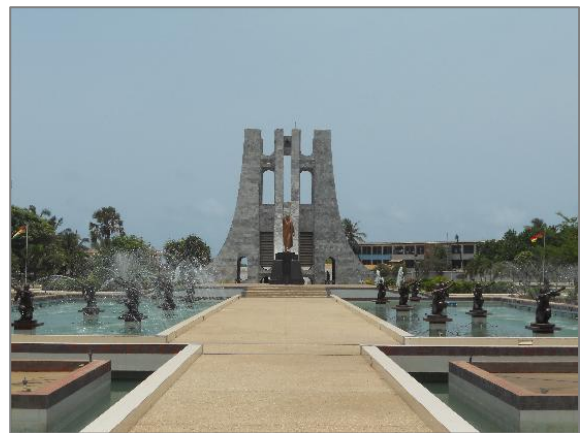


Figure 6.4: Kwame Nkrumah Memorial Park

(c) Independence Square / Black Star Square

Independence Square, also known as Black Star Square, is a public square bordered by the Accra Sports Stadium and the Kwame Nkrumah Memorial Park. The square was commissioned by Kwame Nkrumah to honour the visit of Queen Elizabeth II after its construction was completed in 1961.

It is the site for Ghana's Independence Day parades, which fall on the 6 March every year. It also hosts all major national public gatherings and national festivals. The square boasts two monuments: the Independence Arch and the Black Star Monument, also known as the Black Star Gate. A statue of a soldier faces the Independence Arch symbolizing the Ghanaians who lost their lives fighting for Ghana's independence.



Figure 6.5: Independence Square

(d) National Theatre of Ghana

The National Theatre, which opened in 1992 was built by the Chinese and offered as a gift to Ghana. The theatre has a building area of 11,896 m² and is sited near the junction of the Independence Avenue and Liberia Road. The building has a complicated construction when viewed at from afar, the whole structure looks like a gigantic ship or a seagull spreading its wings. The building houses the National Dance Company, the National Symphony Orchestra, and the National Theatre Players. Clearly it plays an important role in continuing to define Ghana's culture.



Figure 6.6: Ghana's National Theatre

(e) National Museum of Ghana

The National Museum of Ghana is the largest and oldest of six museums and was opened on 5 March 1957 as part of Ghana's independence celebrations. The official opening was performed by the Duchess of Kent. Objects of archaeology, ethnography as well as fine art find place in the National Museum. Some artefacts include an elaborately carved oware board (an Ashanti strategic board game), several decorated staffs used by royal spokesmen, the chair used at the presidential inauguration of Kwame Nkrumah and various Ashanti ancestral stools. The outside sculpture garden displays life-size statues of musicians and of historical figures such as Kwame Nkrumah.



Figure 6.7: National Museum of Ghana

(f) Accra International Conference Centre

The Accra International Conference Centre is an important events venue located in the Christiansborg area in Accra Osu and is close to a number of important locations such as the Parliament of Ghana, the Accra Sports Stadium, the Independence Square and the Black Star Square.



Figure 6.8: Accra International Conference Centre

(g) Jamestown Lighthouse

Jamestown Lighthouse was built 1871 and rebuilt in 1930 to reach a height of 28m. The lighthouse with its red and white candy-striped building is a clear landmark in the area. Though it is a historic building it is not really open to the public.



Figure 6.9: Jamestown Lighthouse

(h) Jamestown Fort

Near to the Lighthouse is Jamestown Fort which was built by the British in 1673. Up until 2008 the Fort served as a prison.

Today it is open to the public as a historical monument that reflects part of the country and area's heritage.

6.4.7 Appraisal of the 1991 GAMA Land Use Proposals

A brief overview of the 1991 Strategic Plan for GAMA (Planning Proposals), as shown in **Plan 6.3** on the following page, indicates:

- The greenbelt / open space areas in many instances have been overtaken by urban development and are at present severely threatened by continuing sprawl.
- The catalytic impact of the N6 road together with the main railway line was underestimated and the rural areas of Ga-West have as a consequence dramatically urbanised.
- Land earmarked for defence purposes has largely been overtaken by unplanned urban development.
- The intention of a greenbelt system is sound but its implementation can be problematic as shown in this plan.
- The road development proposals were not implemented, and although misplaced in some instances, would have assisted to alleviate the present day clogging of the road network.

Plan 6.3: GAMA Land Use Proposals 1991

Source: Gibb ex, Strategic Plan for the GAMA, 1991 Vol 2.

6.5 Spatial Functionality

6.5.1 Urban / Rural Division

There is a clear urban and rural division in GAR. The western part of the region is defined by a powerful urban core surrounded by urban settlements of moderate densities, compared to dispersed rural settlements i.e. villages located over the eastern half of the study area. The rural area is sparsely populated and is typified by rural land uses. The line of division is most clear between Kpone Katamanso and Ningo Prampram as shown in the figure below. Accepting the urban and rural divide is essential to understanding the functionality of the

area. These areas are different; have different roles, functions, responsibilities, focus areas, issues and pressures.

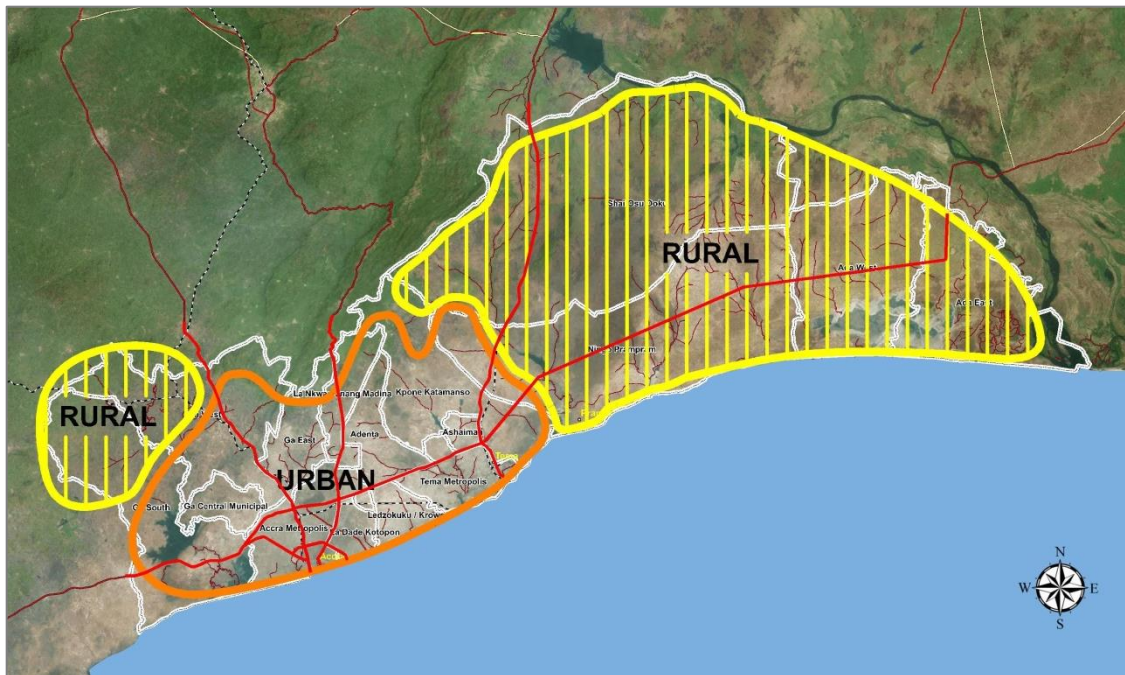


Figure 6.10: Urban / Rural Division

6.5.2 Urban Functionality

The urban core generally incorporates all or portions of the following district areas:

- Ga-Central;
- Ga-South;
- Ga-West;
- Ga-East;
- Accra;
- La Dade Kotopon;
- Ledzokuku Krowor;
- Adenta;
- La Nkwantananga Madina;
- Katapone Katamanso;
- Ashaiman; and
- Tema.

This section explores the internal components of the urban complex and is accompanied by the figure below.

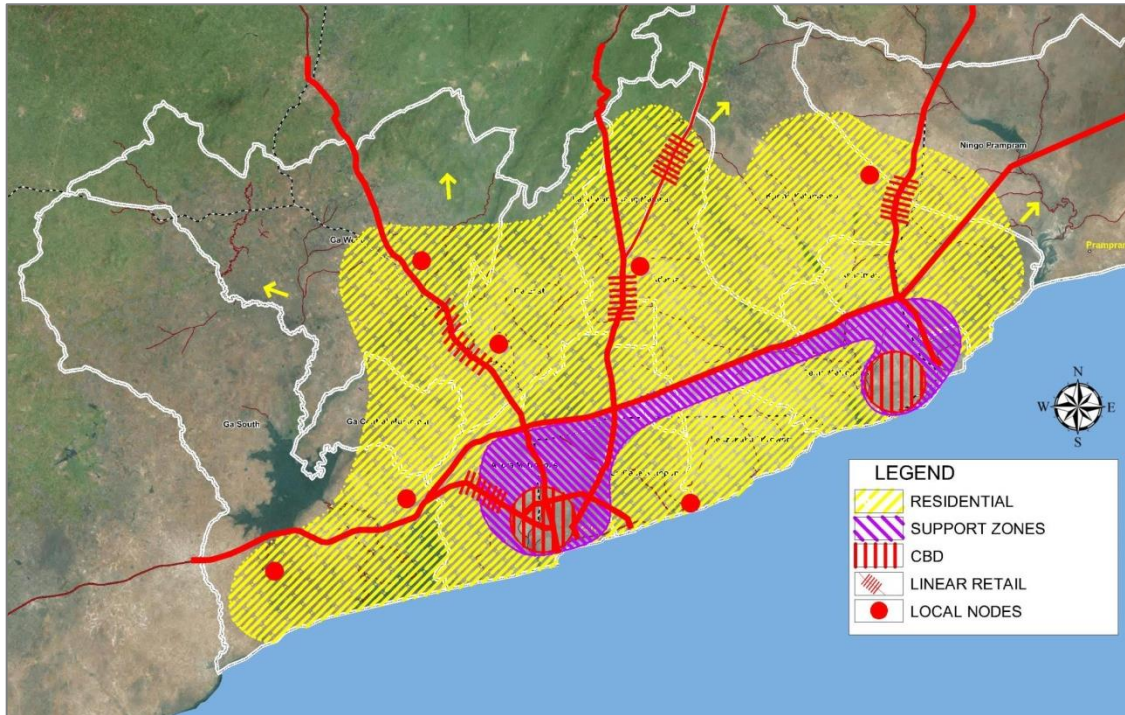


Figure 6.11: Urban Functionality

(a) Accra Urban Complex

At the centre of the urban core is Accra urban complex. It includes the old and the new city, as well as the general urban expanse around it. Accra is the capital of the country, hence it has a national function and position centred on its administrative responsibilities. It is also recognised as Ghana's commercial hub with many businesses, hotels, some light industry, banking, government, the airport, etc. in the core area.

Having its roots in colonialism followed by nationalism the City is an important heritage centre. It boasts many cultural and historic sites, most of which are celebrated and grand to foster a sense of national pride. As capital city of Ghana, Accra also serves as a gateway to the rest of Ghana and to some other countries in West Africa. Many international flights fly to Accra from where business travellers or tourists move onto other West African destinations either by road or by air.

(b) Tema Urban Complex

Second to Accra is Tema Urban Complex. The keystone of the city is its harbour which is Ghana's deepest seaport. It outranks Sekondi Takoradi with 1.7km² of water enclosed area, 5km of breakwaters, 12 deep-water berths, a huge tanker berth and a vast container yard. It handles 80% of Ghana's import and export cargo and deals with goods in transit to landlocked Burkina Faso, Mali and Niger. The town was formally established when the harbour was completed in 1962. The harbour is man-made and the town was specifically planned and designed by Doxiadis and so it reveals a very structured and well-designed core. The urban area has grown significantly since 1962 and informal expansion has also occurred

where the structure urban form was unable to keep pace with in-migration and residential demand.

(c) Support Zones

Supporting Tema is an industrial zone slightly north of the town. The industrial zone is near the N1 which is important for regional freight access and access to the airport. While the N1 is important to the industrial hub the hub has also strengthened the N1 affirming its role as development corridor. Evidently there is a mutual interrelationship between the hub and the N1.

Where the N1 transits through the urban core it has mutated into a development corridor with access-reliant industry located along it and Accra and Tema on either end. The N1 has become an important development spine essential to the economic livelihood of the city and region. However, this has also led to congestion on the road as it is unable to handle all the traffic. The roads mobility function is totally lost in the urban core which is problematic.

While there is no definite nodal hierarchy development does occur outside the CBDs of Accra and Tema. Such development is not in nodes, but occurs along the mobility routes of the N2, N4, N6 and other arterials. Likewise to the transition of the N1 from a mobility route to a congested development corridor, so these roads have also been transformed with development tightly clustered around the radials. Though development is needed its unmanaged location hampers the proper functioning of the road hierarchy and the important radials that should feed the economic core.

Accra Airport (Kotoka Airport) is spatially well located, near the CBD, amidst the urban core and along Liberation Road. Airport City is in the making, exploring its position and acting as a development catalyst for the CBD. The remaining undeveloped land will be explored over time to strengthen the area. Developing such in a planned and managed manner could certainly contribute to a better functional urban form. The area is characterised by residential and commercial development which leans towards businesses, offices and banking. Indeed it has affected Liberation Road transforming it into an important development corridor.

(d) Residential Expanse

Surrounding the urban cores of Accra and Tema are vast and dense residential areas. These areas include the full range of urban land uses comprising a proper urban environment. There is a multitude of schools, clinics, hospitals, police stations, shops, markets, etc. However, there is little urban structure or defined form to enable the urban area to grow in a manageable manner.

The urban form is greatly defined by the road pattern, of which the N-routes play an important role. At a regional level a radial road pattern is evident. The N1 is aligned to follow the coast line providing east-west access, while several north-south roads lead from

the hinterland to the coast terminating in Accra and Tema. The life of the urban area is in the roads and so points of convergence are evident along these roads. Yet these points can only be rated as weak service nodes. This is so because the nodes are poorly defined, poorly serviced, there is no hierarchy and they are not managed or planned. By and large retail follows a linear pattern. This is typical of the market concept, which causes congestion on arterial roads and limits the creation of an economy of scale.

6.5.3 Rural Functionality

Contrary to the urban agglomeration, is the vast rural hinterland that completes the GAR. The vast rural area is located north-east of the urban complex and consumes most of the north-eastern segment of the GAR, but there is a small rural area found in the north-western corner. The rural functionality of the region is shown in the following figure.

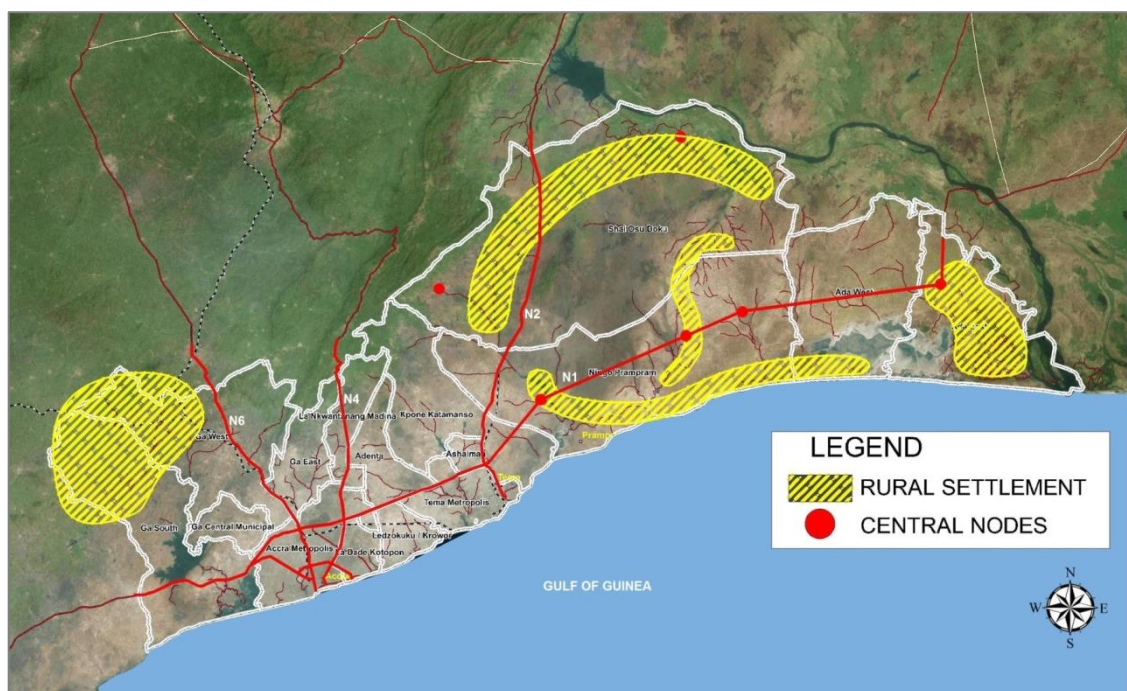


Figure 6.12: Rural Functionality

The small north-western portion, which forms part of Ga-West and Ga-South, is under significant pressure to urbanise. It is wedged between the urban core and the region's administrative boundary. It is served by rail and regional roads and is in near proximity to the N6 which is an important regional corridor connecting Accra and Kumasi. In addition, its western location, which is where national and regional development is concentrated linking toward Sekondi Takoradi, also burdens the area. Presently the area comprises low-density urban housing, which can easily be consumed by incremental growth and unmanaged urban infill. The lack in urban structure is problematic to accommodate future growth as it will escalate the urban settlement complexities which are already pronounced throughout the Region. An undefined urban structure upon which densification occurs makes servicing of the area in future near impossible.

The vast rural area that consumes the north-eastern segment is undoubtedly rural though a fair land use mix is still evident. The area comprises intensive and extensive agriculture, mining, villages, water bodies, forests, etc. The area is served by roads which are the lifeline of the region. Most villages are located along these roads and so appear as beads on a string.

The N1 which remains a critical corridor, stretching from Sekondi Takoradi in the west to Togo in the east typifies the nature of development all along it. Where the N1 leads into the rural hinterland development along it becomes sparser, less commercial and of a lower order. Thus while the N1 is an important regional link to the urban centres, its commercial and social resources, the character along the road also depicts its position.

The area is generally rich in water and has several wetlands. The richness in water along with the significant coastline makes fishing a prime economic activity and prominent source of protein for the people.

Prampram is the most prominent town of the rural hinterland and in a sense is a gateway and an edge to the urban region. The town is the largest in the area and experiences some development pressure from growth in Kpone Katamanso. This growth is spilling over into Ningo Prampram and causes some concerns.

Generally the dispersed settlement / village pattern throughout leads to poor service levels and poor infrastructure. Rural service delivery is costly and difficult and the more dispersed the settlement pattern the more complicated delivery and servicing is.

6.5.4 Linkages

(a) International Linkage

Internationally GAR is connected to the outside world by Kotoka International Airport, located in Accra, and Tema Harbour.

Kotoka International Airport is an international airport that has capacity for large aircrafts such as the Boeing 747-8. The airport has two terminals and in 2016 construction of the third terminal commenced so as to expand the airports passenger handling capability to 5 million passengers per year. The terminal is expected to be completed by end of July 2017. The airport handles some freight but its main focus is passengers, not only to and from Ghana but also to other West African countries. Indeed it is a travel node and hence the expansion of the facility. Spatially there is some vacant land around the airport which is ideally located for mixed use development and managed urban infill and growth. The airport is well connected to the N1, providing east-west connectivity, and to the N6 and N4 providing north-south connectivity to Kumasi and beyond.

Tema Harbour is the Region's other international port and in opposition to the airport focuses on freight. Tema is Ghana's largest harbour and in addition to handling 80% of the country's import and export cargo it also serves as a transit point for goods to and from the

northern landlocked countries. It has ideal access to the N1 and N2 allowing for cargo to readily leave the area to its ultimate destination.

The port accommodates a wide range of industrial and commercial companies that produce or handle among other goods petroleum products, cement, food items, iron and steel, aluminium products and textiles. Most of the country's chief export i.e. cacao is shipped from Tema.

Tema Harbour and Port is in the process of being expanded and upgraded to meet rising cargo traffic; and such is planned to include the purchase and instalment of cranes, reach-stackers and ship to shore cranes. The upgrades will improve the cargo-handling capacity of the port, which should continue to rise as Ghana's economy maintains its high rate of growth.

Since the airport and the harbour are vital international links for passengers and freight access must continuously be retained and development in and around both be managed and optimised.

(b) Regional Linkage

The regional linkages are as important as the two international ports, because the ability of the Region to connect to other regions is what sustains the international ports. Without good regional linkages neither the airport nor Tema harbour would be able to fulfil and retain their role and function. Refer to the following figure.

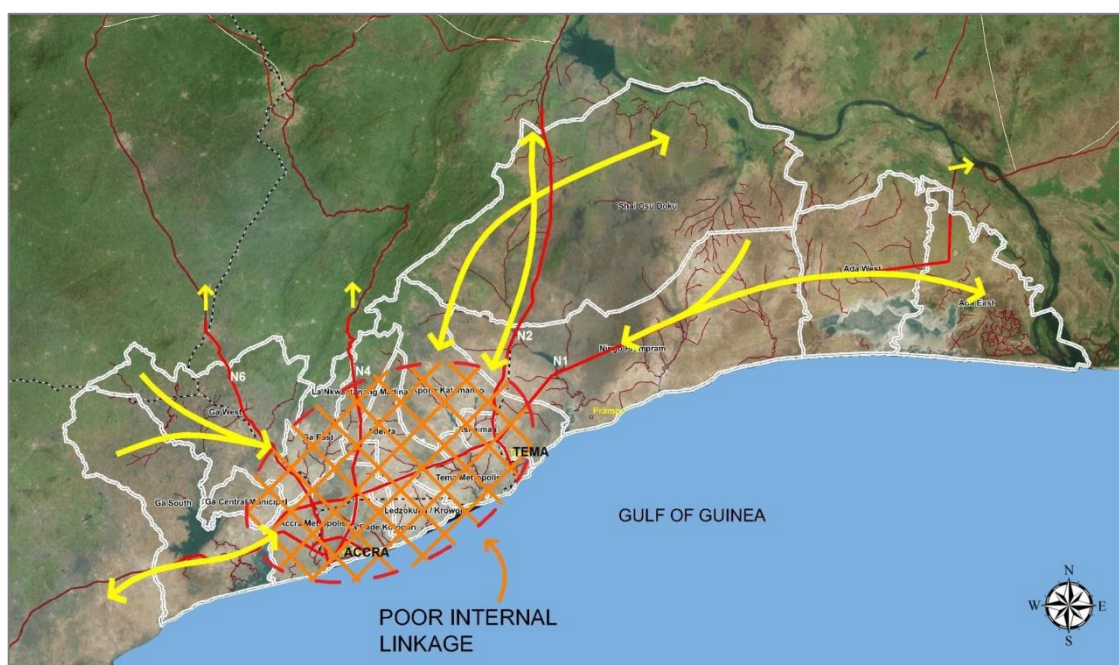


Figure 6.13: Linkages

The N1 is probably the most pronounced and important regional connector. It follows the coast in an east-west alignment linking to Abidjan (Côte d'Ivoire) in the west and Lome (Togo)

in the east. Cargo and passengers use the N1 to reach these destinations. Connecting to the north to Burkino Faso the N2 and N6 are important. The N2 leads north to link into the N10 north of Tamale, while the N6 connects to Kumasi and then onto Tamale from where it heads to the border of Burkino Faso.

Nationally the N1 provides access to Sekondi Takoradi, which is second to Tema, as Ghana's international trade harbour. Hence, the harbour and access to it play an important regional and international role.

Kumasi is the gateway to Ghana's hinterland and so the N4 and N6 are relevant regional connectors.

While all these roads are crucial to the economy of Ghana and the Region they are congested, overburdened and in need of expansion and improvements. The hauling and mobility functions of all regional connectors must be upgraded liken to the upgrades of the two international harbours in recent years.

(c) Local Linkage

Local road linkages in the rural hinterland are good primarily because of the dispersed settlement pattern and low frequency of local travel. However, local linkages in the urban areas are very poor as traffic volumes exceed the capacity and design standards of the roads.

The regional connectors lose their regional function in the urban area as traffic is so congested on the local roads spilling over onto the regional connectors. Thus the N1, N4 and N6 are exceedingly congested in the urban core so that they no longer fulfil a regional function but are overwhelmed with local traffic trying to access the economic core during morning peak periods and trying to leave the core during afternoon peak periods. This 'hi-jacking' of the regional corridors is an impediment to regional mobility; the regional movement of people, goods and services.

The solution thereto is a seriously upgraded local road network across all urban districts and an improved urban settlement and nodal hierarchy.

6.5.5 Land Use and Transport Integration

Integration of land use and transportation would suggest that these two critical functions of the city have to support each other, to increase the functionality of a city in general, as well as the functionality of the individual elements. On the one hand land use developments respond to the transportation system, which includes road infrastructure, access and visibility, and on the other hand transportation must respond to changing land uses by increasing the capacity of the system to meet the needs of the land uses. Both work together and are co-dependent. If the one leads without the other dysfunctionality is a sure outcome.

In the urban core land use developments have outstripped the provision of effective transport systems and infrastructure. In addition, the highly centralised urban structure of the GAR has led to a total overload of traffic on the transport/road system, which in turn has produced a breakdown in the functionality of the urban core as a whole. There is complete dysfunctionality between land use and transportation as road infrastructure has not kept up with land use changes and in a sense the city is suffocating from congestion. This not only affects the duration people sit in traffic to move from one point to another, it affects the entire economy of the region.

In the rural areas, settlements relate to the main road system, and therefore, have good access to and from their surrounds. At a local level this bides well for the villages. However, the regional mobility of the roads, which as discussed before is of international and national relevance, is sacrificed as lengthy travel times are experienced due to the slowing effect of regional routes when passing through villages. Villages also tend to be spaced at regular intervals which causes a continuous speeding up and slowing down of traffic, which along regional routes is not desirable. Creative solutions need to be sought to attain fast-moving unhindered regional traffic while ensuring the safety and sustainability of rural villages.

6.5.6 Land Use and Engineering Services

Rapid urban growth, in particular housing development, has not only had an impact on transportation infrastructure, it has also had a profound impact on engineering services, including all elements therefore, viz. water supply, sewer reticulation, electricity supply, waste management, etc. Continuous in-migration into the urban core has caused such significant densification, infill and sprawl to the extent that none of the engineering services have managed to keep pace. The result is that demand has completely overtaken supply to the extent that major infrastructural works will be required in future. Infill has occurred without any concern for the future installation of services and has effectively led to un-coordinated land use development and to wasteful land use practices. Moreover, it hampers attempts to achieve a more efficient city structure through sensible and needed densification.

6.5.7 Land Use and the Natural Environment

The GAR is endowed with an extensive natural open space system, including a fairly underutilised and underdeveloped coastline. These areas contributed significantly to the livelihoods and well-being of the general populace who remain dependant on primary resources to sustain their lives. The sustainable protection of these areas is of great importance and any encroachment onto these natural features, with specific reference to wetland areas, the coastline and floodplains, would have a negative impact on the functionality of the areas and their ability to contribute to the overall quality of the GAR.

Urban sprawl, unmanaged urban developments and un-serviced urban areas would surely have a detrimental impact on these areas.

6.6 Existing Spatial Planning Proposals

All 16 Districts within GAR have compiled Medium Term Development Plans. These are plans which for the most part, include a vision and mission, a long list of programmes / projects to be implemented and a general summary of existing services and infrastructure.

These reports do not have a spatial reliance or undertone and no spatial development framework for their area. They can rather be described as project implementation programmes. All reports were reviewed by the different teams to extract any and all relevant detail, but spatial proposals were lacking. Hence, none of the Medium Term Development Plans provided existing spatial planning proposals.

The only plan which has provided spatial directives is the NSDF 2015-2035, though these proposals are for all of Ghana and therefore do not filter down to detail district level for the GAR. Nevertheless, the main elements that apply to the Region have been extracted for the sake of the RSDF.

The NSDF centres on five pillars these being:

- Emphasise balanced polycentric development;
- Improve regional, national and international connectivity;
- Strengthen the metropolitan city regions of Accra and Kumasi;
- Promote development in networks and secondary cities; and
- Ensure sustainable development and protect ecological assets.

As far as the GAR is concerned the NSDF proposes the following:

- Promote the Accra Capital Region as a world-class city while maximising the benefits this can bring to the nation as a whole, and develop regional and lower order urban centres to serve more of their regional communities' needs locally.
- Promote urban settlements along major transport corridors by concentrating population and economic activities in urban settlements along the major transport corridors so as to improve the economic efficiencies of both.
- Plan for integration of rural settlements into expanding urban areas. Identify rural settlements that are likely to be incorporated into the expansion of nearby urban areas. Planning measures may include regularising feeder road networks, land-pooling, guided land development, re-plotting and re-blocking, and advanced identification of land for infrastructure and services.
- Protect agricultural land and forests from settlement development, identify and designate land with high or potential agricultural value, allow only agricultural use of designated agricultural land, protect most productive agricultural land and forests from further settlement development.

-
- Maintain and improve the efficiency of the main expressway network, by extending transport infrastructure in the main urban corridors, promoting high-occupancy of vehicles and improving public transport facilities and priorities for pedestrians and cyclists on urban streets, as well as reducing the time for commuting.

Furthermore the NSDF embraces the Abidjan-Accra-Lagos coastal mega region / urban corridor as a major formative element, therefore it promotes the two city-regions around Accra and Kumasi, the challenge for Accra being to define it as the gateway to international trade given the rapid expansion of the city but at declining densities. For Accra and Kumasi's development the NSDF specifically recommends adopting "city-region planning and management including city-region spatial development frameworks; promote regional accessibility; discourage scattered development; establish urban growth containment boundaries; provide ring roads where applicable; establish and strengthen development corridors; promote "centrality", or the share of the population that lives close to the city centre compared to its suburbs and periphery; promote "centeredness", or the share of jobs and other attractions located in the main activity centres; promote high densities; promote "compactness", or the degree to which a city footprint approaches that of a circle; strengthen the central business district; invest in other urban centres; promote transport-oriented-development, or TODs; promote mixed land uses; promote public transport; discourage private vehicle use; promote alternative transport modes; promote physically connective road networks; manage traffic before building new roads; promote digital connectivity; and adopt a grid-based model for urban expansion." (NSDF, 2015-2035)

Over and above this the NSDF proposes certain initiatives:

- A national and international expressway system;
- Upgraded and improved trunk roads;
- A national and international rail network;
- Two international airports;
- New Airport City at centre of triangle;
- Options for three new seaports;
- Green infrastructure network;
- Agricultural growth corridor;
- Proposed urban food sheds; and
- Alternative Energy Projects.

6.7 Spatial Development Trends

In identifying spatial development trends in the GAR it has to be acknowledged that the western half of the study area is highly urbanised while the eastern half is rural in nature. The development trends are therefore different and do not commonly relate to each other.

It would further appear that spatial development in general is following historical growth paths and trends with little intervention to re-direct development and to create a more sustainable spatial development footprint.

The following brief description of current spatial development trends intends to assist in identifying possible future development options or scenarios.

- The Accra CBD remains the main activity node in GAR and as such attracts large numbers of citizens on a daily basis. The most vibrant growth area, comprising mixed commercial and residential uses, is the CBD linked to the airport and includes Liberation Corridor and the Airport City Complex. This is illustrated in the figure below.

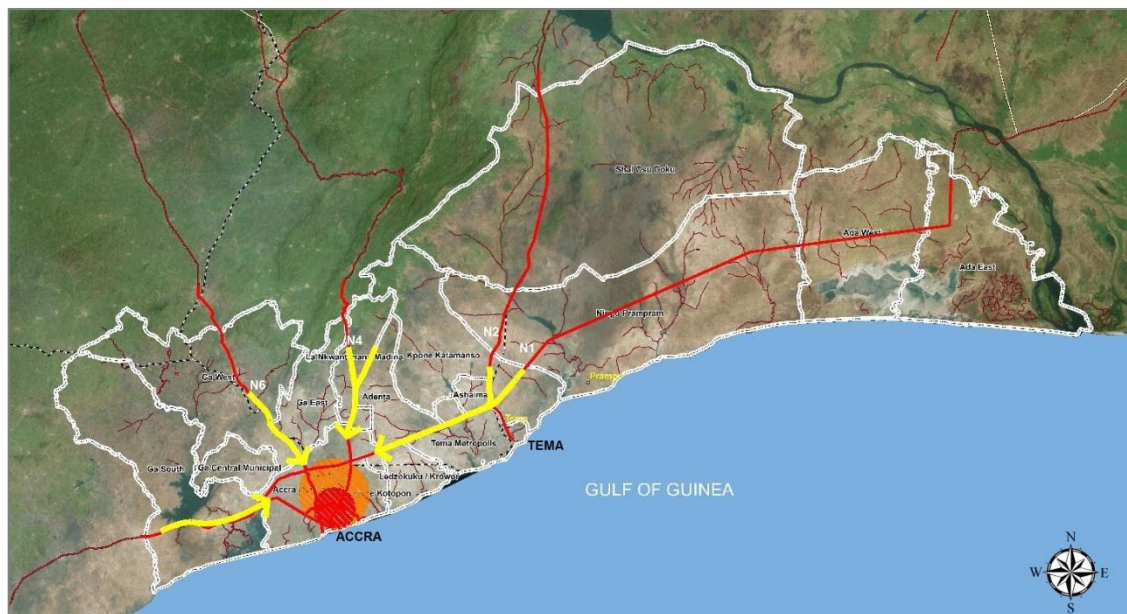


Figure 6.14: CBD Remains Important

- The most significant urban growth, mainly residential and social services, occurs on the edges of the city and is mainly unplanned with limited, if any, engineering services. This obviously causes urban sprawl and is a major concern in terms of service delivery, urban management and sustainable development in general.
- Rural settlement growth mainly relates to the main regional road system, with higher levels of clustering in the eastern and north-western corners of the GAR. In this case the

dispersed nature of settlements also complicates the delivery of services, including engineering, social and commercial services. Refer to the figure below.

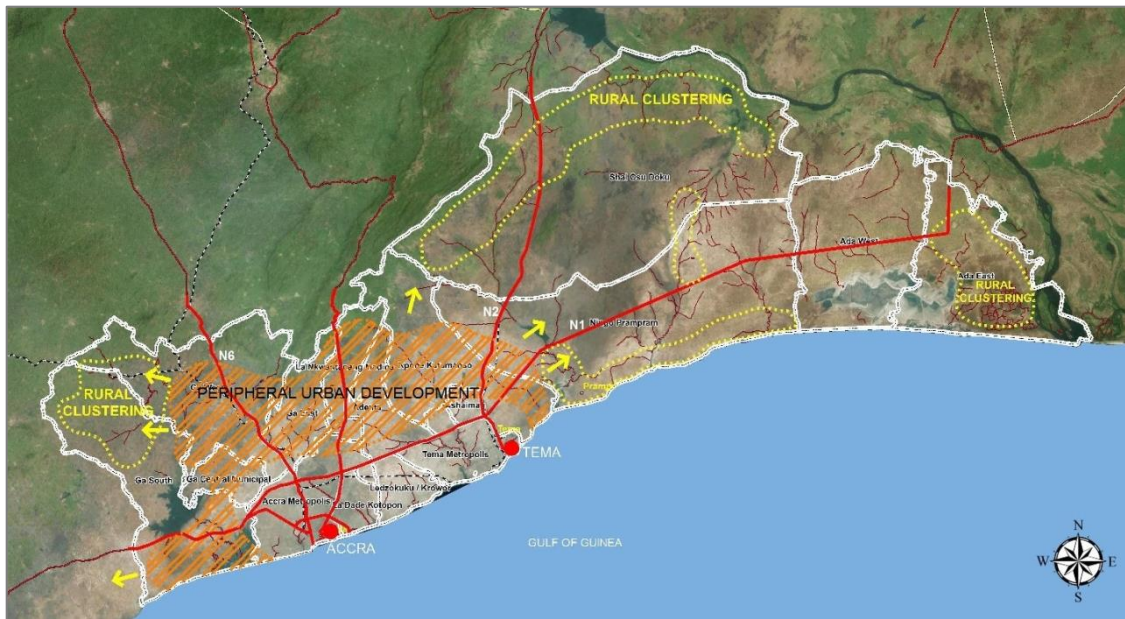


Figure 6.15: Peripheral Urban Growth

- The present notion is to strengthen the nodes of Tema, the airport and the CBD and to connect these with the existing road network and mixed use corridors. It appears to be a natural progression of historical trends and, although, in theory this should be a workable concept, in practice it would only contribute to a more congested and non-sustainable city structure.
- The absence of a hierarchy of activity nodes, which should be supported by a hierarchy of urban roads and an efficient public transport system, neither of which exist, is clear and this has an unquestionable negative impact on the functionality of the city. This is illustrated below.

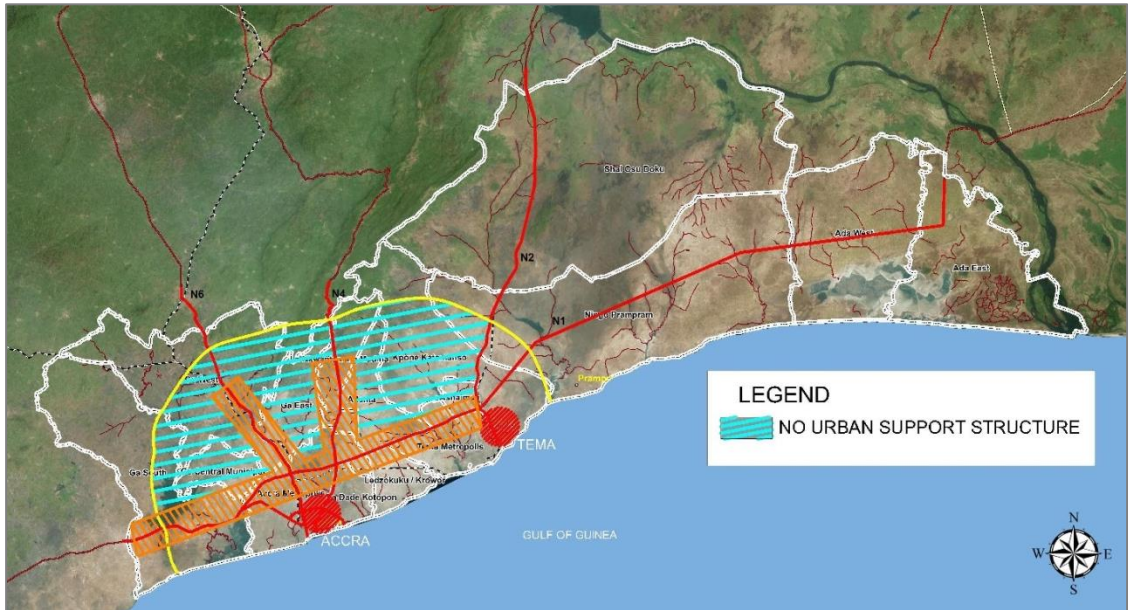


Figure 6.16: Lack of Urban Support Structure

- The Oduponkpehe area to the west of the study area is an attractive growth area and has an influence on the functionality of the GAR. With the proposed new airport site to the east of Tema, north of the N1 national road, influencing urban development and land investment, it could be argued a linear urban structure is in the making. Refer to the figure below. However, this must not be assumed at this stage since it will be an important aspect of this planning project.

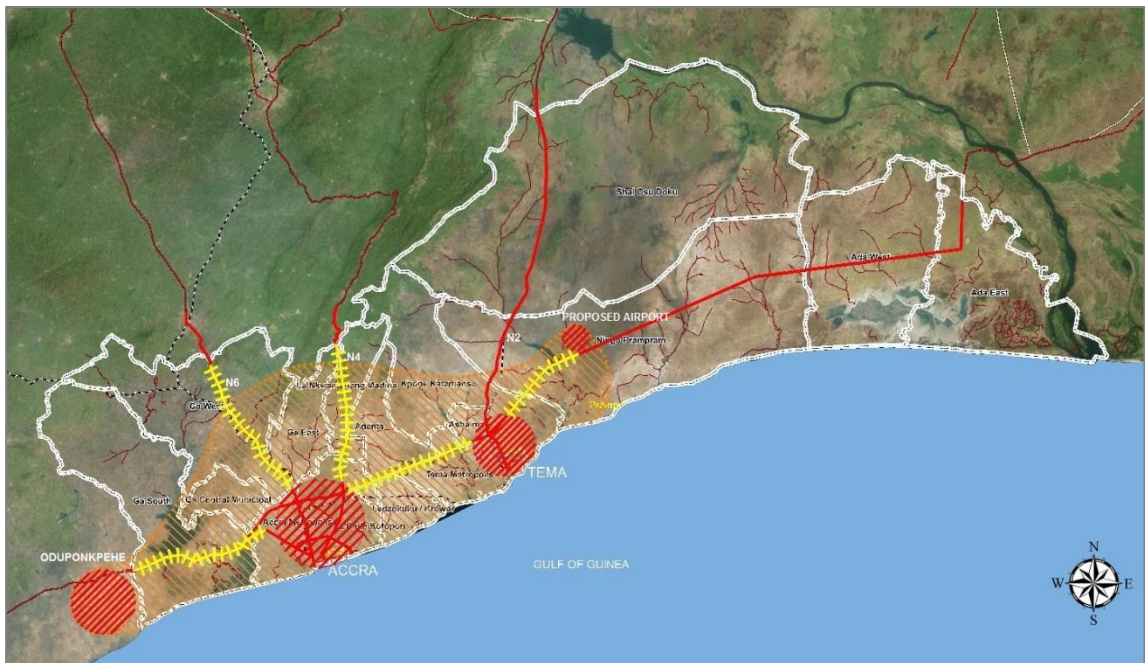


Figure 6.17: West-East Pull Factors

The above observations reflect on regional trends at play in GAR and are merely informative as regards the planning process. They also only represent prevailing spatial trends.

6.8 Main Findings – Regional Built Environment

The main findings of the regional built environment follow:



REGIONAL BUILT ENVIRONMENT FINDINGS

Urban

- The urban form is defined by a centralised urban structure around Accra and to a lesser extent around Tema which is smaller than Accra.
- Urban sprawl in an uncoordinated and unmanaged manner is evident throughout the area.
- Horizontal densification leads to urban sprawl and unhealthy living conditions which are very difficult to upgrade in future.
- There is a very limited hierarchical system of supporting urban centres / nodes. The deficient hierarchy complicates urban management and functioning.
- There is no integration of land use and transport facilities.
- Informal housing encroaches on and threatens natural assets such as water catchment areas and the beachfront.
- New housing developments are moving away from the “compound house” typology to more conventional and individually-owned housing and / or dwelling units.
- New urban development north-east of Prampram can have an impact of the city’s future “footprint”.
- There are strong links with western coastal hinterland.
- The radial regional roads will continue to be a dominant formative element in the future structure of the region.

Rural

- The rural areas are characterised by a dispersed settlement pattern.
- The peripheral rural areas are under threat and pressure to urbanise as the urban areas grow and expand without constraint.
- Road related settlements hamper the mobility function of roads in the rural hinterland and create unsafe urban settlements.
- The lack of “scale” / hierarchy in the rural settlement pattern leads to difficult

and expensive service delivery of all services, including social, economic and engineering services.

- High levels of dependency on natural resources occur throughout the rural areas.
- Rural villages and towns generally have non-functional layouts.

7 Population and Social Environment

The demand for social facilities, as well as potential for growth, is a derived demand. Hence, the current socio-economic overview, as well as anticipated future growth, needs to be thoroughly examined.

The socio-economic overview is outlined in terms of the following headings:

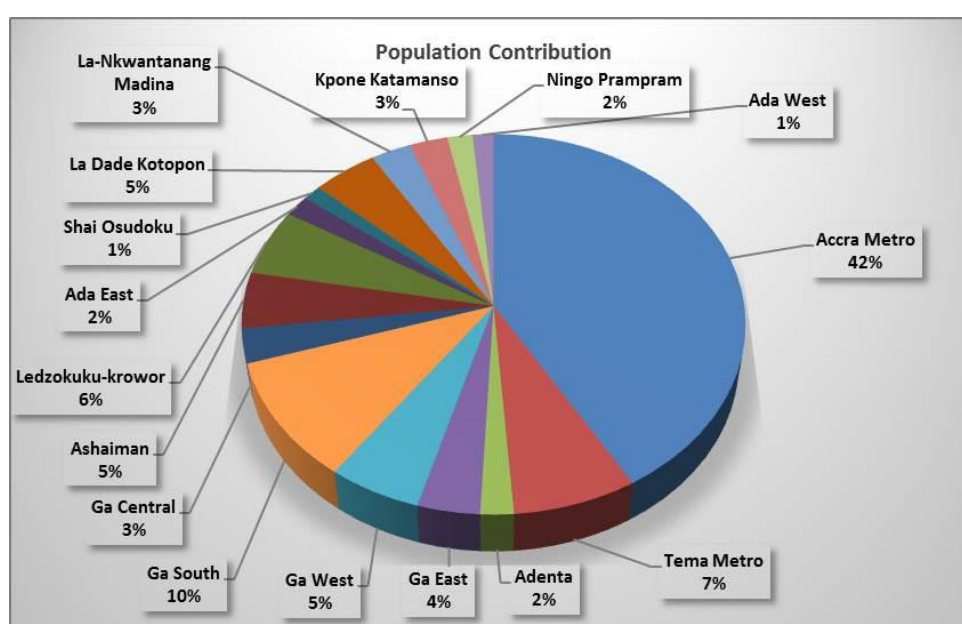
- Population size
- Population distribution
- Age profile
- Growth projections
- Employment and income
- Education and literacy
- Population distribution
- Dwelling type and occupancy
- Tenure status and delivery system

7.1 Population profile

7.1.1 Population Size

The total population size for the GAR was 4 010 054 persons in 2010. The chart below indicates how the population was dispersed between the various districts. It can be seen that Accra Metro contributes the largest portion (41.5%) of the population.

Chart 7.1: Population Distribution per District, 2010



Source: Demacon ex Ghana Statistical Service, 2010

In 2010 there were 1 036 370 households within GAR. The average household size for the Region was 3.9 persons per household. **Plan 7.1** on the following page illustrates the population distribution within the GAR.

Plan 7.1: Population Distribution 2010

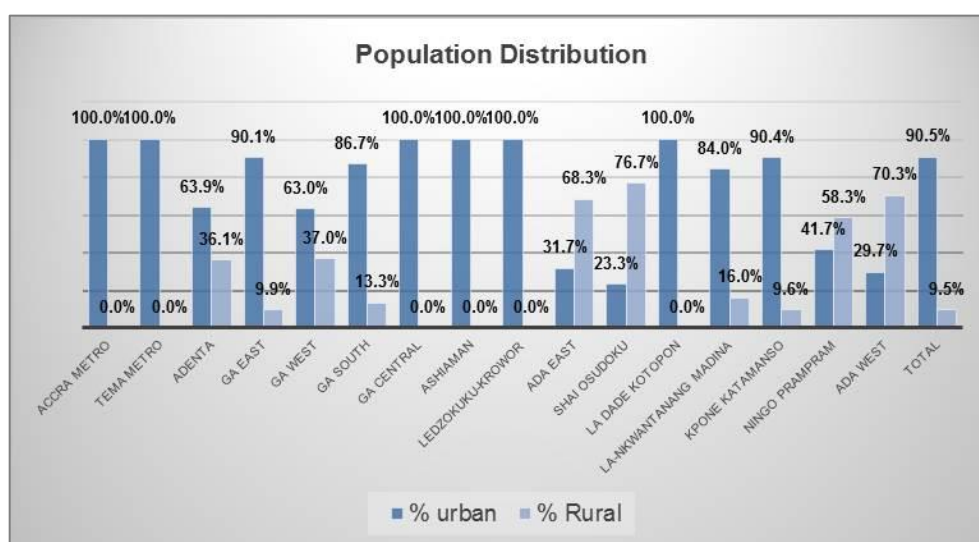
Source: Demacon ex Ghana Statistical Service, 2010

7.1.2 Population distribution

There are two main types of localities in Ghana, rural and urban. The classification of localities into 'urban' and 'rural' was based on population size. Localities with 5 000 persons or more were classified as urban, while localities with less than 5 000 persons were classified as rural.

The graph below indicates the distribution of the population in GAR between urban and rural locales. The largest portion (90.5%) of the Region's population is seen as urban.

Graph 7.1: Urban-rural Population Distribution in GAR



Source: Demacon ex Ghana Statistical Service, 2010

Various districts (Accra Metro, Tema Metro, Ga Central, Ashaiman, Ledzokuku-Krowor and La Dade Kotopon) are viewed as being completely urban with no residents living in rural areas. The Shai Osudoku District has the highest portion (76.7%) of rural residents.

The World Bank (2015) states that the urban population Ghana's cities has more than tripled over the last three decades and is outpacing rural population growth. The country as a whole is moving steadily and uniformly towards cities through migration away from rural areas. Urban population growth has been more rapid in Ghana's smaller cities than its larger cities.

Urbanization has already had a strong effect on the country's transformation. The correlation between urbanization and economic growth has led to Ghana's GDP growing

rapidly (averaging 5.7% growth) since 1984. This rapid economic growth has resulted in a reduction in both urban and rural poverty. Migration to urban areas has also led to structural transformation veering off from subsistence farming with an increase in industry and service jobs which has boosted Ghana's economy.

The side effects of rapid urban migration have started to emerge which include, *inter alia*, congestion, unregulated urban expansion, limited access to services, lack of affordable housing, and institutions struggling to cope with this rapid transition. The World Bank (2015) states that the country now finds itself at a crossroads where, depending on the approach it chooses to manage urbanization, it will ensure Ghana's growth is accompanied by better productivity and inclusion which will improve the lives of citizens, or conversely, it could create a grave danger if it is not properly planned for.

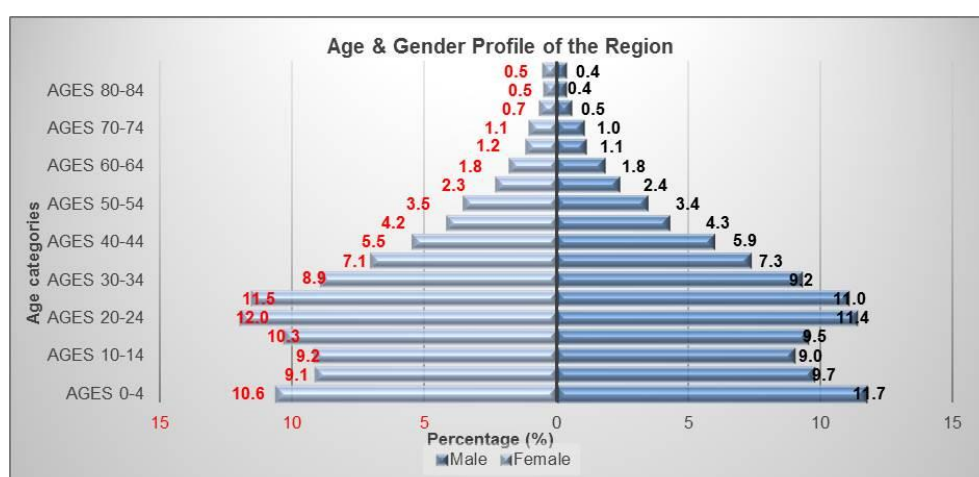
7.1.3 Age Profile

The graph below illustrates the population age profile of the GAR. The Region is characterised by a large segment of persons between 20 and 40 years of age. From this profile it can be deduced that the Dependency Ratio for the GAR is 49.9%, which is relatively low. A high ratio increases the burden on the productive part of the population to maintain upbringing and pensions of the economically dependent.

From the graph the following population dispersion can be deduced:

- 0-19 years: 29.7%
- 20-40 years: 32.8%
- 40-60 years: 39.7%
- 60 years and older: 7.8%

Graph 7.2 Population Age Profile for GAR

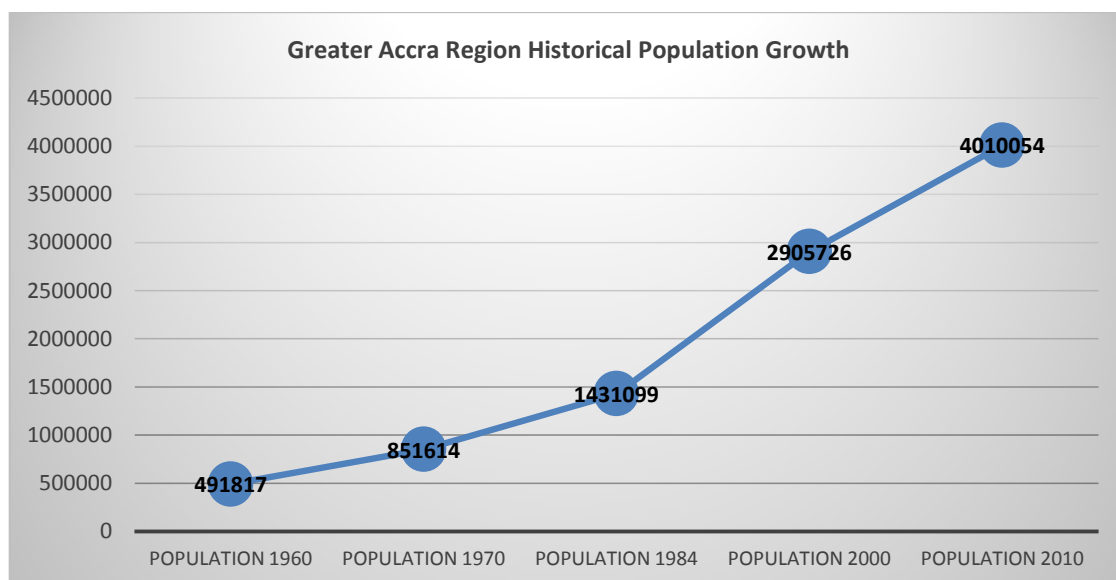


Source: Demacon ex Ghana Statistical Service, 2010

7.1.4 Population Growth Projections

The graph below indicates the historical population growth of the Greater Accra Region since 1960. The population has grown from 491 817 persons in 1960 to 4 010 054 in 2010. This constitutes an average growth rate of 4.29% per annum for the Region.

Graph 7.3: GAR Historical Population Growth



Source: Demacon ex Ghana Statistical Service

Table 7.1 illustrates the population 20-year growth projections for each district within the GAR. Individual growth rates for each district were used based on the 2000 and 2010 census population counts. Where the demarcation of districts has changed the average growth rate for GAR, which is 3.1%, was applied. **The total population is expected to increase from 4.01 million persons in 2010 to 9.88 million persons in 2037. This growth is substantial.**

The average annual growth rate is 72 557 persons per annum. Accra Metro is the largest contributor to growth at 36.3%, growing at an average rate of 26 318 persons per annum.

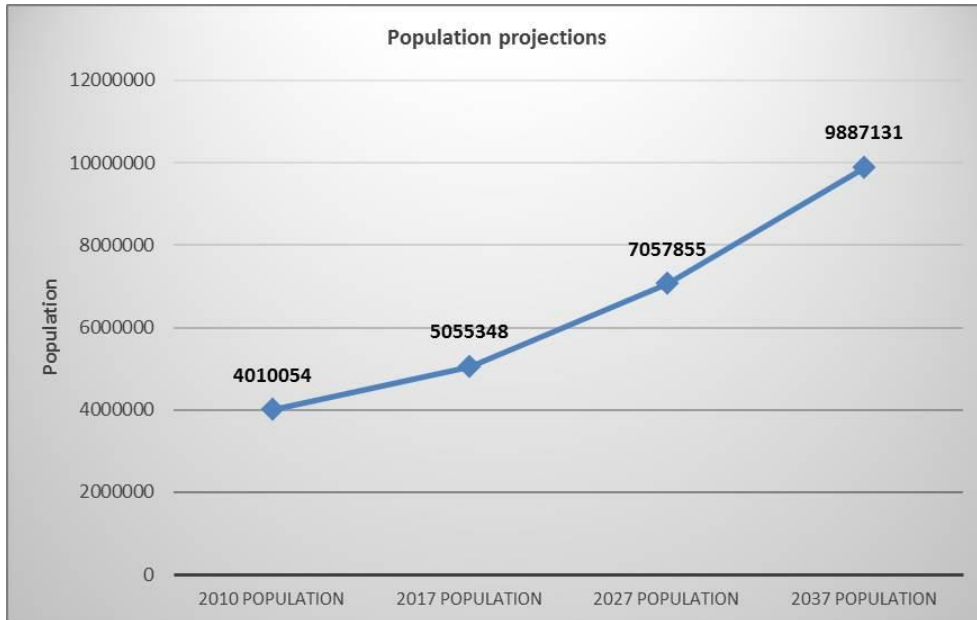
Table 7.1: Population Growth Projections 2010-2037

District	2010 Population	Population Growth Rate	2017 Population	2027 Population	2037 Population	Average Annual Increase	Proportion contribution to population growth
Accra Metro	1 665 086	3.1%	2 061 804	2 797 912	3 796 825	78 953	36.3%
Tema Metro	292 773	2.6%	350 399	452 935	585 477	10 841	5.0%
Adenta	78 215	2.6%	93 610	121 003	156 412	2 896	1.3%
Ga East	147 742	4.2%	197 051	297 341	448 676	11 146	5.1%
Ga West	219 788	4.2%	293 142	442 339	667 471	16 581	7.6%
Ga South	411 377	4.3%	552 370	841 537	1 282 084	32 248	14.8%
Ga Central	117 220	3.6%	150 148	213 854	304 590	6 940	3.2%
Ashaiman	190 972	4.6%	261 632	410 212	643 169	16 748	7.7%
Ledzokuku-krowor	227 932	3.1%	282 238	383 003	519 744	10 808	5.0%
Ada East	71 671	3.1%	88 747	120 432	163 428	3 398	1.6%
Shai Osudoku	51 913	2.4%	61 288	77 692	98 486	1 725	0.8%
La Dade Kotopon	183 528	3.1%	227 255	308 390	418 491	8 702	4.0%
La-Nkwant. Madina	111 926	3.1%	138 593	188 074	255 220	5 307	2.4%
Kpone Katamanso	109 864	3.1%	136 040	184 609	250 518	5 209	2.4%
Ningo Prampram	70 923	3.1%	87 821	119 175	161 723	3 363	1.5%
Ada West	59 124	3.1%	73 211	99 348	134 818	2 803	1.3%
Total Greater Accra Region	4 010 054		5 055 348	7 057 855	9 887 131	217 670	100.0%

Source: Demacon ex Ghana Statistical Service, 2010

The graph below illustrates the population projection for GAR over the next 20 years. The rapid population growth is projected to the population more than doubling from 2010 to 2037.

Graph 7.4: 20-Year Population Projection



Source: Demacon, 2016

Plan 7.2 on the following page illustrates the anticipated population distribution by 2037 based on the aforementioned population growth. Comparing **Plan 7.1** and **Plan 7.2** the significant population growth can be better comprehended.

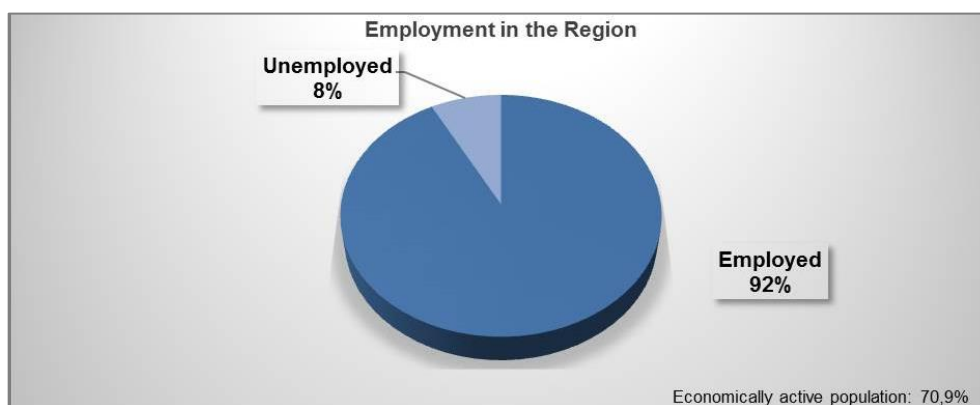
Plan 7.2: Population Distribution 2037 (Demacon, 2016)

Source: Demacon, 2016

7.2 Employment/ Unemployment and Income

The level of employment reflects employment and unemployment levels in the GAR, which impacts on economic growth and disposable income patterns. Level of employment, coupled to household size is also indicative of dependency ratios.

Chart 7.2: Employment in GAR

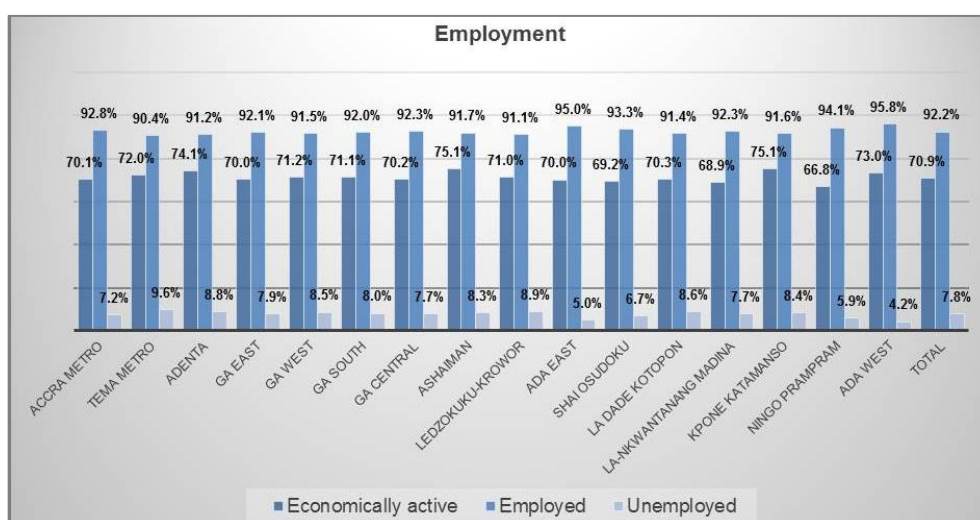


Source: Demacon ex Ghana Statistical Service, 2010

From the above chart it can be deduced that the majority (70.9%) of the population is economically active, of these 92.2% are employed and 7.8% are unemployed. The Region is characterized by high employment levels which bodes well for the economy. Coupled with a high percentage of people who are economically active, this reflects low dependency ratios, putting less pressure on breadwinners.

The graph that follows indicates the employment profile of the various districts. Most districts have a large portion of economically active population (more than 70%), of these more than 90% are employed.

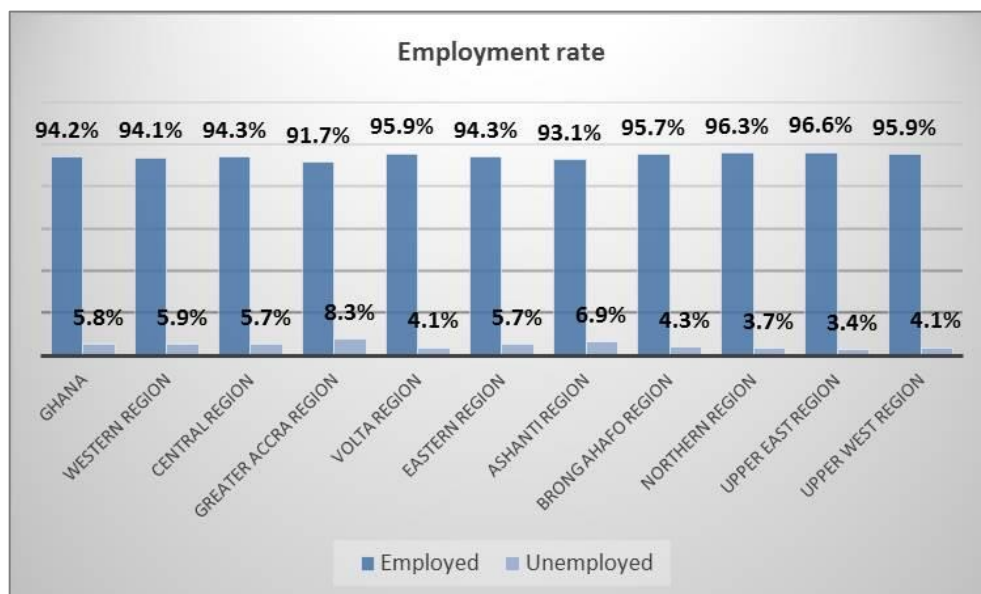
Graph 7.5: Employment Profile per District



Source: Demacon ex Ghana Statistical Service, 2010

According to the GLSS 6 the unemployment rate within Ghana was 5%. The incidence of unemployment is higher in urban areas (6.5%) than in rural areas (3.9%). Accra has the highest unemployment rate (7.4%) of all urban areas. The graph below illustrates the employment rate per region in Ghana. All regions have an employment rate of above 91%, with the Upper East Region (96.6%) having the highest employment rate and the GAR (91.7%) having the lowest employment rate.

Graph 7.6: Employment Rate per Region



Source: Demacon ex Ghana Statistical Service, 2010

Plan 7.3 on the following page illustrates the employment per district.

Plan 7.3: Employment per District

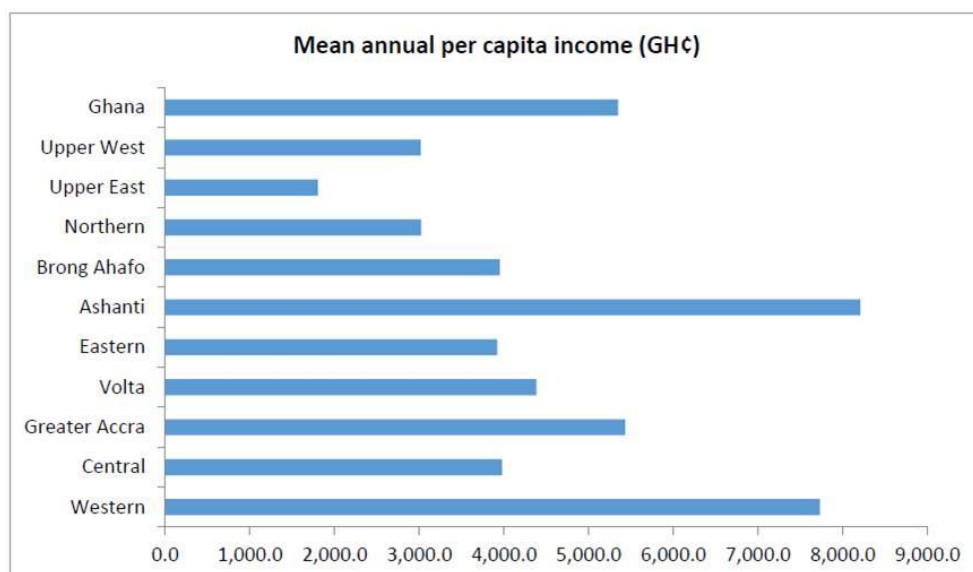
Source: Demacon, ex Ghana Statistical Service, 2010

The mean average annual income of urban households is GHC 20 930.05, while annual income in rural locales averages GHC11 408.01 as per GLSS, Round 6, 2014. Households in other urban areas have a higher average income compared to those in Accra (GHC 17 023.71). Income disparities also exist between rural areas:

- Rural coastal areas – GHC 11 351.13
- Rural forest areas – GHC 12 102.59
- Rural savannah areas – GHC 16 644.59

The GLSS 6 states that the GAR has the highest proportion of households (56.6%) falling within the highest quintile and a small portion of households (2.9%) falling within the lowest quintile compared to all other regions. In contrast the three northern regions have high proportions of households falling within the lowest quintile. This could be an indication that poverty is more prevalent in the three northern regions than in the GAR. The graph that follows indicates the average annual per capita income per region. The GAR ranks the third highest in terms of per capita income when compared to the other region in Ghana.

Graph 7.7: Average Annual per Capita Income in Ghana per Region



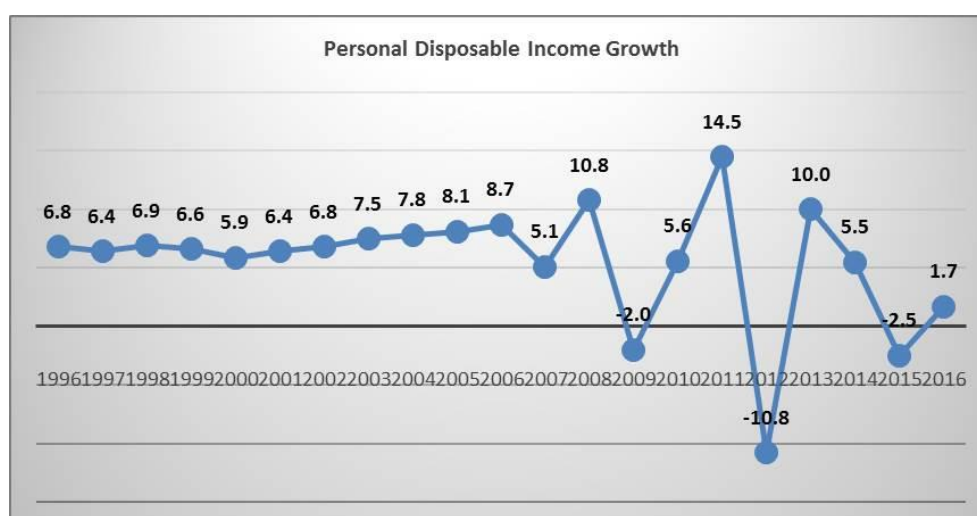
Source: Ghana Living Standard Survey 6, 2012

According to the GLSS 6 the total annual estimated revenue earned by all non-farming activities were GHC 48 645.9 million. Of this income, the highest annual estimated earnings were from the trading sector (GHC 31 134.3 million). Manufacturing enterprises (GHC 7 987.5 million) attributed the least to the estimated national annual revenue.

The GLSS 6 further indicates that the largest share of income from non-farming activities (GHC 7 467.9 million) was allocated to use by/in own household. Households saved GHC 3 578.2 million and allocated a further GHC 970.9 million for other purposes.

The graph below illustrates growth in disposable personal income within Ghana from 1996 until 2016. Personal disposable income grew by 4.2% per annum over the long term (2006-2016). Short-term growth of personal disposable income amounted to 3.1% per annum over the short term (2011-2016).

Graph 7.8: Growth in Personal Disposable Income in Ghana, 1996-2016



Source: Demacon ex Ghana Statistical Service, 2010

According to the GLSS 6 the majority (48.3%) of household income is attributed to non-farm self-employment. Wages represent the second largest contributor (36.3%) with household agriculture accounting for 10.1% of Ghana's household income.

7.2.1 Poverty Incidence

According to the GLSS 6 the Greater Accra Region, at 6.6%, has low levels of poverty incidence. The figure below illustrates the significant variations in incidence and depth of poverty between the various districts.

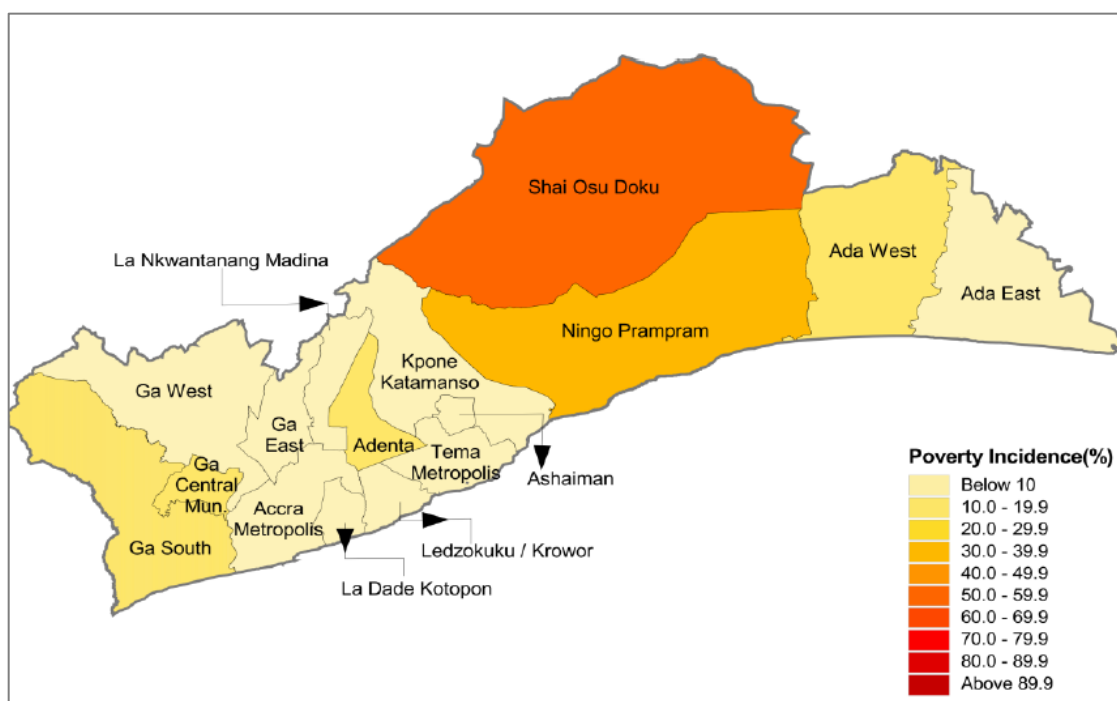


Figure 7.1: Poverty Incidence within GAR

Source: Ghana Statistical Service, 2015

From the figure it can be seen that Shai Osudoku District has the highest poverty depth at 23.2%, followed by Ningo Prampram at 10.1%. This could be attributed to the fact that these districts are largely rural in nature.

La Dade Kotopon revealed the lowest rate in terms of depth of poverty (0.3%), followed by the Accra Metro District with 0.6%. These districts are urban districts which reveal a higher average income, as stated earlier in the report.

7.3 Health (including health facilities)

Healthcare is mostly provided by the government and is largely administered by the Ministry of Health and Ghana Health Services. Ghana Health Services is a publicly funded body though it operates independently from central government.

DID YOU KNOW?

In 2014, Ghana had 4,345 health care facilities that were spread over the ten regions. There are 115 district hospitals in 114 (out of 216) districts. Of these, 90 district hospitals are government-owned, 24 are non-profits and one is a quasi-government hospital.

Source: Ghana National Development Framework, 2015

Ghana Health Services is mandated “*To provide and prudently manage comprehensive and accessible quality health services with emphasis on Primary Health Care in accordance with approved national policies*” (Ghana Health Service 2014 Annual Report).

The healthcare system has the following levels of providers:

- Health posts which are first level primary care for rural areas;
- Health centres and clinics;
- District hospitals;
- Regional hospitals; and
- Tertiary hospitals.

There are also a number of private and mission hospitals which are not part of Ghana Health Services.

Information derived from the Medium Term Development Frameworks for the various assemblies indicated there are approximately 417 health facilities (mostly in the urban and peri-urban areas) that cover all levels of providers in GAR.¹ At a workshop held in 2016, participants indicated that although there is a new regional hospital in the GAR and two new district hospitals (Dodwa and Lekma), there are no public hospitals in Ga Central, Ga East, Ada West, Kpone Katamanso, La-Nkwantanang and Ningo Prampram (*MTDFs and the draft Dodowa SDF*). .

Plan 7.4 on the following page provides a visual representation of the spatial distribution and highlights the settlement trends which are centred around Accra, Madina and Tema. It highlights the present dominance of Accra, Tema and the Madina area.

Plan 7.4: Distribution of Health Facilities in the GAR

Source: Ministry of Health, Republic of Ghana, <http://www.moh.gov.gh/>

The doctor-population ratio in GAR ranges from 1:8179 (Tema MTDF) to 1:158 437 (Ga Central MTDF). It is evident that GAR does not compare favourably with the national figure for doctor-population ratio of 1:10,452 and the recommend standard of the World Health Organisation of 1:5000 (*Ningo-Prampram MTDF 2014, pg. 74*). According to the Health Sector Medium Term Development Plan 2014-2017 (*Ministry of Health Ghana*) 50% of all Ghana’s doctors are in the GAR.

The top five diseases in the GAR (as per the Medium Term Development Plans for the various assemblies) are:

- Malaria;
- Acute Respiratory Infections;

¹ The number of health facilities exclude the facilities for the La Nkwantanang-Madina Municipal Assembly.

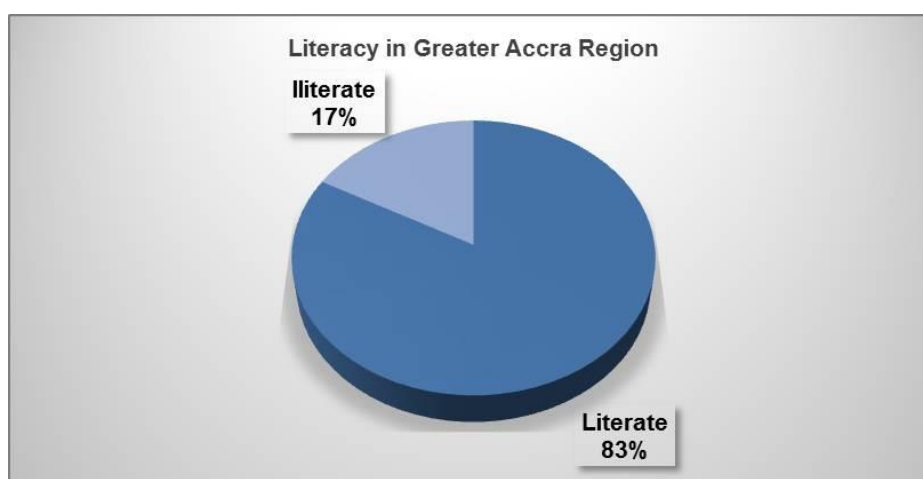
- Diarrhoea;
- Skin diseases; and
- Hypertension.

Although Malaria tops the chart it is mainly followed by the transmission of diseases caused by a lack of adequate sanitation. Access to safe water, basic sanitation and waste disposal are critical in maintaining a healthy environment, this implies that activities geared toward addressing the problems of sanitation can go a long way to positively influence the health status of residents in the Region.

7.4 Education and literacy

Education and literacy serve as proxies for human development. The chart below indicates the level of literacy within the Region. The majority (83.0%) of persons 11 years and older are literate.

Chart 7.3: Level of Literacy in GAR

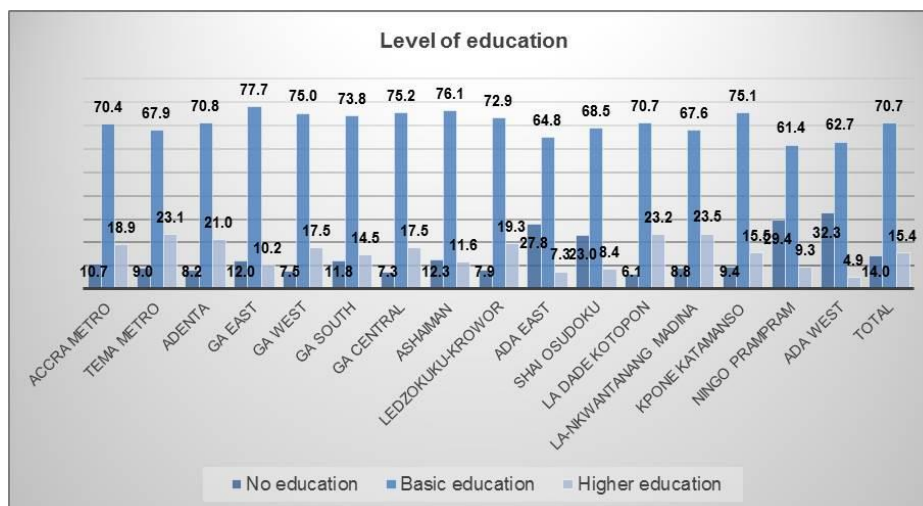


Source: Demacon ex Ghana Statistical Service, 2010

Ada West is the district with the lowest literacy rate (45.7%) while Accra Metro has a literacy rate of a mere 50%. Ga East has the highest literacy rate with 98.3% of persons over the age of 11 being literate.

The graph below shows the level of education of persons 12 years and older for each district within the region. It can be deduced that the majority of persons 12 years and older have had at least some basic education, which includes both persons with basic and/or secondary education. A small portion (15.4%) of persons in the GAR have had some form of higher education, which includes vocational, technical and community education; post middle, secondary certificate/diploma education; and tertiary education.

Graph 7.9: Level of Education



Source: Demacon ex Ghana Statistical Service, 2010

Findings from Medium Term Development Plans 2014-2017 indicate that pupil-teacher ratios across the region vary considerably. The highest pupil-teacher ratio for primary schools is found in Tema (56:1) followed by Kpone Katamanso (49:1). Several districts fall within the higher ratios including Ada West (43:1) and Ningo Prampram (40:1). The district with the lowest ratio for primary schools is Ga West at 22:1.

Where junior high schools are concerned the ratios look somewhat different. The region with the highest pupil-teacher ratio is also Tema at 31:1, though it is much better than the primary school ratio. The majority of districts fall within the 15-30:1 range, while the district with the lowest ratio is Ga West at 9:1.

7.5 Education (including educational facilities)

The elimination of illiteracy has been an objective of the Ghana Government for the last 40 years. To achieve this objective, basic education between the ages of four (4) and 15 is compulsory. Furthermore, in support of this objective a new Education Plan in line with the Millennium Development Goals was finalised in 2007 aimed at providing universal free primary education by 2015.

DID YOU KNOW?

Number of schools in GHANA

- 19 277 Pre-primary Schools
- 19 854 Primary Schools
- 12 436 Junior High Schools

Source: <http://www.ghana.gov.gh>

The Ghanaian educational structure and the number of educational facilities within the GAR are illustrated in the following figure.

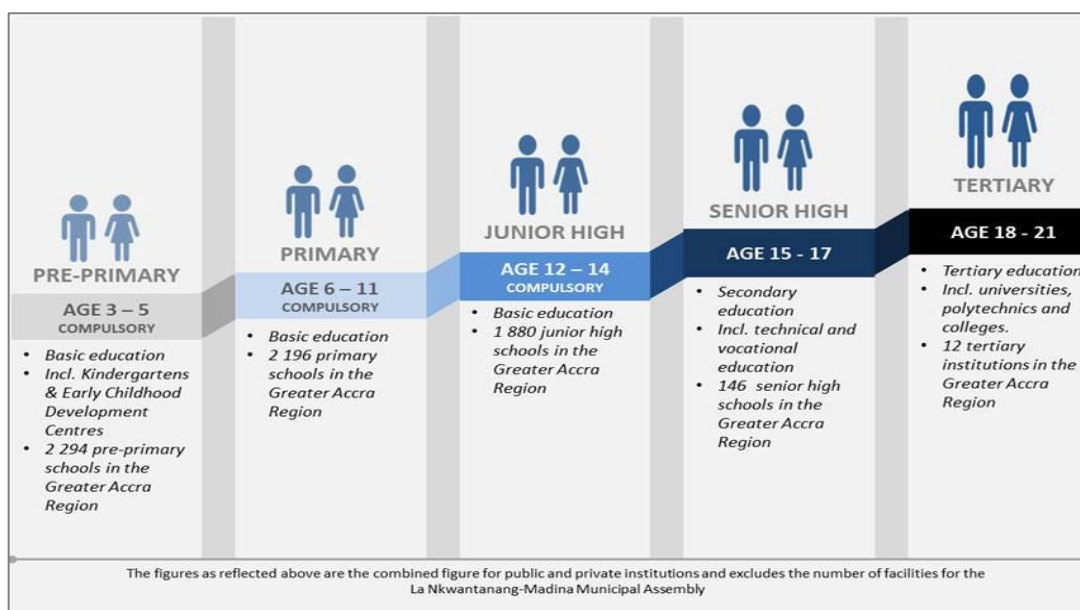


Figure 7.2: The Ghana Educational Structure and Number of Educational Facilities within GAR

Source: GIBB ex MDTF's

What is not evident in the above-mentioned figure is that the number of private schools within the GAR outweighs the number of public schools. Private educational institutions are mostly located in the urban and peri-urban communities whilst very few of these are found in rural areas.

Plan 7.5 on the following page provides a visual representation of the spatial distribution of schools and affirms the settlement concentration around Accra, Madina and Tema. It highlights the present dominance of Accra, Tema and the Madina area.

Plan 7.5: Distribution of Schools in the GAR

Source: Ministry of Education, Republic of Ghana. <http://ghanaschoolsinfo.org/explore>

The table below provides an analysis of the number of schools required (as per the planning standards) in GAR for an estimated population of 5 055 348 (2017).

Table 7.2: Number of Schools Required in GAR

Category School	Standard	Required
Primary	1/5 000	1 011
Junior	1/10 000	505
Senior	1/20 000	252

When comparing the required number of schools with the totals in the figure above it would appear that there is an oversupply of primary and junior high schools. However, when assessing the required number of schools against the number of public schools there is shortage of primary and senior high schools in GAR (see table below).

Table 7.3: Shortage of Public Schools

Category School	Standard	Required	Public *	Shortage
Primary	1/5 000	1 011	863	-148
Junior	1/10 000	505	936	431
Senior	1/20 000	252	49	-203

* Excluding the figures for the La Nkwantanang-Madina Municipal Assembly

Generally there is an increase in enrolment in schools in the peri-urban and urban areas and the factors which contributed to this increase include inter alia (as per the MTDFs for the various assemblies):

- The Capitation Grant;
- School feeding programme;
- Distribution of free school uniforms and text books;
- Increase in access to schools due to private schools being established in old and new settlements; and
- Expansion and rehabilitation of existing school structures.

The following problems are experienced in the GAR (as per the MTDFs for the various assemblies):

- Uneven distribution of schools;
- High enrolment in public basic schools;
- Overcrowding, as the number of classes exceeds the number of classrooms;
- Inadequate and poor quality educational infrastructure;
- Public schools lack ancillary facilities (i.e. kitchens for school feeding programmes, ablution facilities, etc.);
- Lack of i.e. libraries, workshops, school laboratories, etc.;
- Availability of land for the construction of educational facilities;
- Makeshift structures for classrooms; and
- Access to education in the rural areas.



Makeshift structures for classrooms at Agortor Presby Primary.

Source: Shai Osudoku Medium Term Development Plan

“The Metropolitan Education Directorate had, for many years, been compelled to adopt the Shift System of Basic Education in order not to deny the school going population their right to education. By this system, a classroom was shared between two classes due to limited number of classrooms. The classrooms are used in turns for the morning and afternoon shifts by Two (2) different schools.

This meant that pupils in this system benefitted from only 4 hours of school work daily, instead of the standard 8 hours required for a meaningful instruction. In effect, this system reduced the required instructional period. “

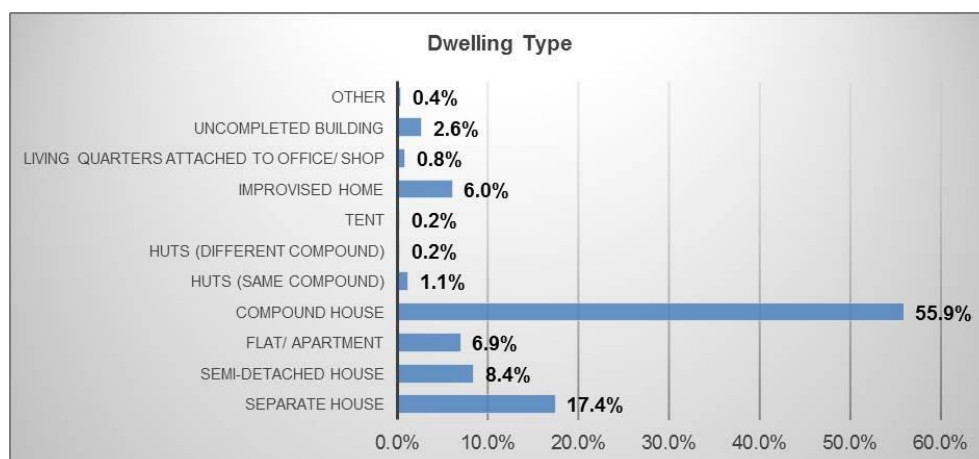
Source: Accra Medium Term Development

Based on the aforementioned it is evident that GAR lacks educational facilities to accommodate the current and future needs of the population. Strangely, the measures put in place to ensure access to education is hampering the objective to eliminate illiteracy. Furthermore, this problem is aggravated by the availability of land.

7.6 Dwelling type and occupancy

The following graph indicates the different dwelling types of the population of the GAR.

Graph 7.10: Dwelling Types in GAR



Source: Demacon ex Ghana Statistical Service, 2010

From the above it is determined that the majority of households in the Region (55.9%) occupy a compound house (room). Nationally the portion of households living in compound housing has risen from 43.7% (GLSS 5) to 60.6% (GLSS 6). While compound housing still dominates the existing housing stock in GAR the proportion of supply is declining due to rapid growth in the supply of bungalows and flats (UN Habitat, 2011). A mere 17.4% of households reside in a separate house.

Room occupancy relates to the number of rooms occupied by a household (excluding bathrooms, toilets and kitchens). According to the GLSS 6 (2014) 49.9% of Ghana's households occupy one room for living while 26.7% occupy two rooms. Urban households (53.5%) are more likely to occupy one room compared to households in rural areas (45.4%). In the GAMA 42.7% of households occupy only 1 room as stated in the GLSS 6.

Table 7.4 on the following page provides detail on the amount and categorisation of housing stock available in the region per district. From the table it can be seen that the current housing stock, as per the 2010 census, is 1 049 994 dwelling units. This amounts to 3.8 persons per dwelling unit, which correlates to the average household size.

Unfortunately this housing stock includes inadequate housing such as tents, improvised housing, uncompleted buildings and other undefined forms of accommodation. If these dwelling units were to be subtracted from the housing stock, only a supply of 953 149 adequate dwelling units would remain, resulting in an average occupancy of 4.2 persons per dwelling unit as per the 2010 census population and housing stock.

It must also be taken into consideration that of these 953 149 adequate dwelling units 61.6% are rooms in compounds. Families living in a compound often occupy only one or two rooms in the compound and share facilities such as water, toilets, kitchen and the enclosed courtyard, with other residents. Where toilets in the compound are insufficient the men tend to use public latrines and leave the toilet in the compound for the women and children. Compound living is unpopular, especially with the younger generation (UN Habitat, 2011), hence the housing projects currently being implemented by Ghana's government is aimed at supplying 1-3 bedroom apartments. The main house types popular with new developers are detached and semi-detached dwellings with all services, intended for a single household.

Table 7.4: Housing Stock per Dwelling Type per District in GAR

District	Separate house	Semi-detached house	Flat/ Apartment	Compound house (rooms)	Huts (same compound)	Huts (different compound)	Tent	Improved home	Living quarters attached to office/ shop	Uncompleted building	Other	Total
Accra Metro	48 632	33 551	34 727	339 956	3 442	889	1 144	30 906	4 666	2 241	1 749	501 903
Tema Metro	14 279	17 989	6 506	22 112	847	94	180	6 327	528	1 621	314	70 797
Adenta	6 360	1 685	783	6 294	110	12	41	2 844	193	2 088	68	20 478
Ga East	11 202	3 400	2 803	12 038	422	50	126	3 251	309	3 511	303	37 415
Ga West	16 106	4 013	3 542	25 863	322	77	105	2 914	263	2 541	167	55 913
Ga South	30 182	9 456	7 367	38 052	2 556	384	194	2 583	624	9 024	279	100 701
Ga Central	8 509	2 290	2 258	12 118	147	34	47	694	149	2 633	57	28 936
Ashaiman	4 551	1 568	1 186	38 677	265	66	139	2 815	358	245	66	49 936
Ledzokuku-krowor	8 469	3 503	3 296	4 162	378	143	135	2 141	270	724	108	23 329
Ada East	3 848	785	532	9 059	1 036	118	10	47	40	141	15	15 631
Shai Osudoku	4 250	384	383	5 817	540	120	17	151	60	128	12	11 862
La Dade Kotopon	6 042	3 627	6 639	29 718	607	74	129	3 046	478	402	392	51 154
La-Nkwant. Madina	5 717	2 057	1 312	15 195	232	41	64	3 131	191	861	69	28 870
Kpone Katamanso	7 088	2 336	865	12 752	232	36	53	1 892	152	1 332	62	26 800
Ningo Prampram	4 539	716	365	8 169	283	40	22	216	81	150	46	14 627
Ada West	2 915	500	277	7 268	456	50	7	65	44	44	16	11 642
Total Greater Accra Region	182 689	87 860	72 841	587 250	11 875	2 228	2 413	63 023	8 406	27 686	3 723	1 049 994

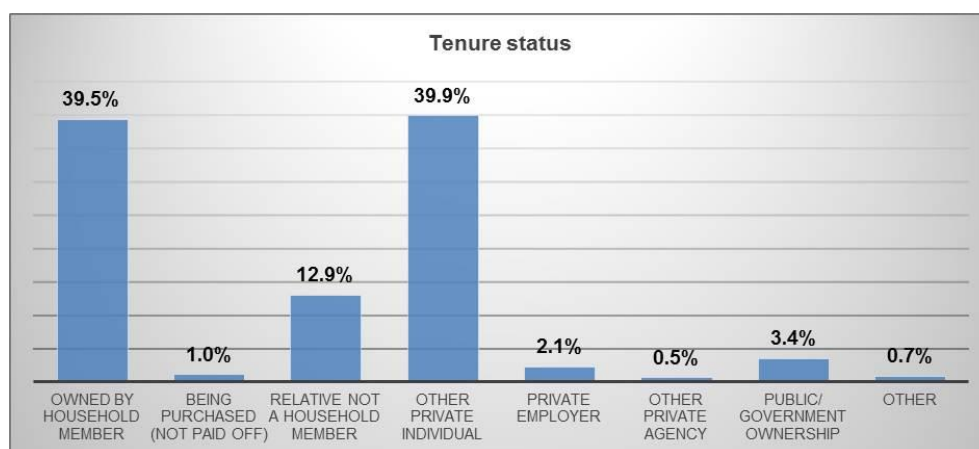
Source: Demacon ex Ghana Statistical Service, 2010

With an average household size of 4.6 and the average number of rooms per households 2.4, the GAR has an average room density of 2.0 persons per room. All districts, except Accra Metro, have an average room density lower than that for the Region. Shia Osu Doku and Ada East have a density of 1.6 persons per room, the lowest in the Region. This implies that overcrowding is a more significant problem in Accra Metro.

7.7 Tenure status and housing delivery system

The following graph indicates the tenure status of the population in the Region in terms of residences that are owned and fully paid off, a residence owned but not yet fully paid off and other types of tenure.

Graph 7.11: Type of Tenure in GAR



Source: Demacon ex Ghana Statistical Service, 2010

The dominant type of tenure at 39.9% is households residing in homes owned by another private individual. This could include rental accommodation and persons occupying rent free.

Yet, a significant portion (39.5%) of households owns the home they live in, while 1.0% are still in the process of paying off their home. This indicates that a large segment of the population represent home owners.

In Ghanaian cities, the local chiefs allocate land to individuals and building may take place outside of planning and building control. Informal settlements are not illegal they are simply outside the formal development system and control (UN Habitat, 2011. Ghana Housing Profile).

An important supply mechanism where formal and informal housing meets, is in the informal extension of existing formal dwelling units. Future extension activity allows more people to live on the same ground area and provide rental income for the owner. There are also many rooms provided through extending completed buildings either on the existing plot or intruding into public space.

According to the UN credit is used by about 25% of Ghanaians but most households in Ghana do not borrow money to build housing – they borrow for business and use profits to build. A conventional formal sector finance system, notably through the Housing Finance Company, exists which was set up ostensibly to serve ordinary Ghanaian households. Currently, however, it and the banks only deal with the very richest few and impose very high thresholds for borrowing, high down-payment and interest rates. This constrained access to home finance has personal wealth implications and has led to a under developed real estate market in Ghana.

7.8 Main Findings – Population and Social Environment

The main findings of the population and social environment follow:



POPULATION AND SOCIAL ENVIRONMENT FINDINGS

Population

- The total population size for the GAR was 4 010 054 persons in 2010.
- Accra Metro contributes the largest portion (41.5%) of the population.
- In 2010 there were 1 036 370 households within the region and the average household size was 3.9 persons per household.
- The total population is expected to increase from 4.01 million persons in 2010 to 9.88 million persons in 2037.
- The average annual growth rate is 72 557 persons per annum. Accra Metro is the largest contributor to growth in the Region (36.3%), growing at an average rate of 26 318 persons per annum.
- The dependency ratio is 49.9%, which is relatively low. A high ratio increases the burden on the productive part of the population to maintain upbringing and pensions of the economically dependent.
- The largest portion (90.4%) of the population is seen as urban. Localities with 5 000 or more persons are classified as urban, while localities with less than 5 000 persons are classified as rural.
- The majority (70.9%) of the population is economically active, of which 92.2% are employed and 7.8% are unemployed. It therefore has high employment levels.
- The mean average annual income of urban households is GHC 20 930.05, while

annual income in rural areas average GHC 11 408.01

- Personal disposable income grew by 4.2% per annum over the long term (2006-2016), while short-term growth of personal disposable income amounted to 3.1% per annum over the short term (2011-2016).
- The majority (83.0%) of persons 11 years and older are literate.
- The majority of persons 12 years and older have had some basic education (this includes both persons with basic and/or secondary education). A small portion (15.4%) of persons have had some form of higher education.
- The majority of households (55.9%) occupy a compound house (room).
- The current housing stock (as per the 2010 census) is 1 049 994 dwelling units, which amounts to 3.8 persons per dwelling unit, which in turn correlates to the average household size.
- The region has an average room density of 2.0 persons per room.
- The dominant type of tenure (39.9%) is households residing in homes owned by another private individual. This could include rental and rent-free accommodation. 39.5% of households own the home they live in and have fully paid off their mortgage, while 1.0% is still in the process of paying off their home.

Health

- Healthcare is generally provided by the government and administered by the Ministry of Health and Ghana Health Services.
- It provides a hierarchy of health care facilities throughout the Region.
- Though there are new facilities in the urban areas (hospital in the GAR and two new district hospitals (Dodwa and Lekma)) there are no hospitals in other, particularly the rural areas and also densely populated Ashaiman.
- Although Malaria tops the diseases chart, it is mainly followed by the transmission of diseases caused by a lack of adequate sanitation. Access to safe water, basic sanitation and waste disposal are critical in maintaining a healthy environment.

Education

- Basic education between the ages of four (4) and 15 is compulsory.
- Problems experience include: uneven distribution of schools; high enrolment in public basic schools; overcrowding, as the number of classes exceeds the number of classrooms; inadequate and poor quality educational infrastructure; public schools lack ancillary facilities (i.e. kitchens for school feeding

programmes, ablution facilities, etc.); lack of i.e. libraries, workshops, school laboratories, etc.; availability of land for the construction of educational facilities; makeshift structures for classrooms; and access to education in the rural areas.

- Generally GAR lacks educational facilities to accommodate the current and future needs of the population.

8 *Economic Environment*

This section provides insight into the economic profile of Ghana's national economy and GAR's economy. The assessment serves to highlight growth trends in the market and future investment opportunities will be informed by this sub-regional assessment.

The economic overview is outlined in terms of the following headings:

- Composition of the economy
- Employment sectors
- Policies impacting on economic conditions
- Foreign direct investment
- Historical underpinning of current space economy
- Challenges faced by the economy
- Growth Potential

8.1 **Economic base**

8.1.1 **Composition of the economy**

(a) Ghana National Economy

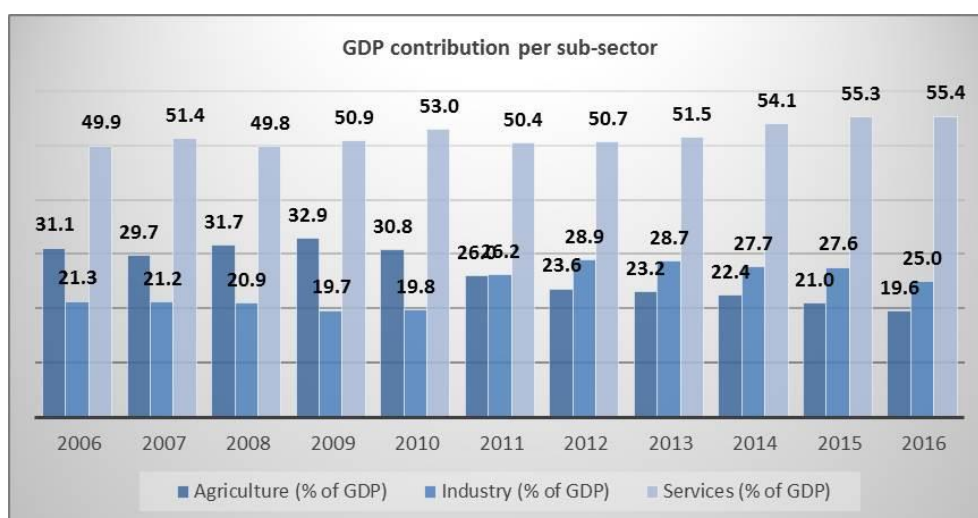
The graph below illustrates the contribution per sub-sector to the national GDP of Ghana. In terms of the Standard Industrial Classification of all economic activities (SIC) economic activity in Ghana is divided into three broad sectors, namely agriculture, industry and services. The agriculture sector includes inter alia crop farming, animal husbandry, forestry and fishing. The industrial sector comprises all mining and quarrying activities, manufacturing establishments, utilities (electricity, gas, steam and air-conditioning supply, water supply, sewerage, waste management and remediation activities) as well as construction. The services sector in turn comprises the following sub-sectors:

- Wholesale and retail trade
- Repair of motor vehicles and motorcycles
- Transportation and storage
- Accommodation and food service activities
- Information and communication
- Financial and insurance activities
- Real estate activities
- Professional, scientific and technical activities
- Administrative and support service activities
- Public administration and defence, compulsory social security

- Education
- Human health and social work activities
- Arts, entertainment and recreation
- Other service activities

The services sector constitutes the largest contributor at 55.4% in 2016 to the GDP. The services sector has shown constant growth as primary contributor to the GDP of Ghana. The industrial sector's contribution has decreased from 31.1% in 2006 to 25.0% in 2016. This denotes a change in the structure of the national economy.

Graph 8.1: Contribution per Sub-sector to Ghana GDP, 2006-2016



Source: Demacon ex Economic Intelligence Unit, 2016

The table below provides the absolute US\$ figures associated with Graph 8.1 per economic sub-sector. All sub-sectors show steady growth. The only outlier is the Industry sector which showed significant growth in 2010/2011 going from a US\$4.67 million contribution to the national GDP in 2010 to US\$7.05 million in 2011.

Table 8.1: Trend of Ghana's GDP Structural Changes, US\$ million (2006-2016) – 2006 constant prices

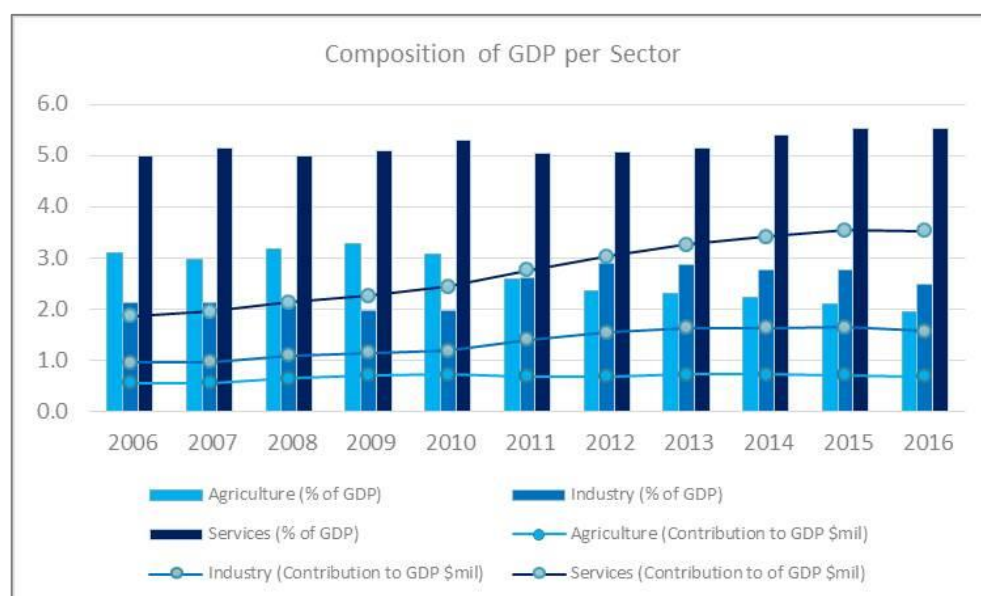
Year	Agriculture contribution to GDP	Industry contribution to GDP	Services contribution to GDP
2006	5.69	3.89	9.13
2007	5.67	4.05	9.81
2008	6.61	4.36	10.38
2009	7.19	4.26	11.12
2010	7.27	4.67	12.49
2011	6.99	7.05	13.55
2012	6.93	8.50	14.91

Year	Agriculture contribution to GDP	Industry contribution to GDP	Services contribution to GDP
2013	7.30	9.06	16.23
2014	7.34	9.07	17.75
2015	7.15	9.40	18.86
2016	6.93	8.84	19.59

Source: Demacon ex Economic Intelligence Unit, 2017

The figure below illustrates both the proportional contribution of each sector to the national GDP as well as the value of said contribution. From this figure it can be seen that the value of the industrial sector has shown marginal, though steady, growth. The agricultural sector has remained more or less in stasis while the services sector has shown significant growth since 2009, although the growth trajectory has started to decelerate.

Graph 8.2: Composition of National GDP per Sector (2006-2016), constant 2006 prices

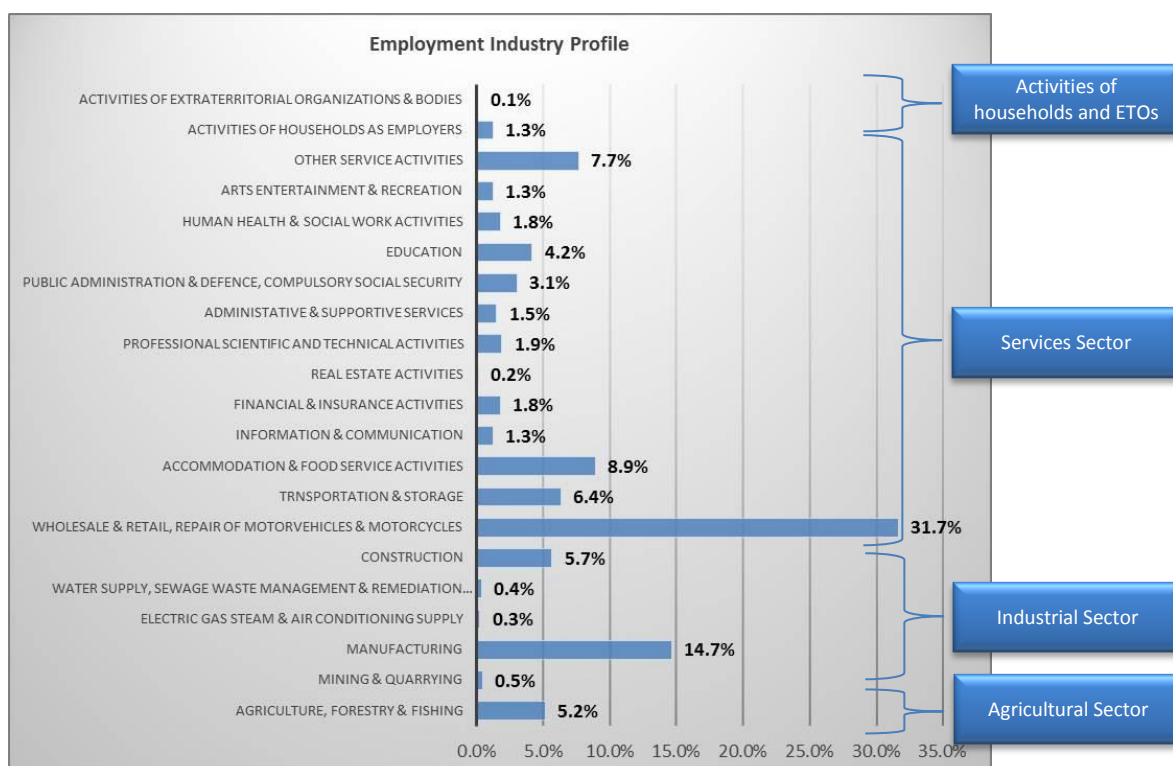


Source: Demacon ex Economic Intelligence Unit, 2017

(b) Greater Accra Regional Economy

The graph below illustrates the employment industry profile for GAR's economy. A total of 1 832 068 persons are formally employed within these sectors in the GAR. Wholesale and retail trade (31.7%) (581 145 persons) and manufacturing (14.7%) (269 194 persons) are the dominant branches of activity. Approximately 5.2% of economically active persons are engaged in the agriculture, hunting, forestry and fishing industry. This proportion is far below the national average of 52.1%. More females (39.0%) are employed in wholesale and retail trade compared to 22.2% of males. There is no gender differential as far as manufacturing is concerned. However, females are about three times more likely than males to be employed in the hotels and restaurants industry. Actual figures for the employment industry per district and for the GAR as a whole can be found in **Appendix B** to this document.

Graph 8.3: Employment Industry Profile of GAR



Source: Demacon ex Ghana Statistical Service, 2010

An assessment of sectoral size and growth reveals that the services sector has developed into the main growth driver of the Region. The services sector is the single largest employer of people (71.8% of the total labour force) and is also the sector which has recorded the highest economic growth in recent years (6.3% per annum).

The table contained in **Appendix C** summarizes the macro-economic trends per district within the GAR. The Wholesale and Retail sector is the dominant employment sector in most districts with the exception of Ada East, Ada West, Shia Osu Doku and Ningo Prampram, in which the agriculture, forestry and fisheries sector is dominant. It is common for the sectoral employment profile not to reveal a perfect correlation with the sectoral production profile, as it reflects on the capital or labour intensiveness of the particular sector.

As the services sector is the fastest growing sector in the Region as well as the largest employment sector it is expected that employment within the services sector will continue to grow at a steady pace. As growth in the industrial sector continues so too will employment in the sector increase, however, the services sector will remain the largest single employment industry within the Region.

The Accra City Region contained in the GAR accounts for approximately 25% of the national GDP (Ghana Statistical Service, 2010) and is dominant in most non-primary sectors with the exception of education. The Region is roughly at the centre of a West African regional economic corridor stretching from Abidjan to Lagos. The GAR as main metropolitan hub in Ghana fuels national growth and should therefore record growth well above the national

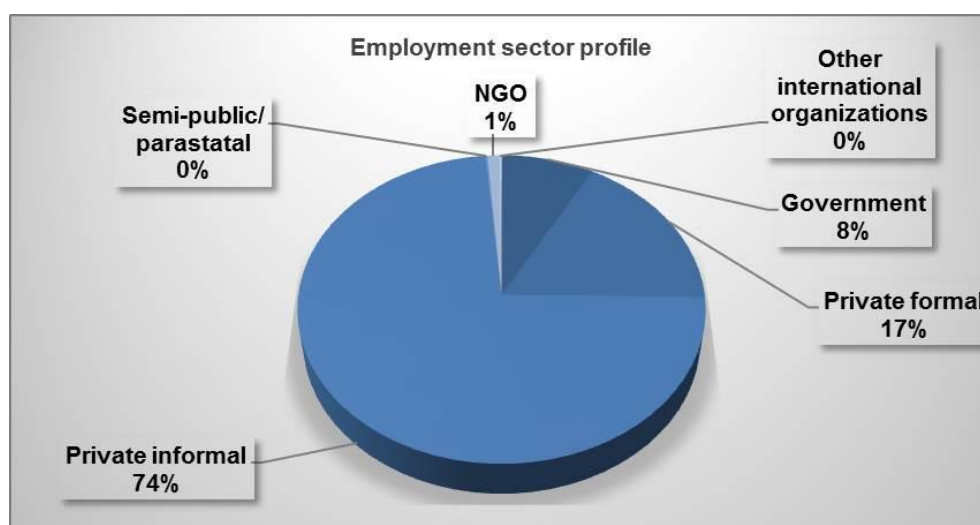
average. No disaggregated statistics are available. Anecdotal evidence would suggest that the GAR is expanding at a rate of above 7% per annum, and in certain instances where large-scale capital investment occurred, as high as 10-13% per annum.

8.2 Economic Trends

8.2.1 Employment Sectors

The following chart illustrates the employment sector profile of the GAR. The majority of the population (74%) is employed in the private informal sector. Only 17% of the population is employed in the private formal sector.

Chart 8.1: Employment Sector Profile of GAR



Source: Demacon ex Ghana Statistical Service, 2010

In Ghana the informal sector is recognised in official statistics as an active economic role player: it is mainly on account of the significance of the informal sector (which employs 73.4% of the labour force) that an extremely low unemployment rate of 7.8% is achieved.

The bulk of informal sector activity is interspersed with the urban fabric and more specifically in residential areas. The informal economy in the GAR currently takes the form of vendors and tradesmen selling their goods and services along established transportation corridors and at certain concentration points. Infrastructure for said entrepreneurs is severely lacking, often resulting in informal stalls being erected on sidewalks and in roads adding to the existing congestion problems. No formal provision is made for the spatial location of this sizable employment sector in the urban fabric of the GAR.

Future developments should take cognisance of this shortcoming and address this challenge by providing formalised areas for the location of informal businesses. Formal recognition of the sector in the city/region's spatial structure potentially holds beneficial future implications in respect of economic growth, government taxation and revenue base expansion. Consideration should be given to spatial integration of informal activity as part of future mixed-use nodes. Economic policy should furthermore be tailored to promote the development of informal activities into mainstream formal economy.

As can be seen in the preceding chart 74% of the Region's population is employed in the private informal sector. As this is the largest employment sector it can be deduced that it also plays a significant part in the regional economy.

The informal economy in the GAR currently takes the form of vendors and tradesmen selling their goods and services along established transportation corridors and at certain concentration points. Infrastructure for said entrepreneurs is severely lacking, often resulting in informal stalls being erected on sidewalks and in roads adding to the existing congestion problems. No formal provision is made for the spatial location of this sizable employment sector in the urban fabric of the GAR. Future developments should take cognisance of this shortcoming and address this challenge by providing formalised areas for the location of informal businesses. Formal recognition of the sector in the city/region's spatial structure potentially holds beneficial future implications in respect of economic growth, government taxation and revenue base expansion.

Plan 8.1 on the following page illustrates the employment sector composition per district for the GAR. As can be seen private informal employment dominates in all districts. **Plan 8.2** indicates the distribution of the work force between the main employment industries – i.e. Agriculture, Industrial and Services.

Plan 8.1: Employment Sector Composition per District

Source: Demacon ex Ghana Statistical Service, 2010

Plan 8.2: Employment Industries Composition per District

Source: Demacon ex Ghana Statistical Service, 2010

8.2.2 Policies Impacting on Economic Conditions and Employment Structure

According to the Government of Ghana (2014:2) after declaring as a Heavily Indebted Poor Country (HIPC) in the context of an IMF programme between 2002 and 2006, Ghana benefitted significantly from debt relief with fiscal space to embark on critical infrastructure investments, particularly in the roads and energy sectors as well as targeted social spending. The Government of Ghana (2014:3) states that the rebasing of the national GDP in 2010 and the onset of oil production in 2011 boosted the national economic growth further, subsequently, making Ghana one of the fastest growing economies in Africa, albeit largely based on exports of raw material. This newfound prosperity has led to a change in the country's classification by donors and institutions, such as the World Bank, and has the effect of limiting access to grants and concessional financing.

Ghana escaped the full effects of the initial global financial crisis in 2008 mainly as a result of improvements in commodity prices and overflow of credit from quantitative easing (QE) programmes in advanced countries. Recently, however, economies which were spared the initial backlash are experiencing the negative impact of the windows of the stimulus and QE programmes designed to stimulate growth in the major global economies. The largest impact hereof on Ghana's economy has been the slump in gold and cocoa prices on

international commodity markets, affecting revenue collection, output expansion and foreign exchange inflows (Government of Ghana, 2014:3-4).

More recent economic policy will be set against the backdrop of the three year Extended Credit Facility (ECF) signed with the IMF in April 2015. The cornerstone of the policy agenda in Ghana is fiscal consolidation, as a large fiscal deficit is at the root of many of Ghana's current economic woes. It is expected that Ghana might miss some of its ECF fiscal targets given that whichever party takes over power after the elections in 2017 will have made many promises it must uphold. Both of the main parties contesting the December 2016 elections have ambitious industrialisation plans which will be costly to finance (e.g. the NPP's pledge to establish a factory in each of Ghana's 216 districts). Central policy planks, which will be supported by the IMF, are expected to likely involve investment in infrastructure and the local business environment. (Economist Intelligence Unit, 2016:7)

Industrial development will create a latitude of beneficial economic effects, including value chain extension, employment creation and tax base expansion, and will furthermore require appropriate and pro-active spatial planning interventions.

8.2.3 Foreign Direct Investment

The emerging favourable prospects of the oil and gas resources in Ghana have attracted large inflows of FDI (Government of Ghana, 2014:3). According to Ghana Embassy (2017) recent divestments have encouraged multinationals, medium and small-sized foreign companies as well as Ghanaian nationals residing overseas to expand their business interests in Ghana. In September 1995, Coca-Cola initiated a \$19 million investment in a new bottling plant and training facilities, and Heinz recently invested \$20 million in a tuna canning operation. The Ghanaian government is also emphasizing the development of non-traditional export sectors. For example, Coleman has invested \$23 million in freshwater fish farming for export.

Ghana has recently embarked on a reform programme to improve the investment climate for both local and international investors. These efforts have since paid off, with Ghana being ranked as the best place for doing business in West Africa according to the 2017 Ease of Doing Business Report (Ghana Investment Promotion Centre, 2017).

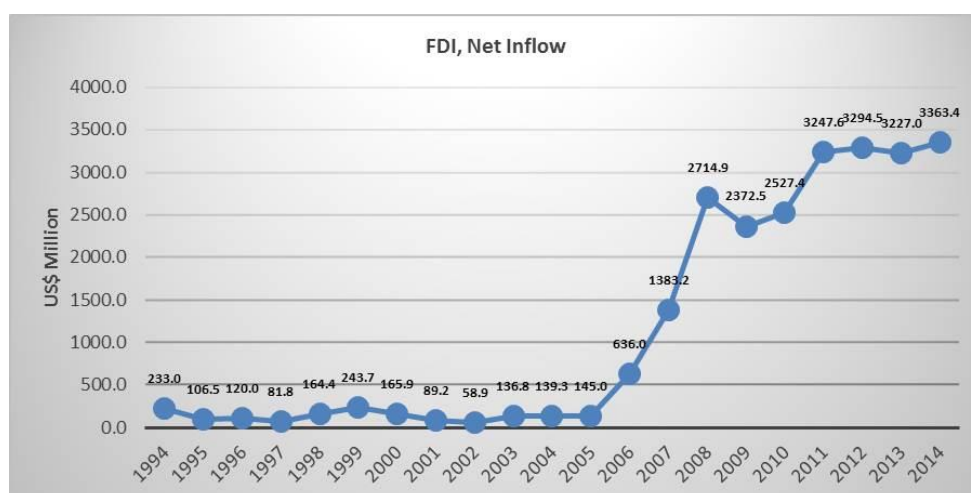
According to the Ghana Investment Promotion Centre (2017) Ghana has a solid tradition of investments in agriculture and agro-processing. The financial services and telecommunications sectors are fast gaining ground, providing dynamic and innovative services. Further opportunities for investment exist in manufacturing, ICT and tourism. Mineral deposits including gold and diamond abound, and with the discovery of oil the economic outlook is strong.

The figure that follows illustrates the FDI inflows into the Ghana economy since 1994. It is evident that FDI has risen dramatically from US\$ 233 million in 1994 to US\$3.3 billion in 2014. According to Santander (2016) FDI into Ghana has been constantly increasing in recent years. In late 2013, Ghana was the fourth largest recipient of FDI in sub-Saharan Africa. In 2015 FDI

flows decreased, mainly due to the falling prices of oil. As a consequence there has been less interest in investing in the country's mining capacities.

In March 2016 the Ghana government signed four agreements between themselves and Turkey, especially to promote FDI. Ghana is trying to attract projects that would drive development in the local labour market. In 2013, the government authorised the exploitation of a new oilfield. Mining and oil exploration are the main sectors that attract the most FDI. The United Kingdom, India, China and Lebanon are the main investing countries (Santander, 2016). With the expansions of oil productions and related industries FDI is expected to continue with its upward trajectory. South African mining firm, Gold Fields, has announced its intention to invest US\$ 1.4 billion in Ghana (Economist Intelligence Unit, 2016).

Graph 8.4: FDI Net Inflows into Ghana, 1994-2014



Source: Demacon ex Indexmundi, 2017

Accra has been ranked as the second most attractive destination for FDI in Africa, according to PWC (Allafrica, 2015). Accra is a shining example of a city that has a strong reputation throughout Africa and beyond for the quality of its communications infrastructure, low crime rates and steady democracy. A clustering of FDI in agricultural projects can be witnessed in the GAR (Djokoto, 2012). The Volta Region also holds strong attraction to FDI projects from Germany.

FDI in the services sector has manifested in the form of *inter alia* numerous shopping centre developments in GAR. Atterbury Properties developed the 20 619m² Accra Mall in 2007. An increase to 40 000m² is envisioned for the Mall. The initial phase constituted an investment of approximately US\$82 million (2016 value) with a further estimated US\$77.5 million to be invested in the second phase. Hyprop also constructed the 13 000m² Achimota Mall in 2015 at an investment value of US\$52 million. These investments create further sustained benefits on an annual basis in the form of business sales, job creation and taxation.

Kwasi (2016) states that the Ghanaian government deployed several location incentives to encourage FDI away from the GAR, specifically into the three northern regions. A study by Dr Kwasi (2016), however, found that there was no relationship between these location

incentives and regional location of FDI, which would seem to suggest that the current incentives are neither efficient nor appealing to the investment fraternity. He recommended that the government should rather provide social and economic infrastructure in the northern part of Ghana as to make the area more attractive to foreign investors. It can thus be deduced that most FDI remains located in the GAR.

8.2.4 Historical Underpinnings of Current Space Economy

Accra, the administrative capital of the GAR, is also the political and economic capital of modern Ghana. The city was settled as early as 1500 by European settlers operating fort as outlet for trade between the Ga people and Europe. However, Accra was not initially the most prominent trading centre. The ports of Ada and Prampram, along with the inland centres of Dodowa and Akusa to the east initially were more significant (Macalester, 2016). In 1877 Accra became the colonial capital of the Gold Coast Colony (Caelen, 2017). With the influx of Europeans that came to Accra as the administrative functions were moved to Accra, the city began to expand to accommodate the new residents. Thus, Victoriaborg was formed in the late 19th century as an exclusive European residential neighbourhood, located to the east of the city limits of the time (Macalester, 2016).

Throughout the colonial era, Accra maintained its importance as a centre for trade. Even after the construction of a deep water port in Takoradi in 1928, Accra's surf port remained economically important (Caelen, 2017).

The building of the Accra-Kumasi railway in 1908 signifies one of the most influential decisions in the Regions history. The decision was made mainly to connect Accra, the main port at that time, with Ghana's main cocoa producing regions. The railway was completed in 1923, and by 1924 cocoa was Ghana's largest export. By the end of WWI, Ghana was viewed by some as the most prosperous colony in Africa with the best schools and civil service on the continent (Macalester, 2016).

Until 1928, Accra was the main exporter of cocoa, and this was one of the main reasons for its rapid growth during the early 20th century. Another factor that drew in many migrants from rural areas was the service of piper water that was made available in Accra in 1915 (Macalaster, 2016).

During WWII Accra became a crucial link in the Allied transportation network between Europe and East Africa. To accommodate this transportation, the airport was significantly expanded to meet the needs of the increased air traffic (Caelen, 2017). Kotoka International Airport has since become the only international airport in Ghana, and is fast becoming the regional hub for air travel in West Africa (Awoniyi, 2016). Passenger numbers have been on the rise since 2001 thanks to Ghana's increasing profile as a preferred business hub and tourist destination.

In the years following WWII the population of Accra expanded rapidly. This increase was due to both in-migration of rural people into the city, and the immigration of increasing numbers of European businessmen and administrators. As a result the Ridge and Cantonments were

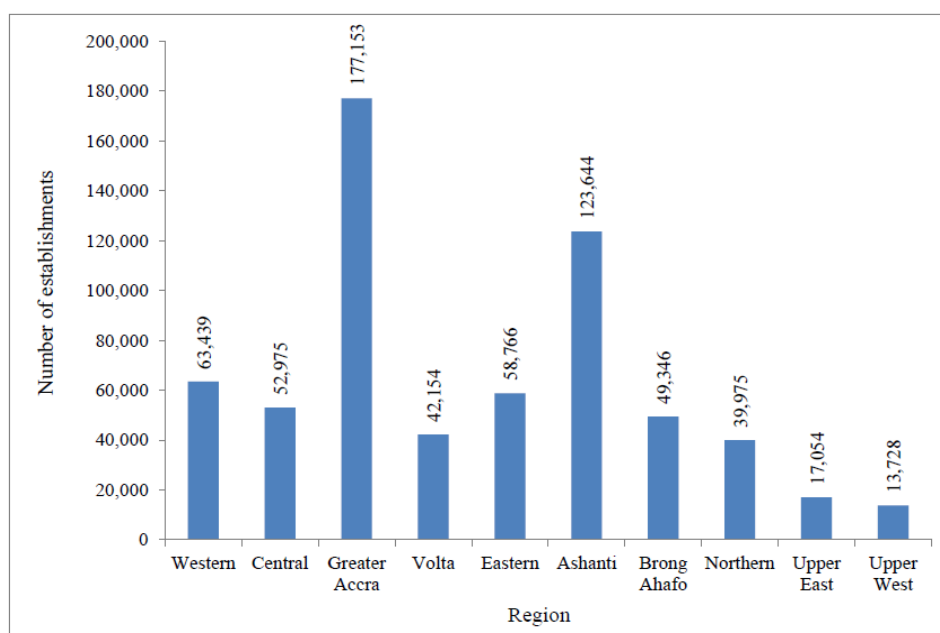
planned as low-density developments for Europeans, while many of the rural migrants settled in neighbourhoods such as Nima and Accra New Town that had not yet been incorporated into Accra's municipal boundary. Another area in Accra that took shape during the post-WWII era was the CBD. More administrative buildings were built on High Street, including a massive judicial/administrative complex. In addition more commercial buildings were built in the CBD (Macalester, 2016).

Central Accra is compact, centred on the historical British, Danish, and Dutch forts. Over the years, however, with immigration from rural areas, the city has expanded with no regard to zoning, giving it a sprawled attribute. The city of Accra is the anchor city of the Greater Accra Metropolitan Area (GAMA), which is made up of the Accra Metropolitan District, Tema Metropolitan District, Ga South District, Ga East District, Ga West District, Adenta District, Ashaiman District and Ledzokuku-Krowor District,. Modern Accra does suffer the perennial problems of traffic congestions, housing shortages, and pollutions that plague other African capitals such as Lagos or Nairobi. However, it remains relatively affluent and stable (Caelen, 2016).

8.2.5 Spatial Distribution of Economic Activities

The graph below indicates the distribution of business establishments in Ghana per region. It can be seen that GAR houses the largest proportion of business establishments (27.8%) within Ghana.

Graph 8.5: Distribution of Business Establishments per Region



Source: Ghana Statistical Services, 2015

Due to its favourability for FDI Accra is the premier destination for business development within Ghana. The GAMA houses numerous head offices for multi-national companies, as well as national enterprises. The Region also boasts the most modern and largest shopping malls.

Formal business is largely concentrated in the Accra CBD and around the Kotoka International Airport precinct. Office and associated administrative functions (i.e. service sector based activities) have historically established in the CBD with pull factors evident in the current spatial fabric as the emerging airport precinct is proving to serve as a powerful magnet. The retail environment reveals a similar spatial configuration with older, street front retail in and around the CBD and new mall development having established in the airport precinct during 2012.

Industrial activity is centred on the Tema Port. The Free Zone is situated due west of the Port.

A major tertiary precinct is situated approximately 5km north of the Accra CBD along the N4.

Agricultural activity is mainly located towards the periphery of the Region, although smaller patches of activity are encountered in the vicinity of the Volta Lake.

Informal activity is relatively well integrated with the residential fabric and in the three main markets, respectively Kantamanto market, Mokola market and Kaneshie market.

The formal retail environment is still relatively under-developed and it is interesting to note the weak correlation between formal and informal retail. Given experiences elsewhere in Africa, this correlation can be expected to become increasingly pronounced over time.

8.3 Economic Focus Areas

8.3.1 Challenges faced by the economy

According to the Economist Intelligence Unit (2016) both of the main political parties contesting in the December 2016 elections have pledged to undertake ambitious industrialisation projects, spending on which will likely see fiscal consolidation target agreed with the IMF being missed. The risks will however not be big enough to risk donor support.

The new government will face a tight financing situation, with public employment cuts, slow wage growth and privatisation all likely to be on the agenda. Industrial tensions are expected to be fuelled by the oil-related (including hydrocarbons) bump up in economic growth expected in 2017 which is not likely to translate quickly into rising living standards. This is primarily on account of the fact that these industries are extractive in nature (Economist Intelligence Unit, 2016). Impacts can only be optimised through deliberate guidelines that would oblige such extractive companies to actively invest in local economic infrastructure, including:

- Hard infrastructure (utilities, roads, electricity generation, water infrastructure, etc.)
- Soft and social infrastructure (housing, educational facilities, healthcare facilities, etc.).

It would be imperative for future spatial plans to be sufficiently responsive and facilitative in this regard.

After a hydrocarbons-related spike in GDP growth in 2017/2018 growth is expected to ease back to a robust, but not spectacular, 5.4% in 2020 as Ghana is affected by weaker global economic conditions and election-related uncertainty. A threat to the growth picture is the maritime border dispute with Côte d'Ivoire. If the arbitration process should rule in the favour of Côte d'Ivoire the contribution of the TEN oil productions will be lost to the Ghana economy (Economist Intelligence Unit, 2016).

In the view of the aforementioned challenges the task will fall to the government to maintain sustained levels of FDI within the country. This has specific implications for the GAR as it is the main recipient of FDI within Ghana. The Region contains high-value coastal real estate, the main port, an international airport, the seat of national government and an emerging modern, mixed-use node around the airport.

A backlog in bulk infrastructure has, and continues to hinder economic growth expansion within the Region. GAR authorities face immense backlogs in most bulk services which have been to the detriment of economic development within the Region.

The economy of the GAR is primarily vested in the services sector with the manufacturing and industrial sectors lagging behind. Research is needed into value chain analyses, industrial cluster developments, and economic growth and development strategies in order to diversify the Regional economy. Such analyses will guide and inform appropriate sectoral interventions and stimuli. This could ensure sustained, effective and facilitative economic interventions which could improve the viability and sustainability of the regional economy.

A further challenge facing the expansion of the GAR economy is optimizing port based industrialization.

Implementing the principles and concepts of airport economics, which some may refer to as the aerotropolis concept, should be centred on facilitating appropriate high-tech industrialization in the vicinity of the airport.

The Spatial Development Framework should be leveraged to promote mixed-use nodal development. Real estate development and investment are often underestimated as economic development instruments.

Closely correlated with the above, traditional/chieftan systems have been found to be inhibitors of economic growth and tax base expansion. In order to optimize the potential benefits associated with real-estate development, the land tenure, valuation and taxation system should ideally be revised. Revenue base expansion will be a critical requirement to fund sustained infrastructure investment.

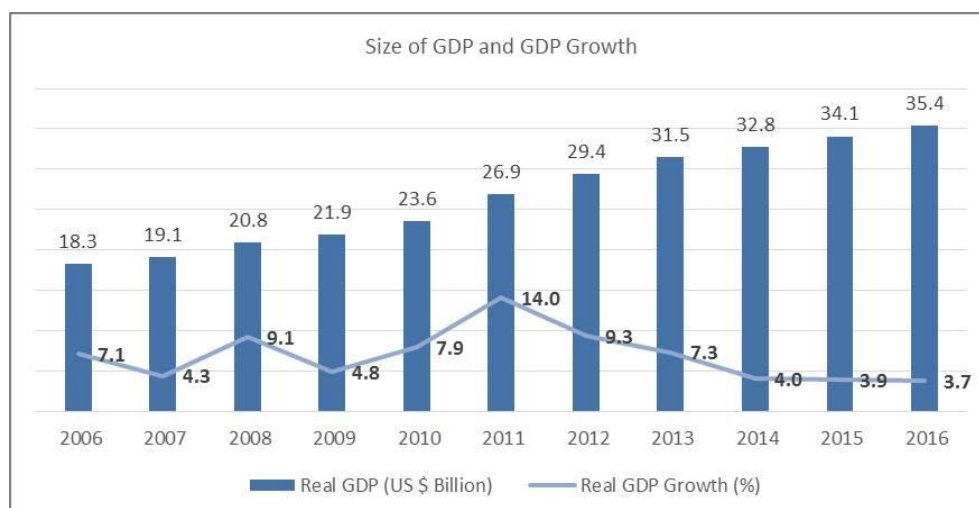
In view of the poor performance of the continental economic leader, South Africa, there is a unique window of opportunity emerging for other African countries to capitalize on attracting foreign investors. Over and above sound economic considerations, the key requisites, however, remain stable governance, policy certainty (including planning legislation and policies), sophisticated economic and financial systems and leadership integrity.

Sustained high rates of in-migration into the Region create challenges and opportunities. An appropriate spatial planning response is required.

8.3.2 Growth Potential

The graph below indicates the GDP growth for Ghana between 2006 and 2016. The average GDP growth was 6.9% over the long term (2000-2016), while average short term (2010-2015) GDP growth was 7.0%.

Graph 8.6: GDP Size and Growth in Ghana, 2006-2016



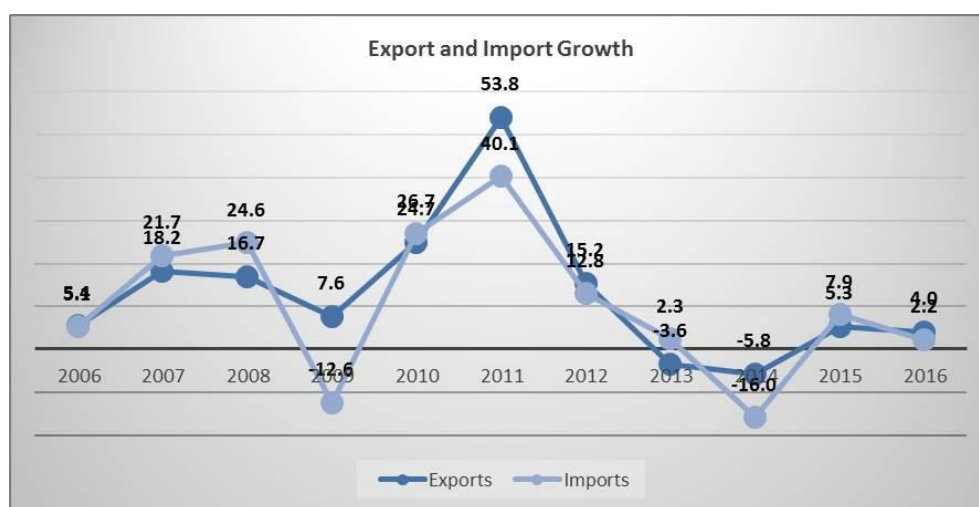
Source: Demacon ex Economic Intelligence Unit, 2016

According to the Economic Intelligence Unit (2016:9) real national GDP growth prospects are favourable for 2017/2018, boosted by the onset of new oil and gas production. The first oil from the Tweneboa-Enyenra-Ntomme (TEN) oilfields came on-stream in August 2016. The main impact, however, will be felt as production reaches capacity in 2017. Gas production from the Sonkofa fields will commence in 2018. Adding to this new growth, production from Ghana's first oilfield, Jubilee, will recover after a series of technical problems in 2016. Operational costs in oil production in Ghana are low so it is insulated from global price trends to some extent, while strong demand domestically for gas as a feedstock to power station will support gas production. A threat to the growth picture is the maritime border dispute with Côte d'Ivoire. If the arbitration process were to come down in favour of Côte d'Ivoire – considered unlikely – the contribution of TEN productions to Ghana's growth will be eliminated altogether.

Improving electricity generation will support growth as government belatedly gets to grips with boosting supply after years of severe shortages. Tariff increases will encourage investment in power generation.

The following graph indicates the annual growth in exports and imports of goods and services within Ghana between 2006 and 2016. Long term growth (2006-2016) in exports (12.9%) eclipses that of imports (10.4%). The short term growth (2011-2016) of exports (12.9%) is also higher than that of imports (11.5%). This is indicative of the growth potential within the GAR as the region houses the majority of Ghana's industries and export hubs.

Graph 8.7: Growth in Exports and Imports in Ghana, 2006-2016



Source: Demacon ex Economic Intelligence Unit, 2016

Export revenue is expected to increase strongly in 2017/2018 as oil production at TEN increases and gold prices partly recover from the 2015 dip. Cocoa prices will remain strong. Export revenue growth is expected to slow in 2019 amid weaker global conditions, although those conditions will support gold prices, before an expected better performance in 2020/2021 (Economist Intelligence Unit, 2016).

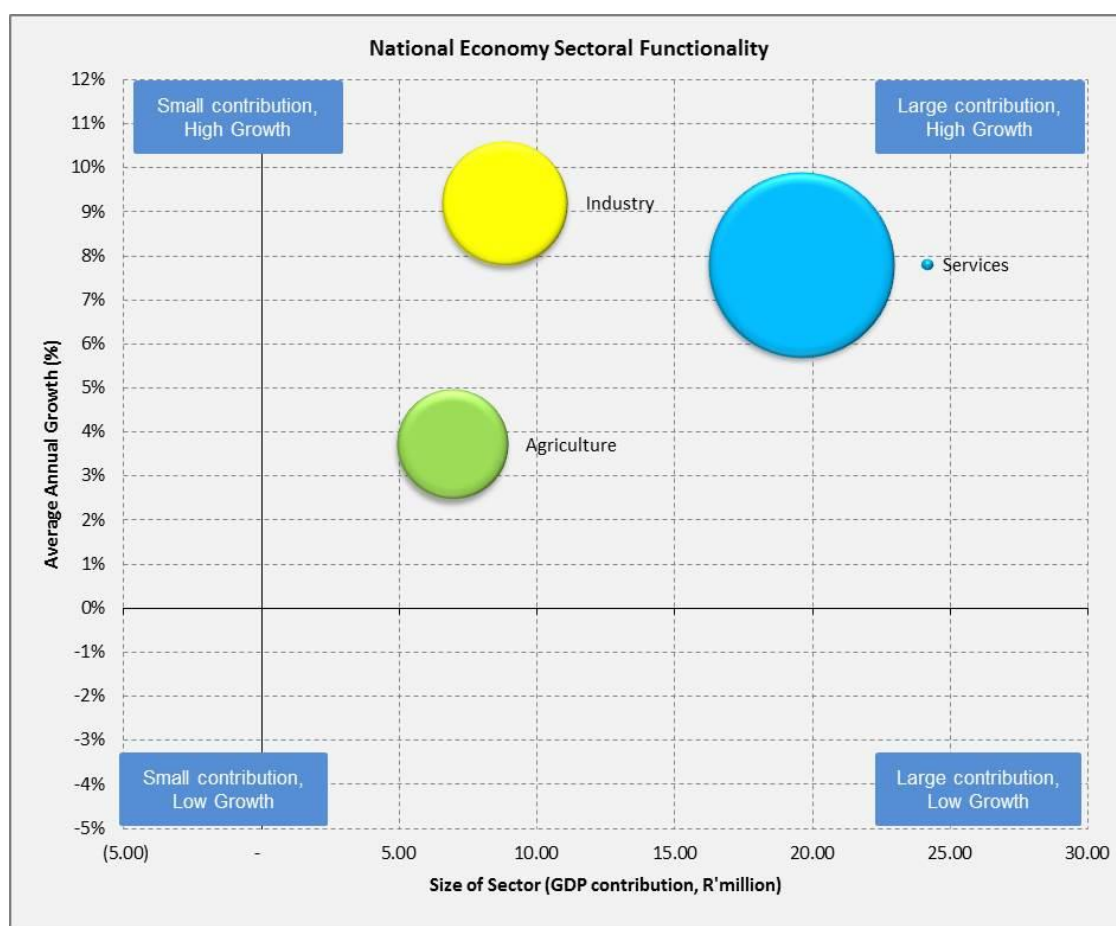
Port differentiation specialisation can be observed: Whereas the port at Secondi-Takoradi handles bulk and break bulk, the port at Tema is primarily responsible for containerized goods. The port at Secondi-Takoradi is larger on account of volume considerations. The port at Tema is smaller as it is designed to accommodate relatively higher value added goods compared with Takoradi. Similarly no disaggregated import/export data is available. Based on observation it would appear that Secondi-Takoradi serves the purpose of export harbour and Tema predominantly fulfils the role of import harbour. The absence of container terminal at Takoradi precludes this harbour city from developing value added industries. Tema, however is ideally positioned to attract value adding industrial and associated enterprises. Considering that most commodities enter and exit Ghana through these two port cities it would be fair to assume that import/export statistics reflect directly on these two cities. Export growth averages 12.9%, by inference this reflects more on Takoradi. Similarly, import growth fluctuates from 10-11% and, on account of port functionality, reflects more

closely on the performance of Tema port. These growth dynamics hold spatial growth and planning implications.

The chart that follows indicates the shift share between the agricultural, industrial and services sectors in Ghana. The services sector is the largest contributor (55.4%) to the national GDP and also boasts the second largest growth rate per annum (7.8%).

The shift share analysis reflects the significance of the services sector. The industrial sector is proportionately smaller and, compared with agriculture, has not yet developed to its full potential. In the context of the economic needs of a metropolitan region attracting future industrial development to the area should be a priority. Seaport access as well as the presence of an international airport both count in favour of further industrial development and expansion.

Chart 8.2: Shift share of Sectors in Ghana



Source: Demacon ex Economic Intelligence Unit, 2016

The economic data for Ghana is relatively coarse. The coarseness of data does not support detailed sub-sectoral analyses, neither is it particularly supportive of advanced analysis.

The current spatial response to economic growth is informal, organic and unstructured. By planning a formal, structured spatial response to economic growth many of the spatial challenges could be mitigated.

The current sectoral and geographic distribution of economic activity in GAR suggests the major future economic drivers would be service sector based activities, coupled with industrial development. In as far as service sector based activities are concerned future growth and investments can be expected in:

- Trade: Including retail, automotive trade, informal markets.
- Office development: A-grade offices around destination retail centres. Typical office tenants would include banking institutions, finance houses, insurance establishments, telecoms and enterprises involved in the Free Zone, which would typically include beneficiation of raw materials, commodities trade, electronics and associated service industries.
- Tourism: Business and leisure tourism will continue to derive benefit from growth in the services and manufacturing sectors. Hotel development in the vicinity of the airport precinct and towards the Free Zone can be expected to reveal a strong drive, whereas hotel development geared towards leisure tourism can be expected to manifest in some of the more appealing coastal and forestry areas as well as along Lake Volta and Volta River.
- Industry: Agro-processing industries, minerals beneficiation, pharmaceuticals, etc.
- Housing: In response to economic growth and development as well as refurbishment of existing precincts.

The future spatial plan should anticipate the future space needs and most appropriate, market-based positioning of these activities.

8.4 Main Findings – Economic Environment

The main findings of the economic environment follow.



ECONOMIC ENVIRONMENT FINDINGS

- The Greater Accra Region is the administrative, economic and industrial hub of Ghana.
- The services sector constitutes the largest contributor (55.4% in 2016) to the national GDP and has recorded the highest growth (6.3% per annum) in recent years.
- The average national GDP growth was 6.9% over the long term (2000-2016). The short term (2010-2015) GDP growth is 7.0%. The Accra City Region currently contributes approximately 25% to the Ghana national economy. The GAR as main metropolitan hub in Ghana fuels national growth and should therefore record growth well above the national average. Anecdotal evidence would suggest that the GAR is expanding at a rate of above 7% per annum, and in certain instances where large-scale capital investment occurred, as high as 10-13% per annum.
- In the Greater Accra Region the services sector is the single largest employer of people (71.8% of the total labour force).
- The majority of the Region's population (74%) is employed in the private informal sector. Only 17% of the population is employed in the private formal sector.
- Long term growth (2006-2016) in exports (12.9%) eclipses that of imports (10.4%). The short term growth (2011-2016) of exports (12.9%) is also higher than that of imports (11.5%).
- Port differentiation specialisation can be observed: Whereas the port at Sekondi-Takoradi handles bulk and break bulk the port at Tema is primarily responsible for containerized goods. Based on observation it would appear that Takoradi serves the purpose of export harbour and Tema predominantly fulfils the role of import harbour. Tema port is ideally positioned to attract value adding industrial and associated enterprises. Considering that most commodities enter and exit Ghana through these two port cities it would be fair to assume that import/export statistics reflect directly on these two cities. Export growth averages 12.9%, by inference this reflects more on Takoradi.

Similarly, import growth fluctuates from 10-11% and, on account of port functionality, reflects more closely on the performance of Tema port. Accra has been ranked the second most attractive destination for FDI in Africa. FDI in the services sector has manifested in the form of inter alia numerous shopping centre developments in GAR.

- The bulk of informal sector activity is interspersed with the urban fabric and more specifically in residential areas.
- Formal business is largely concentrated in the Accra CBD and around the Kotoka International Airport precinct.
- Industrial activity is centred around Tema Port and the associated Free Zone as well as the north industrial area and the Tema/Accra motorway.
- The current sectoral and geographic distribution of economic activity in GAR suggests the major future economic drivers would be service sector based activities, coupled with industrial development.
- In as far as service sector based activities are concerned future growth and investment can be expected in trade, office development, tourism, industry and housing.

9 *Institutional Environment*

The Republic of Ghana has, since gaining independence in 1957, focused on developing an institutional structure that will assist in the country's growth and development. This focus informed the governance structure of the Ghanaian State as set out in the 1992 Constitution. The constitution outlines how the various individuals and public bodies fit together and it separates the state into three branches, the Executive, the Legislature and the Judiciary.

The Constitution puts emphasis on the delegation of power away from central government into the hands of local authorities. To give effect to the delegation of power, the Constitution prescribes that Ghana shall have a local government system. Therefore, the state is divided into ten administrative regions headed by Regional Ministers.

The ten regions and their regional capitals are:

- Greater Accra Region (Accra),
- Eastern Region (Koforidua),
- Central Region (Cape Coast),
- Western Region (Sekondi-Takoradi),
- Volta Region (Ho),
- Ashanti Region (Kumasi),
- Brong-Ahafo Region (Sunyani),
- Northern Region (Tamale),
- Upper East Region (Bolgatanga), and
- Upper West Region (Wa).

Each region has District Assemblies responsible for the effective development of the Region. The purpose of the District Assemblies is to ensure people are more in control over their own affairs and therefore no part of the country would be neglected. (LaVerle Berry, 1994).

The figure below provides an overview of the organisational structure of Ghana based on the aforementioned.

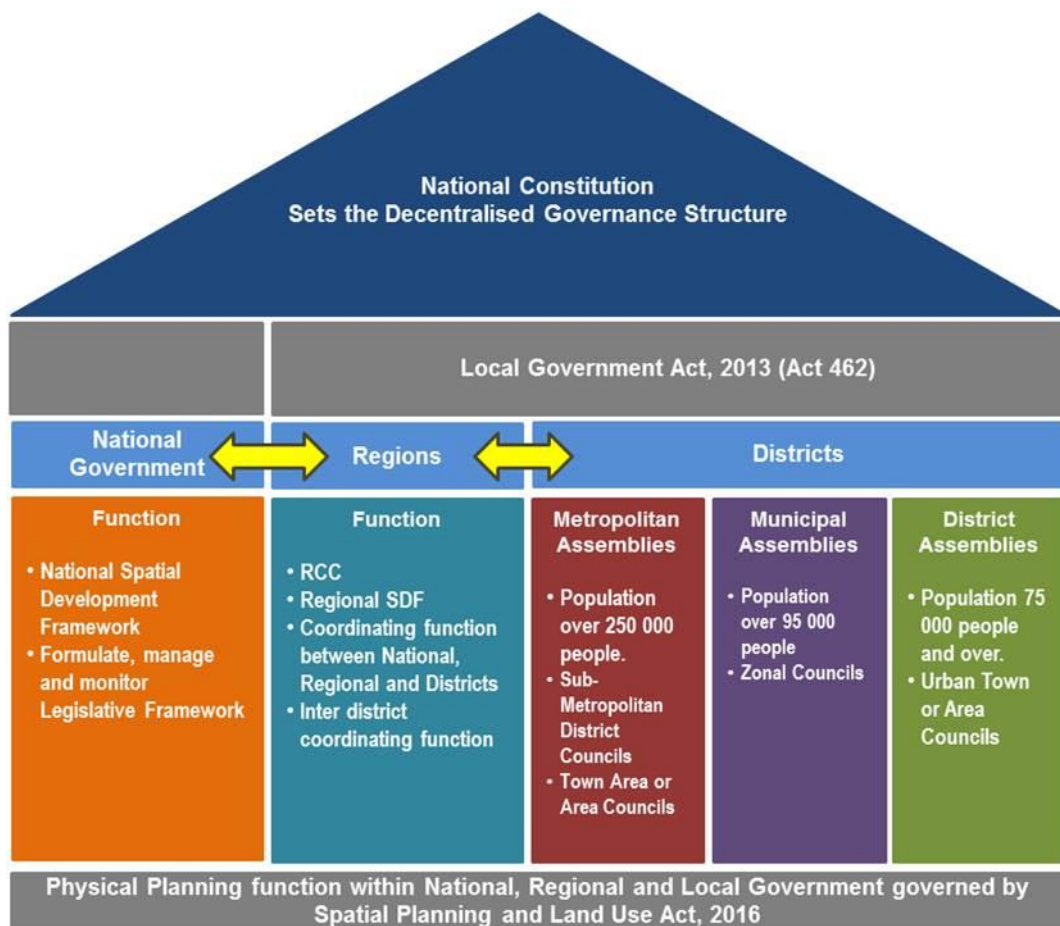


Figure 9.1: Ghana's Institutional Framework

9.1 Organisational structure of Local Government

The Local Government Act, 1993 (Act 462) was enacted to establish and regulate the local government system in accordance with the Constitution. This act deals with the establishment and functions of the Regions and District Assemblies.

A District Assembly is the highest political and administrative authority in each region and is responsible for:

- Formulating and executing plans, programmes and strategies for the effective development of the region;
- Creating town or area councils and unit committees; and
- Providing guidance, giving direction to, and supervising the other administrative authorities in the district.

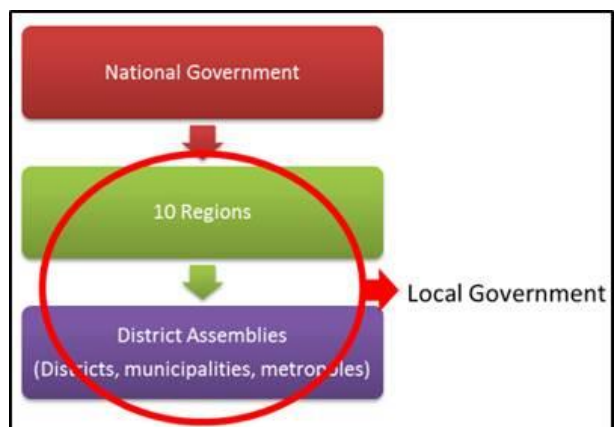


Figure 9.2: Composition of a Local Government

There are three kinds of District Assemblies, viz. districts, municipalities and metropolises, refer to the accompanying figure. The composition, powers and duties of the different types of District Assemblies are prescribed in the Local Government Act of 1993. The Greater Accra Region consist of 16 districts, 2 Metropolitan, 9 Municipal Assemblies and 5 District Assemblies.

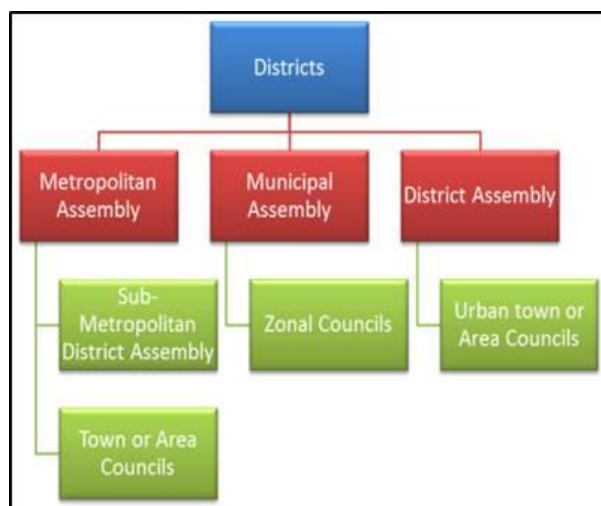


Figure 9.3: Composition of a District Assembly

The figure that follows provides a typical example of an organogram for a Metropolitan / Municipal or District Assembly. It would suggest a sound institutional framework for the district to manage and control the area. Such a governing structure is needed to implement projects, manage growth and control land use.

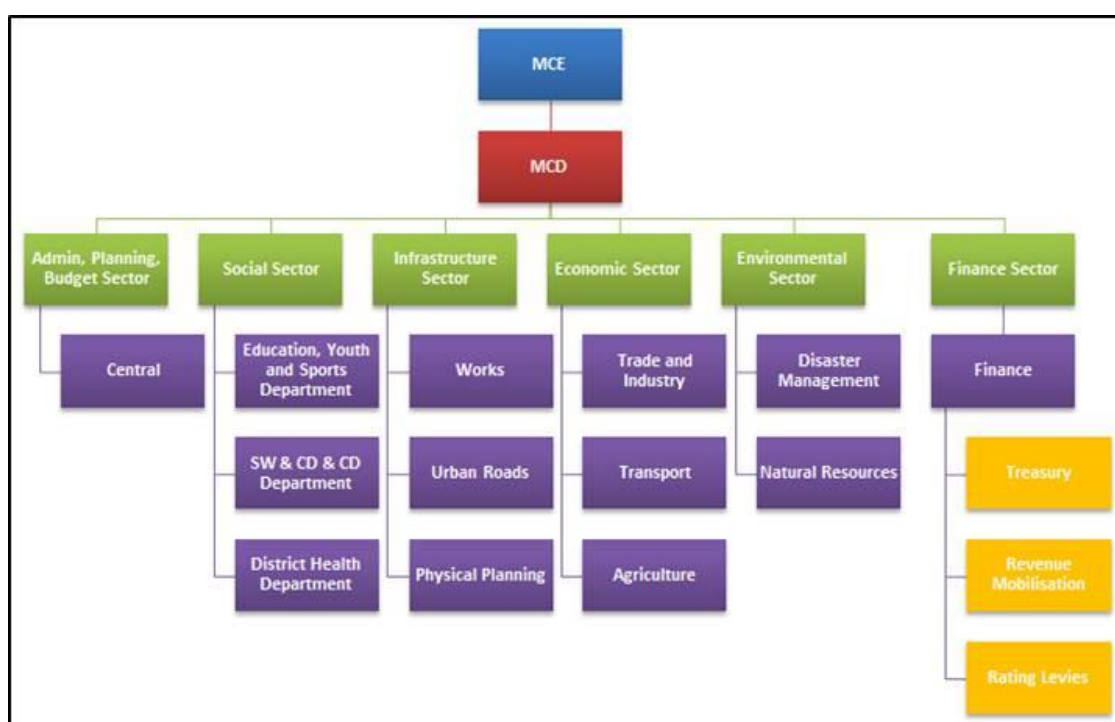


Figure 9.4: Example of a District Assembly Organogram

To assist and support the District Assemblies a Regional Coordinating Committee (RCC) was established within each region. The purpose of the RCC is to formulate and coordinate programmes through consultation with the assemblies located within the region. The RCC is responsible for harmonising its programmes with national development policies and priorities, and for mentoring, implementing and evaluating programmes and projects within the region.

According to the said act, a District Assembly shall be responsible for:

- (a) The overall development of the district and shall ensure the preparation and submission through the regional co-ordinating council
 - (i) of development plans of the district to the National Development Planning Commission for approval, and*
 - (ii) of the budget of the district related to the approved plans to the Minister responsible for Finance for approval.**
- (b) The formulation and executing plans, programmes and strategies for the effective mobilisation of the resources necessary for the overall development of the district;*
- (c) Promoting and supporting productive activity and social development in the district and remove any obstacles to initiative and development;*
- (d) Initiating programmes for the development of basic infrastructure and provide municipal works and services in the district;*
- (e) Development, improvement and management of human settlements and the environment in the district;*
- (f) The maintenance of security and public safety in the district (in co-operation with the appropriate national and local security agencies);*
- (g) Ensuring ready access to Courts in the district for the promotion of justice;*
- (h) Initiating, sponsor or carry out studies that are necessary for the performance of a function conferred by this Act or by any other enactment; and*
- (i) Performing any other functions provided for under any other enactment.*
- (j) Taking the steps and measures that are necessary and expedient to:*
 - (i) execute approved development plans for the district;*
 - (ii) guide, encourage and support sub-district local government bodies, public agencies and local communities to discharge their roles in the execution of approved development plans;*
 - (iii) initiate and encourage joint participation with any other persons or bodies to execute approved development plans;*
 - (iv) promote or encourage other persons or bodies to undertake projects under approved development plans; and*
 - (v) monitor the execution of projects under approved development plans and assess and evaluate their impact on the people's development, the local, district and national economy.*
- (k) Co-ordinating, integrating and harmonising the execution of programmes and projects under approved development plans for the district, any and other development programmes promoted or carried out by Ministries, departments, public corporations and any other statutory bodies and non-governmental organisations in the district.*

9.2 Land Use and Spatial Planning Act 2016, Act 925

The Land Use and Spatial Planning Act 2016, Act 925 was passed by government on 14 September 2016. This law revised and consolidated the laws on land use and spatial planning and propose the creation of a Land Use and Spatial Planning Authority (National level), Regional Spatial Planning Committees and District Spatial Planning Committees within each region. It stipulates the role and function of the aforementioned committees on all matters related to physical planning in Ghana such as the development of land, preparation of spatial frameworks, and integration of plans and policies between national, regional and district government.

Broadly, the functions of each of the three levels (National, Regional and District) according to this act are as follows:

9.2.1 Land Use and Spatial Planning Authority (National)

- Provide for sustainable development of land and human settlements through a decentralised planning system.
- Ensure judicious use of land.
- Enhance the attainment of Ghana's decentralisation programme and in particular create an enabling environment for District Assemblies to better perform the spatial planning and human settlements management functions.

9.2.2 Regional Spatial Planning Authority

- Develop a regional spatial development framework for the region in consultation with the district assemblies as part of the spatial development component of the Regional Integrated Plan.
- Adjudicate on appeals or complaints resulting from decisions, actions or inactions of the District Spatial Planning Committee of District Assemblies.
- Where required, prepare sub-regional or multi-district spatial development frameworks for two or more districts within the region.

9.2.3 District Spatial Planning Committee:

- Ensure physical development is carried out in the District.
- Ensure that the preparation of the District Spatial Development Framework is in accordance with the Act.
- Ensure that the preparation of the structure plan and local plan in the district is in accordance with the Land Use and Spatial Planning Act 2016, Act 925.
- Deliberate on and approve the recommendations of the Technical Sub-Committee where necessary.
- Consider and approve applications for permit.

9.3 National Land Policy ²

The Land Policy of Ghana aims *“at the judicious use of the nation's land and all its natural resources by all sections of the Ghanaian society in support of various socio-economic activities undertaken in accordance with sustainable resource management principles and in maintaining viable ecosystems.”*

The objectives of the National Land Policy *inter alia* are:

- Ensure that every socio-economic activity is consistent with sound land use through sustainable land use planning in the long-term national interest.
- Protect the rights of landowners and their descendants from becoming landless or tenants on their own lands.
- Instil order and discipline into the land market to curb the incidence of land encroachment, unapproved development schemes, multiple or illegal land sales, land speculation and other forms of land racketeering.
- Minimise, and eliminate, where possible, the sources of protracted land boundary disputes, conflicts and litigations in order to bring their associated economic costs and socio-political upheavals under control.
- Create and maintain effective institutional capacity and capability at the national, regional, district, and where appropriate, community levels for land service delivery.
- Promote community participation and public awareness at all levels in sustainable land management and development practices to ensure the highest and best use of land, and thereby guarantee optimum returns on land.
- Promote research into all aspects of land ownership, tenure and the operations of the land market and the land development process.
- Ensure continuous education of the general public on land matters.

For the purpose of the Greater Accra Region SDF, the relevant sections in the act are sections 4.4 and 5.4. Both sections deal with sustainable use of land and ensuring planned land use.

Section 4.4 of the Act seeks to ensure the sustainable use of land through the protection of natural resources. It also promotes that land development planning for the purpose of human settlement, industry, large scale intensive agriculture or their expansion will have to make adequate provision for:

- “Population density, growth and distribution pattern;
- Settlement location and pattern preference.
- Direction for spatial growth.
- Physical and social infrastructural development or expansion.

² National Land Policy, 1999

- Land and other environmental conservation requirements.
- Provision for persons displaced by such development.”

Source: Ghana National Land Policy, 1999, section 4.4

Section 5.4 of the act seeks to ensure planned land use through the development and implementation of District, Regional and National Land Use Plans and Atlas. This section aims to:

- “Ensure that all lands for settlement, industrial and commercial development are planned and serviced before disposal of any kind.
- Collate land use specifications and projections from major user interests to prepare revised land use maps of the country, and develop and circulate the relevant guidelines.
- Ensure that land sector institutions develop, coordinate and effectively implement management plans or programmes based on categories over which they have administrative responsibility.
- Facilitate timely assessment and approval of planning schemes to make land available for development and approved uses.
- Establish an inter-ministerial technical working group with the Ministry of Lands and Forestry as the lead agency to resolve user conflicts and harmonise land resource use among competing users.”

9.4 National Infrastructure Plan

The draft final National Infrastructure Plan (2013) describes Ghana’s infrastructure as “inadequate, outmoded or in a serious state of disrepair”. Accordingly, the objective of NIP is “to elaborate and concretize infrastructure objectives of the Ghana Shared Growth and Development Agenda (2010-2013) and beyond”. NIP provides a vision and recommendations for investment in six infrastructure sectors: energy; transport; information and communications technology; floods, water and waste management; shelter and human settlements; and social infrastructure. NIP recognises the need for national level spatial coordination of its proposals. The RSDF has addressed all these issues in the baseline assessment providing greater clarity on the status quo.

9.5 Long-Term National Development Plan for Ghana (2018-2057)

Although the RSDF is more aimed at the spatial issues and management thereof, the proposals made embrace the institutional goals as set out in the Long-Term National Development Plan for Ghana 2018-2057, these being:

1. To build an industrialised, inclusive and resilient economy;
2. To create an equitable, healthy and disciplined society;
3. To build safe, well-planned and sustainable communities;
4. To build effective, efficient and dynamic institutions; and

-
5. To strengthen Ghana's role in international affairs.

9.6 Ghana Shared Growth and Development Agenda (GSGDA)³

The purpose of the GSGDA is to provide “a set of policy objectives and strategies to guide the preparation and implementation of medium term development plans; guide the preparation and annual development plans and provides budgets at sector level and serve as a platform for donor coordination.”

In summary, the Medium-Term Policy Interventions relate to the following:

1. Ensuring and Sustaining Macro-economic Stability
2. Enhancing the Competitiveness of Ghana's Private Sector
3. Accelerate Agricultural Transformation and Sustainable Natural Resource Management;
4. Oil and Gas Development
5. Infrastructure and Human Settlement Development
6. Human Development, Productivity and Decent Work
7. Transparent, Responsive and Accountable Governance
8. Facilitating Effective Development Planning
9. Culture and Development
10. Monitoring and Evaluation

For the purpose of this report, the medium-term policies that are to be prioritised and will affect the institutional environment are grouped under Human Settlement Development. The key areas of policy interventions that are focussed on in the medium term are:

1. Spatial/land use planning and management;
2. Urban development and management;
3. Rural development and management;
4. Institutional Arrangement for Implementing Human Settlements Development

The table below is a summary of the above-mentioned key areas indicating priority policy interventions for Human Settlement Development in the medium term. This table is an extract from the Ghana Strategic Growth and Development Act, 2014 – 2017.

³ Ghana Shared Growth and Development Agenda, 2014-2017

Table 9.1: Summary of Medium-Term Policies and Strategies, 2014-2017

Key Focus Areas	Issues	Policy Objectives	Strategies
Spatial/Land Use Planning and Management	Absence of a Human Settlements Policy to guide the comprehensive growth and development of human settlements.	Promote a sustainable, spatially integrated and orderly development of human settlements.	- Formulate a Human Settlements Policy (including Land Development) to guide settlements development. - Ensure a spatially integrated hierarchy of settlements in support of rapid transformation of the country. - Promote through legislation and public education the use of green technologies in the planning and development of human settlements.
	Ineffective and inefficient spatial/land use planning and implementation particularly in the urban areas.	Streamline spatial and land use planning system.	- Implement relevant planning models, simplified operational procedures and planning standards for land use. - Integrate land use planning into the Medium-Term Development Plans at all levels. - Expand the use of Geographic Information System (GIS) and Global Positioning System (GPS) in spatial/land use planning at all levels.
	Weak enforcement of planning and building regulations.	- Facilitate on-going institutional, technological and legal reforms in support of land use planning - Facilitate on-going institutional, technological. and legal reforms in support of land use planning.	- Accelerate the enactment of coherent legal framework for land use planning. - Adopt new and innovative means of promoting development control and enforcement of the planning and building regulations. - Support research and development in urban and regional planning.
	Inadequate human and institutional capacities for land use planning.	Strengthen the human and institutional capacities for effective land use planning and management.	- Strengthen the institutional capacity to manage human settlements and land use and spatial planning nationwide. - Create Regional Mobile Planning Teams as a stop-gap measure to address critical shortage of professional staff especially at the district level. - Expand the facilities for the training of professionals in land use planning.
Urban Development and Management	- Rapid, uncontrolled and uncoordinated urban growth. - Limited capacity of Government to provide	Promote redistribution of urban population and spatially integrated hierarchy of urban.	- Create and develop new growth points as counter-magnets to fast growing cities especially in the poorer regions. - Facilitate the implementation of the National Urban Policy and Action Plan as well as the Street Naming and Property Address System. - Facilitate the establishment of a hierarchy of urban centres for

Key Focus Areas	Issues	Policy Objectives	Strategies
	social housing units. - Urban security and safety. - Rapid and unplanned peri-urban growth and inner city decline. - Inadequate intermediate cities between key urban settlements and the rural settlements.		specific functions and level of services throughout the country. - Ensure mixed use development and densification policy in urban areas. - Mainstream security and disaster prevention into urban planning and management systems. - Create awareness on the greening of human settlements. - Design a framework for the establishment of a new hierarchy of urban centres. - Promote accelerated growth of medium-sized towns to large urban centres. - Link all district capitals to regional capitals by all-weather roads. - Formulate and implement national, regional and district spatial development framework for implementation. - Facilitate suitable linkages between urban and rural areas.
Rural Development and Management	- High rate of rural-urban migration. - Poor and inadequate rural infrastructure and services. - Limited capacity in the adoption of innovative approaches.	Create an enabling environment to accelerate rural growth and development	- Improve access to social and infrastructure services to meet basic human needs. - Introduce sustainable programmes to attract investment for the growth and development of the rural areas. - Facilitate the proper utilisation of rural and peri-urban lands by improving land use and land management schemes. - Encourage the channelling of royalties into socio-economic and infrastructure development. - Formulate and implement a National Rural Development Policy and Action Plan. - Expand the implementation of the National School Feeding Programme.
Institutional Arrangements for Implementing Human Settlement Development	- Multiplicity of agencies and overlap of roles in human settlements development. - Low collaboration among. - MDAs and institutions with statutory responsibility for human settlements	Establish an institutional framework for effective coordination of human settlements development.	- Establish a land use and spatial planning authority as National Human Settlements Commission to coordinate the activities of all institutions involved in housing development. - Facilitate the passage of the land use and spatial planning bill into law. - Facilitate the passage of planners registration council bill into law. - Promote effective inter-agency collaboration between relevant

Key Focus Areas	Issues	Policy Objectives	Strategies
	development. • Uncoordinated implementation of human settlements development programmes and action plans.		infrastructure service delivery agencies. • Enhance the capacities of institutions for effective planning of human settlements

9.7 Growth Management and Development Control

Development within Ghana is managed at district level, by means of (a) a zoning scheme and structure plans, (b) proving compliance of the existing land use during the sale or lease of a property and (c) establishing a Planning and Development Inspectorate Unit. Each of the aforementioned is discussed in more detail below.

9.7.1 Managing Growth by Zoning Schemes and Structure Plans

The zoning scheme and structure plan are prepared in terms of the Land Use and Spatial Planning Act 2016, Act 925. “The minimum requirements to be addressed in a zoning scheme according to the said act are:

- Use of land;
- Land coverage of construction of a plot;
- Structure of the building;
- Size of building;
- Height of building;
- Orientation of building;
- Accessibility;
- Waste disposal;
- Drainage system;
- Public utilities; and
- Floor area ration”

(Source: Land Use and Spatial Planning Act 2016, Act 925: 84 (1))

The act allows for land to be rezoned or subdivided. If approved, the applicant will receive a “Land Use Certificate”, which shall be accompanied by an application for the registration of title.

9.7.2 Managing Development during Disposal or Letting of Property

The Land Use and Spatial Planning Act 2016, Act 925 indicates “a person shall not dispose of or otherwise let land or property for any purpose unless that person can demonstrate to the prospective buyer or tenant that the land or property has been zoned or rezoned for the purpose for which it is being let, acquired or otherwise disposed of.” *(Source: Land Use and Spatial Planning Act 2016, Act 925: 96 (1)).*

9.7.3 Planning and Development Inspectorate Unit

The Act recommends that a Planning and Development Inspectorate (PDI) Unit be established. The purpose of the unit is to monitor physical planning development to ensure

compliance with the approved permits. *“In carrying out the enforcement procedures, a District Assembly may issue:*

- *Enforcement notices;*
- *Stop notices;*
- *Orders for discontinuance;*
- *Revocation of permits;*
- *Certificate of approved land use; and*
- *Certificate of habitation”*

(Land Use and Spatial Planning Act 2016, Act 925: 160)

From the aforementioned sections it is evident that the following legalisation provides the background to the institutional structure of Ghana:

- Constitution: it informs the basic governance structure of Ghana.
- Local Government Act, 1993 (Act 462): it establishes and regulates the local government system in accordance with the Constitution; and
- Land Use and Spatial Planning Act 2016, Act 925: it regulates national, regional, district and local spatial planning and generally provides for spatial aspects of socio-economic development.

Clearly the institutional structure for Ghana is well established. However, district representatives at the November 2016 workshop indicated that the Regional and District Assemblies do not have adequate administrative capacity (manpower) to enforce land use regulations and to manage growth. As the GAR grows so too must the capacity / manpower of the institution that governs it. These elements are directly related. In this context the lack of capacity will affect the ability of government to extend essential services, and the poor are often those most affected by this (Turok & Parnell, 2009:172).

9.8 Main Findings – Institutional Environment

The main findings of the institutional environment follow.



INSTITUTIONAL ENVIRONMENT FINDINGS

- There is a good institutional framework in place.

-
- However, institutional capacity needs to be improved.
 - Strong regional leadership is required.
 - Service delivery, across the board and across the various government responsibilities at a regional level is of paramount importance.

10 REFERENCES

10.1 Natural Environment

(a) Documents / Books

1. Accra Metropolitan Municipality, Medium Term Development Plan, 2014-2017.
2. Acorn, 2015. Independent Study of Marine Environmental Conditions in Ghana.
3. Ada West District Municipality, Medium Term Development Plan, 2014-2017.
4. Adank, M.; Darteh, B.; Moriarty, P.; Osei-Tutu, H.; Assan, D.; and van Rooijen, D. 2011. Towards integrated urban water management in the Greater Accra Metropolitan Area. Current status and strategic directions for the future. SWITCH/RCN Ghana, Accra, Ghana.
5. Addy and Addo, 2013: Effect of predicted sea level rise on tourism facilities along Ghana's Accra coast, *Journal of Coastal Conservancy*, 17:155-166
6. Adjei, R.S., 2010: Effects of action aid Ghana land reclamation programme on food production in the Ga west municipality of the Greater Accra Region, Ghana.
7. Aduku, J.M., and Awaah, F., n.d: Small-scale stone quarrying: It's contribution to people's livelihoods. A case study of Ga east municipal assembly.
8. Amoako, C. and Frimpong Boamah, E. 2014. The three-dimensional causes of flooding in Accra. *Ghana International Journal of Urban Sustainable Development* (December).
9. Amponsah, P. E., 2004: Seismic activity in Ghana: past, present and future. *Annals of Geophysics*, 47 (2/3), 539- 543.
10. Amponsah, P.E., Banoeng-Yakubo, B.K., Panza, G.F., and Vaccari, F., 2009. Deterministic seismic ground motion modelling of the Greater Accra Metropolitan Area, southeastern Ghana. *South African Journal of Geology*, 112, 317-328.
11. ARUP, 2016: Ghana Metropolitan Cities , Cities Alliance and the UK Department for International Development (DFID).
12. Asumadu-Sarkodie, S., Owusu, P.B., and Rufangura, P., 2015: Impacts of Flood in Accra, Ghana, *Advanced Applied Science Research*, 6(9), 53-78.
13. Choudhary, V. and D'Alessandro, S. 2015. Ghana: Agricultural sector risk assessment. Risk Prioritization. Agriculture global practice technical assistance paper. World Bank Group Report Number 94288-GH. June.
14. Dawood, A.M.A, Akiti, T.T., and Glover, E.T., 2012: Seismic Refraction Investigation at a Radioactive Waste Disposal Site, *Geosciences*, 2(2), 7-13.
15. Environmental Protection Agency, 2000: Ghana's Initial National Communication.
16. Environmental Protection Agency, 2002: National Programme to Combat Drought and Desertification, Accra-Ghana.
17. Environmental Protection Agency, 2006. Managing Wetlands in Accra, Ghana. African Regional Workshop Cities, Ecosystems and Biodiversity Nairobi, 21 September 2006.

-
18. Environmental Protection Agency, 2011a. Ghana Strategic Investment Framework (GSIF) For Sustainable Land Management (SLM). Republic Of Ghana Ministry Of Environment, Science and Technology (June), Pp.2011–2025.
 19. Environmental Protection Agency. 2011b. Ghana’s Second National Communication to the UNFCCC. September.
 20. Ghana Statistical Services. 2013. 2010 Regional Population & Housing Sensus. Regional Analytical Report, Greater Accra Region. June. Editors: Bentsi-Enchill Nii.
 21. GFDRR. 2011. See Global Facility for Disaster Reduction and Recovery.
 22. Global Facility for Disaster Reduction and Recovery (GFDRR), 2011: Vulnerability, Risk Reduction and Adaptation to Climate Change, Ghana, Climate Investment Funds.
 23. Government of Ghana. Town and Country Planning Department. 2015. Ghana National Spatial Development Framework (2015-2035). 2015, February.
 24. Khatri, K., van der Steen, P., and Vairavamooth, K., 2007: Climate Change: Accra-Ghana, Briefing note, UNESCO.
 25. Kondra, M. 2016. The status of the wetlands in the Greater Accra Region. WaterPower Working Paper, No. 9. Governance and Sustainability Lab. Trier University. Trier.
 26. Kpone-Katamanso District Assembly, Medium Term Development Plan, 2014.
 27. Ministry of Environment Science and Technology, 2012. National Assessment Report on Achievement of Sustainable Development Goals And Targets For Rio+20 Conference (March). Accra.
 28. Ministry of Lands and Natural Resources, 2012. Ghana Forest and Wildlife Policy. Accra, Ghana.
 29. Ministry of Environment, Science, Technology and Innovation, 2013. National Climate Change Policy. Accra, Ghana.
 30. National Development and Planning Commission and United Nations Development Programme (Ghana), 2012. Achieving the MDGs with Equity in Ghana: Unmasking the Issues behind the Averages. Technical Paper.
 31. Nkurumah, F., Klutse, N.A.B., Adukpo, D.C., Owusu, K., Quagraine, K.A., Owusu, A., and Gutowski, W., 2014: Rainfall Variability over Ghana: Model versus Rain Gauge Observation, International Journal of Geosciences, 5, 673-683.
 32. Obuobie, E.; Agyekum, W.; Appiah-Adjei, E.K.; Upton, K.; and Ó Dochartaigh, B.É 2016. Africa Groundwater Atlas: Hydrogeology of Ghana. British Geological Survey. Date of Access: 16 January 2017. Online: http://earthwise.bgs.ac.uk/index.php/Hydrogeology_of_Ghana
 33. Odoi Danquah, I., 2013: Climate Change and its impacts on flooding in Accra-Greater Accra Metropolitan Assembly, Department of Civil Engineering, Colleague of Engineering.
 34. Omlalo, D.S., and Oppong-Boadi, K.Y., 2015: Ghana’s Third National Communication Report to the UNFCCC, Environmental Protection Agency and Ministry of Environment, Science, Technology and Innovation, Accra.

-
35. Peprah, K., 2013: Sand winning and land degradation: Perspective of Indigenous sand winners of Wa, Ghana. *Journal of Environmental and Earth Science*, 3(14), 185-194.
 36. Povlsen, E. & Dahl, S.Ø., 2004a. Environmental Sensitivity Map for Coastal Areas of Ghana Volume II – Coastal Environment (October).
 37. Povlsen, E. & Dahl, S.Ø., 2004b. Environmental Sensitivity Map for Coastal Areas of Ghana Volume III - Oil Spill Sensitivity Ranking Prepared for Environmental Protection Agency , Ghana Environmental Sensitivity Map for Coastal Areas of Ghana Volume III - Oil Spill Sensitivity Ranking. , III (October).
 38. Town and Country Planning Department **see** Government of Ghana. Town and Country Planning Department.
 39. UICN/PACO, 2010. Parks and reserves of Ghana: Management Effectiveness Assessment of Protected Areas.
 40. UNEP, 2011. National Environmental Summary – Ghana (January).
 41. USAID, 2012: Climate Change Adaptation in Ghana.
 42. USAID, 2013: Climate Change and Conflict in West African Countries, Findings from Lagos, Nigeria and Ghana, Accra, United States Agency for International Development.
 43. World Bank, 1998. Findings – Africa Region (Number 113). Integrated Coastal Zone Management Strategy for Ghana.

(b) Internet Sources

1. Birdlife International. <http://datazone.birdlife.org/country/ghana/species>. Accessed November 2016.
2. Climate-data.org. 2012. Climate: Greater Accra Region. Online: <https://en.climate-data.org/region/1331/>. Accessed: 6 June 2017.
3. Emergency Events Database (EMDAT), 2016: http://www.emdat.be/country_profile/index.html Accessed November 2016.
4. Environmental Protection Agency, Ghana. 2016. <http://www.epa.gov.gh/epa/projects/mab>. Accessed November 2016.
5. Ghana Hydro-database. 2014. Greater Accra Region Climate. Online: <https://www.ghanahydrodata.com/time.php?mid=12>. Accessed: 6 June 2017.
6. Ghana Meteorological Agency. 2016. Weather information for Accra. http://www.meteo.gov.gh/website/index.php?option=com_content&view=article&id=65:weather-information-for-accra&catid=38:weather-information&Itemid=54 Accessed: November 2016
7. Hotfmonlinegh. 2015. Annual floods in Accra: An engineering failure. <http://www.hotfmonlinegh.com/?p=3540> Accessed: November 2016.
8. International Federation of Red Cross and Red Crescent Societies , 2015: Emergency Plan of Action Ghana: Floods available at www.ifrc.org

9. La-Nkwantanang Madina Municipal, A., 2013. Republic of Ghana. The Composite Budget, pp.0–106. <http://old.sheltercentre.org/shelterlibrary/items/pdf/Ghana.pdf>. Accessed: November 2016.
10. Ministry of Food and Agriculture, 2016. Greater Accra Region, demographics, weather, land use. http://mofa.gov.gh/site/?page_id=650 Accessed November 2016.
11. Ministry of Local Government and Rural Development. 2016. Regions: Greater Accra. <http://www.mlgrd.gov.gh/posts/regions/19-greater-accra/?plugin=102> Accessed November 2016.
12. Nations Encyclopaedia, 2016: Ghana Topography. <http://www.nationsencyclopedia.com/Africa/Ghana-TOPOGRAPHY.html> Accessed November 2016.
13. Ramsar. 2015a. Densu Delta Ramsar Site. <https://rsis Ramsar.org/ris/564> Accessed November 2016.
14. Ramsar. 2015b. Sakumo Ramsar Site. <https://rsis Ramsar.org/ris/565>
15. Accessed November 2016.
16. Ramsar. 2015c. Songor Ramsar Site. <https://rsis Ramsar.org/ris/566> Accessed November 2016.
17. The Forestry Commission of Ghana. <http://www.fcghana.org/page.php?page=46§ion=22&typ=1&subs=254>. Accessed November 2016.
18. WMO (World Meteorological Organization). 2017. Climatological information for Accra. Online: <http://worldweather.wmo.int/en/city.html?cityId=921>. Accessed: 6 June 2017.

10.2 Engineering Services and Infrastructure

(a) Documents

1. Rising through Cities in Ghana – Ghana Urbanization Review Overview Report
2. 33rd WEDC International Conference, Accra, Ghana, 2008 – Performance evaluation of the UASB sewage treatment plant at James Town (Mudor), Accra
3. AWDA 2014-2017 DMTDP Final Draft - District Medium Term Development Plan (2014-2017)
4. 2014-2017 GEMA MTDP report.
5. Progress report on GEMA Medium Term Development Plan (MTDP) 2010-2013
6. Accra Metropolitan Medium Term Development Plan, 2014 - 2017
7. Tema Metropolitan Medium Term Development Plan, 2014 - 2017
8. Adenta Municipal Medium Term Development Plan, 2014 - 2017
9. Ga East Municipal Medium Term Development Plan, 2014 - 2017
10. Ga West Municipal Medium Term Development Plan, 2014 - 2017

-
11. Ga South Municipal Medium Term Development Plan, 2014 - 2017
 12. Ga Central Medium Term Development Plan, 2014 - 2017
 13. Ashiaman Municipal Medium Term Development Plan, 2014 - 2017
 14. Ledzokuku-Krowor Medium Term Development Plan, 2014 - 2017
 15. Ada East Medium Term Development Plan, 2014 - 2017
 16. Shai Osu Doku Medium Term Development Plan, 2014 - 2017
 17. La Dade Kotopon Medium Term Development Plan, 2014 - 2017
 18. La-Nkwantanang Madina Medium Term Development Plan, 2014 - 2017
 19. Kpone Katamanso Medium Term Development Plan, 2014 - 2017
 20. Ningo Prampram Medium Term Development Plan, 2014 - 2017
 21. Ada West Medium Term Development Plan, 2014 - 2017
 22. Project Performance Assessment Report - Report No.: 105746 - Independent Evaluation Group – World Bank Group
 23. Future Direction of solid Waste Management in Africa (2015)
 24. Water Resources Commission, Ghana - Integrated Water Resources Management Plan – May 2007
 25. D6.1.2b Integrated Urban Water Management in Accra – SWITCH Report - 31st August 2010
 26. URBANIZATION AND FLOODING IN ACCRA, GHANA (by Kizito Afeku)

(b) Internet Sources

1. https://en.wikipedia.org/wiki/List_of_mobile_network_operators_of_the_Middle_East_and_Africa#Ghana
2. <http://www.slideshare.net/abrude/wwrf29-template/5>
3. <http://www.submarinecablemap.com/#/>
4. <https://www.google.com/get/projectlink/>
5. http://www.gwcl.com.gh/accra_west.html
6. http://www.gwcl.com.gh/accra_east.html
7. <http://www.mwrwh.gov.gh/>
8. <http://laboneexpress.com/blog/2015/06/why-the-accra-floods-occur-reasons-from-scientific-studies/>
9. <http://www.ircwash.org/sites/default/files/824GH.AC68-540.pdf>

-
10. <http://www.takamotobiogas.com/biogas-technology/jamestown-waste-water-treatment-plant-accra/>
 11. <https://www.modernghana.com/news/656495/ghana-ranked-second-in-open-defecation.html>
 12. <http://pulse.com.gh/news/lavender-hill-mahama-commissions-mudor-liquid-waste-treatment-plant-id5810609.html>
 13. <https://www.espaghana.com/mudor-waste-treatment-plant-nears-completion/>
 14. <http://ghanatrade.gov.gh/General-Services/acarp-compost-ltd.html>
 15. http://www.waste.ccacoalition.org/sites/default/files/files/city_fact_sheet/Accra_MSW_FactSheet_0.pdf
 16. <http://mci.ei.columbia.edu/files/2013/03/Accra-MCI-solid-waste-report-FINAL-DRAFT-2010.pdf>
 17. <http://www.mofep.gov.gh/sites/default/files/budget/2013/GR/Accra.pdf>
 18. <http://ir.knust.edu.gh/bitstream/123456789/6494/3/dzienyo-final.pdf>
 19. <http://dspace.knust.edu.gh/bitstream/123456789/146/1/Felix%20Puopiel%20thesis.pdf>
 20. <http://laboneexpress.com/blog/2015/06/why-the-accra-floods-occur-reasons-from-scientific-studies/>
 21. <http://www.waterworld.com/articles/wwi/print/volume-26/issue-4/editorial-focus/stormwater-management/stormwater-solutions.html>
 22. <http://floodlist.com/africa/ghana-accra-floods-june-2016>
 23. https://www.researchgate.net/publication/269337297_The_three-dimensional_causes_of_flooding_in_Accra_Ghana
 24. <http://www.rvo.nl/subsidies-regelingen/projecten/accra-storm-drainage-lafa-and-onyasia-drainage-channels>
 25. <http://www.dutchwatersector.com/news-events/news/21538-via-water-used-crowd-sourced-mapping-for-flood-risk-assessment-in-accra-ghana.html>
 26. <http://www.wrc-gh.org/water-resources-management-and-governance/river-systems/>
 27. <http://zoomlionghana.com/news.php?c=News&h=LAVENDER-HILL-WON%27T-SHUT-DOWN&newsID=187&linkID=5&catID=59>
 28. <http://www.gnwp.nl/wp-content/blogs.dir/12/files/sites/12/2014/05/WASH-Stories-From-Ghana.pdf>
 29. <http://wastelandfill.com.gh/accra-gets-new-landfill-site/>

10.3 Electrical Infrastructure

(a) Documents / Books

1. Strategic National Energy Plan 2006 – 2020 – Main report.

-
2. Strategic National Energy Plan 2006 – 2020.
 3. Strategic National Energy Plan 2006 - 2020 - Demand Sectors.
 4. Strategic National Energy Plan 2006 - 2020 – Electricity.
 5. Strategic National Energy Plan 2006 - 2020 – Wood fuels.
 6. Energy (Supply and Demand) Outlook for Ghana (report by Energy Commission- Ghana, April 2013).
 7. Energy (Supply and Demand) Outlook for Ghana (report by Energy Commission- Ghana, April 2014).
 8. GRIDCO Network GRID Map.
 9. Ghana Generation Masterplan (Nov 2011).
 10. GRIDCO Electricity Supply Plan 2016.
 11. Ghana Transmission Masterplan (Feb 2011).
 12. GRIDCO Systems Data Report (by Benjamin Kwame Ahunu, 27 Oct 2016).
 13. ECG Geographical Layout for Accra East and Accra West (Dec 2015) (hard copy and dwg format).
 14. ECG Greater Accra Projected Demand 2016 – 2015.
 15. ECG Tema Geographical Layout Oct 2015) (hard copy and dwg format).

10.4 Road Infrastructure and Transportation

(a) Documents

1. National Airport System Plan, 2014. Ministry of Transport/Ghana Airports Company Limited
2. Railway Master Plan of Ghana, 2013. Ghana Railway Development Authority of the Ministry of Transport.
3. The Transport Master Plan Project in Greater Accra Region, 2016. Ministry of Transport – Greater Accra Regional Coordinating Council
4. Integrated Transport Plan for Ghana 2011 – 2015, 2010. Ministry of Finance and Economic Planning

(b) Internet Sources

1. Wikipedia. Wikipedia.org/wiki/Regions_of_Ghana. Accessed October 2016.

10.5 Town Planning

(a) Documents / Books

1. Ghana, the Bradt Travel Guide, 2014. Phillip Briggs. The Globe Pequot Press Inc.

-
2. Ghana National Spatial Development Framework, 2015-2035. Executive Summary. Government of Ghana, Ministry of Land and Natural Resources, Ministry of Environment, Science, Technology and Innovation, Town and Country Planning Department National Development Planning Commission.
 3. Zoning Guidelines and Planning Standards, Nov. 2011. Ministry of Environment Science and Technology Town and Country Planning Department in the report.
 4. Manual for the Preparation of Spatial Plans, 2011. Ministry of Environment Science and Technology, Town and Country Planning Department.
 5. Western Region Spatial Development Framework
 6. Accra Metropolitan Medium Term Development Plan, 2014 - 2017
 7. Tema Metropolitan Medium Term Development Plan, 2014 - 2017
 8. Adenta Municipal Medium Term Development Plan, 2014 - 2017
 9. Ga East Municipal Medium Term Development Plan, 2014 - 2017
 10. Ga West Municipal Medium Term Development Plan, 2014 - 2017
 11. Ga South Municipal Medium Term Development Plan, 2014 - 2017
 12. Ga Central Medium Term Development Plan, 2014 - 2017
 13. Ashiaman Municipal Medium Term Development Plan, 2014 - 2017
 14. Ledzokuku-Krowor Medium Term Development Plan, 2014 - 2017
 15. Ada East Medium Term Development Plan, 2014 - 2017
 16. Shai Osu Doku Medium Term Development Plan, 2014 - 2017
 17. La Dade Kotopon Medium Term Development Plan, 2014 - 2017
 18. La-Nkwantanang Madina Medium Term Development Plan, 2014 - 2017
 19. Kpone Katamanso Medium Term Development Plan, 2014 - 2017
 20. Ningo Prampram Medium Term Development Plan, 2014 - 2017
 21. Ada West Medium Term Development Plan, 2014 - 2017

(b) Internet Sources

1. Wikipedia. [Wikipedia.org/wiki/Regions_of_Ghana](https://www.wikipedia.org/wiki/Regions_of_Ghana). Accessed October 2016.
2. Wikipedia. [Wikipedia.org/wiki/Accra](https://www.wikipedia.org/wiki/Accra). Accessed October 2016.
3. Wikipedia. [Wikipedia.org/wiki/Ghana](https://www.wikipedia.org/wiki/Ghana). Accessed October 2016.
4. Google. Regions in Ghana and their Districts. Accessed October 2016.
5. Citymayors.com/statistics/largest-cities-densities. Accessed October 2016.
6. www.worldbank.org/en/country/ghana/overview. Accessed October 2016.
7. Wikipedia. [Wikipedia.org/wiki/Greater_Accra_Region](https://www.wikipedia.org/wiki/Greater_Accra_Region). Accessed October 2016.

-
8. Wikipedia. Wikipedia.org/wiki/Tema. Accessed November 2016.
 9. Wikipedia. Wikipedia.org/wiki/Kotoka_International_Airport. Accessed November 2016.

10.6 Population and Social Environment

(a) Documents / Books

1. Ghana Living Standards Survey Round 6, 2014. Ghana Statistical Service
2. National Housing Policy, 2015. Ministry of Water Resources, Works and Housing
3. Ghana Housing Profile, 2011. UN Habitat
4. Land and Property Markets in Ghana, 2006. Royal Institution of Chartered Surveyors.
5. Poverty Profile in Ghana (2005-2013), 2014. Ghana Statistical Service
6. Population and Housing Census – District analytical report, 2010. Ghana Statistical Service.
7. Ghana poverty mapping report, 2015. Ghana Statistical Service

(b) Internet Sources

1. Ministry of Health, Republic of Ghana, <http://www.moh.gov.gh/>.
2. Ministry of Education, Republic of Ghana. <http://ghanaschoolsinfo.org/explore>.

10.7 Economic Environment

(a) Documents

1. Population and Housing Census – District analytical report, 2010. Ghana Statistical Service
2. Djokoto, J.C. 2012. Characteristics of Foreign Direct Investment into agriculture in Ghana. *International journal of technology and management research* Vol 1 No 1.
3. Government of Ghana. 2014. Economic and financial policies for the medium term.
4. Ghana Country Report, 2016. Economic Intelligence Unit.
5. Economist Intelligence Unit. 2016. Country Report: Ghana
6. Awoniyi, F. 2016. Accra's Kotoka International Airport becoming a regional hub for air travel. *The African Courier*.
7. Kwasi, O.C. 2016. Effect of location incentives on regional distribution of foreign direct investment in Ghana.
8. Integrated business establishment survey. 2015. Ghana Statistical Service
9. Ghana Living Standards Survey VI – Labour Force Report. 2014. Ghana Statistical Service
10. National Employment Report. 2015. Ghana Statistical Service

(b) Internet Sources

1. AllAfrica. 2015. Africa: Accra ranks second most attractive destination for FDI in Africa. www.allafrica.com. Accessed January 2017
2. Ghana Districts. www.ghanadistricts.com. Accessed October 2016.
3. Macalaster. 2016. History of Accra. www.macalester.edu. Accessed January 2017
4. Indexmundi. 2016. Ghana – Foreign Direct Investment. www.indexmundi.com. Accessed January 2017
5. Santander. 2016. Ghana: Foreign Investment. www.portal.santandertrade.com. Accessed January 2017
6. Caelen, A. 2017. Accra, Ghana. www.blackpast.com. Accessed January 2017
Ghana Embassy. 2017. Recent Foreign Direct Investments. www.ghanaembassy.org. Accessed January 2017.
7. Ghana Investment Promotion Centre. 2017. Invest in Ghana. www.gipcghana.com. Accessed January 2017.
8. Imirhe, T. 2017. One district one factory implementation plan revealed. www.citifmonline.com. Accessed April 2017.

10.8 Institutional Environment

(a) Documents

1. Constitution, 1992.
2. Land Use and Spatial Planning Act 2016, Act 925
3. Local Government Act, 1993, Act 462
4. LaVerle Berry, Library of Congress: Ghana, A Country Study, November 1994
5. Turok, I. and Parnell, S. (2009). Reshaping Cities, Rebuilding Nations: The Role of National Urban Policies. Urban Forum, 20(2), pp. 157-174.

(b) Internet Sources

1. Wikipedia. Wikipedia.org/wiki/Regions_of_Ghana. Accessed October 2016.
2. http://www.ghanaweb.com/GhanaHomePage/republic/district_assemblies.php. Accessed December 2016
3. Structures of the Ghanaian State (<http://library.fes.de/pdf-files/bueros/ghana/10504.pdf>. Accessed December 2016)

Appendix A

Appendix B

Appendix C

Employment Profile and Economic Structure by District in GAR, 2010

District	Employment Industry Profile	Economic Structure
Accra Metropolitan	Five largest employment industries: - Wholesale & Retail – 35.2% - Manufacturing – 14.1% - Accommodation & Food service – 10.0% - Other service activities – 8.6% - Transportation & Storage – 5.3%	- The district is a major centre for manufacturing, marketing, finance, insurance, transportation and tourism. - Service sector is the largest economic sector in the district economy. - Predominant primary economic activities are fishing and urban agriculture. 10% of fishing catch is exported (red fish, red bullet, herrings, tuna, yellow fish and grouper). - Lack of fish storage facilities means that prices tend to drop during the peak fishing season. - Industrial: - AMA is the second most industrialised area in Ghana, contributing over 10% to the GDP. Over 30% of the manufacturing activities, representing over 50% of value added, are located in the area.
Tema Metro	Five largest employment industries: - Wholesale & Retail – 26.3% - Manufacturing – 18.8% - Transportation & Storage – 8.8% - Accommodation & Food service – 8.2% - Other service activities – 6.7%	- District economy is made up of agriculture, industry and commerce/service. - Industrial and service sectors employ the most people, with the service sector growing at a fast rate. - Farming activities in the district are mainly done in the rural areas. Some of the crops cultivated include onion, okra, cassava, maize, tomato and pepper. - There are over 500 industries in the district and the district thus serves as the industrial hub of the country. - Among the major manufacturing industries in the Tema district are those that produce chemicals. - The country's largest Port and Harbour facilities are situated in Tema, and they contribute substantially to the revenue of the State as well as the district. - Stone quarrying and sand winning activities are carried out in rural areas of the district, notable among them are stone quarrying at Kpone, sand winning at Santeo, Zeenu, Katamanso, and Appolonia. - By virtue of its location, the Tema Port serves as an entry point for the flow of wide range of goods to and from other parts of the country as well as neighbouring countries. Thus, the development of an appropriate bulk breaking market within the district can be seen as an important step towards enhancing economic and social growth in Tema. - The Tema Harbour provides the appropriate facilities to handle efficiently the expected growth in trade and industry in the country. It has the main Harbour, the Fishing Harbour, Shipyard and Dry-

District	Employment Industry Profile	Economic Structure
		dock which is capable of docking both large and medium size fishing vessels. - It is capable of taking large vessels of 61.000 Dead Weight Tonnes. It also has 2 quays and 14 berths. Out of the 14 berths, there is an Oil berth which is 224 metres long and a berth for Volta Aluminium Company for the discharge of Alumina and the export of Aluminium ingots. - There is also a canoe beach where smaller boats/canoes dock. It is equipped with a fish market to make it easy for sales to be conducted.
Adenta	Five largest employment industries: - Wholesale & Retail – 24.8% - Manufacturing – 13.3% - Construction – 12.8% - Accommodation & Food service – 7.5% - Other service activities – 7.1%	- Wholesale and retail; repair of motor vehicles and motorcycles, constitute the largest industry within the district. - Crop farming is the most common (88.9%) type of agricultural activity among the households engaged in agriculture, followed by livestock rearing (22.4%) and tree planting (2.4%).
Ga East	Five largest employment industries: - Wholesale & Retail – 29.8% - Manufacturing – 13.1% - Construction – 9.7% - Other service activities – 8.0% - Accommodation & Food service – 7.4%	- The four main economic activities in the district are commerce, agriculture, service and industry. - The industrial sector can boast of a number of industrial establishments particularly in the New Achimota, Pantang and Madina areas. Notable among them are Guinness Ghana Breweries Limited, Nkulenu Industry, Mechanical Lloyd, Trasacco Limited, Phyto Riker (GIHOC) Pharmaceuticals and Royal Aluminium Company among others. - There are immense opportunities for investment in this sector especially in the rural areas of Kweiman, Danfa and Otinibi where land is available. - The service sector appears to be one of the fastest developing sectors of the local economy. - The construction sector is also fast growing. With the enormous deposits of natural building materials coupled with large tracts of undeveloped lands, especially in the rural areas of the district, the district has become a favourite area for development and the supply of sand, stone and laterite which are won indiscriminately all year round especially around Oyarifa, Otinibi and Kwabenya. - The major agricultural activities in the district are crop production and livestock production. - Irrigation facilities for farming are located in the following areas and are mainly for vegetable production. That is Kweiman, Musuko, Kwabenya and Haatso. - There are quite a number of agro-processing companies in the district. Most of them are engaged in the bagging and packaging of yams and are located at Agbogba. The goods after packaging are then exported. The packaging is done on large-scale basis. Pineapples are also processed into fruit

District	Employment Industry Profile	Economic Structure
		juice and sent to the local market. It is however worthy to note that the raw material, pineapples, etc. are not produced in the district but are brought from Nsawam and its surrounding communities. The district is well known for its poultry production and the production of poultry and pig feed. The major centres where feed mills are located are Adenta West, Oyarifa, Abokobi and Amrahia which is located at the eastern boarder of the district.
Ga West	Five largest employment industries: • Wholesale & Retail – 34.6% • Manufacturing – 12.9% • Other service activities – 8.5% • Construction – 8.4% • Accommodation & Food service – 8.3%	• The industrial sector in the district has seen some remarkable growth in the past few years. The establishment of manufacturing companies such as Aburaaba Mineral water, Voltic Mineral water, a number of aluminium companies such as Rocksters and Instyle, as well as the improved performance and reactivation of existing companies, gives an indication of growth of the sector. • The widespread mining and quarrying of large deposits of sand, stone, clay and laterite materials by both large and small scale operators has also contributed to the growth of the construction industry in the district. • The commercial sector engages the largest working population of the district (34.6%). A wide range of commodities comprising mainly of agricultural produce and industrial goods dominate this sector. • The Assembly also boasts of a number of operational cold storage facilities and commercial warehouses. • The agriculture sector has not seen growth within the past few years in spite of several government initiatives aimed at facilitating the growth of the sector. This has been caused by the loss of existing farmlands to sand winners as well as growth in development and acquisition of land for private housing projects. The land issue notwithstanding, the Ga West District lies in the catchment area of the President's Special Initiative for cassava for the production of industrial starch. The Roots and Tuber Improvement programme which has tremendous government support and funding as well as the Export Development and Investment Fund, that can be accessed by pineapple producers and exporters alike, provide good opportunities for local farmers.
Ga South	Five largest employment industries: • Wholesale & Retail – 32.6% • Manufacturing – 13.2% • Agriculture, forestry & fishing – 8.6%	• The main economic activities in the district include fishing in the coastal and lake areas and farming in the inland areas. • There are large commercial farms which produce pineapple, water melon, pawpaw, mango, pepper and coconut for export.

District	Employment Industry Profile	Economic Structure
	- Construction – 8.6% - Other service activities – 7.2% - Accommodation & Food service – 7.2%	- There are local gin distillation plants in a number of communities. - The Pambros salt industry is also operating in the free zone of the municipality. - The structure of the local economy is predominantly agriculture, followed by the industrial sector and the service sector. - There are four Agriculture Zones in the district, including Kofikwei, Omankope, Ashifla and Weiija.
Ga Central	Five largest employment industries: - Wholesale & Retail – 36.3% - Manufacturing – 13.9% - Other service activities – 8.2% - Construction – 7.9% - Accommodation & Food service – 7.4%	- The district has several block manufacturing factories but has no processing industries. It also has building development construction firms that produce some services. - Trading is the main economic activity in the district with Anyaa and Chantan markets as the major markets. - The industrial sector of the district's local economy includes industrial establishments like the Tiger Aluminium Industries situated at Tabora.
Ashaiman	Five largest employment industries: - Wholesale & Retail – 33.3% - Manufacturing – 19.2% - Transportation & Storage – 10.2% - Accommodation & Food service – 9.7% - Other service activities – 6.5%	Ashaiman is a business hub where there is a ready market for goods and services
Ledzokuku-Krowor	Five largest employment industries: - Wholesale & Retail – 30.3% - Manufacturing – 15.9% - Accommodation & Food service – 8.9% - Transportation & Storage – 7.3% - Other service activities – 7.3%	- The District is well placed to attract large investment concerns for its economic development due to the prevailing economic climate in the region. - The municipality is gradually assuming the role of an emerging commercial centre. - The municipality is an important economic zone for commerce, manufacturing and finance.
Ada East	Five largest employment industries: - Agriculture, Forestry & Fisheries – 33.3% - Wholesale & Retail – 22.2% - Manufacturing – 16.0%	- The gap between industrial growth and agricultural development is wide in the District. - The only industrial subsectors that the district can boast of are salt mining and quarrying. - The Songhor Salt Project is the major mining sector of the district - Aside from the numerous benefits of the Songhor Salt Development Project, feasibility studies and empirical evidence have adjudged the industry to have tremendous capabilities of fuelling

District	Employment Industry Profile	Economic Structure
	- Accommodation & Food service – 7.5% - Education – 4.1%	the proposed Petrochemical Industry including the production of Caustic soda, Chlorine, PVC Pipes etc. Large Quarrying and Sand winning also form part of the domestic industries in the district. These growing industries are supporting housing development in the district; since they are produced at cheaper costs. The quarrying sites can be found at Tehey close to the North Tongu District.
Shai Osu Doku	Five largest employment industries: - Agriculture, Forestry & Fisheries – 35.7% - Wholesale & Retail – 17.4% - Manufacturing – 11.2% - Accommodation & Food service – 6.6% - Transportation & Storage – 5.3% - Construction – 5.3%	- A few noteworthy commercial farms have been established in the district. The relocation of the Golden Exotic farms (a 3,000 hectares banana plantation of which approximately 800 hectares has been planted) has broken new grounds in agriculture. Other gains includes the Tropo farms (a 5 hector fish farm in the Volta Estates), Annapunna Salt and other small scale salt mines along the coast. - Although agriculture dominates the district, the leading sectors in terms of provision of revenue to the district and remunerations to workers are the quarries.
La Dade Kotopon	Five largest employment industries: - Wholesale & Retail – 24.9% - Manufacturing – 12.6% - Public administration & defence – 12.2% - Accommodation & Food service – 10.4% - Other service activities – 7.5%	- The main economic activity for men in the district is operating the public transport system known as trotro business. - The district hosts several shopping malls such as the Accra Shopping Mall, Koala Shopping Mall and Marina Mall.
La-Nkwantanang	Five largest employment industries: - Wholesale & Retail – 29.2% - Manufacturing – 14.0% - Accommodation & Food service – 8.7% - Other service activities – 8.3% - Construction – 7.0%	- The main economic activities in the district are commerce, agriculture, services and manufacturing. - There are several manufacturing industries in the municipality – Nkulenu Industry, Mechanical Lloyd, Royal Aluminium Company, Special Ice Water Company, Voltic Water Bottling. - Items produced include food processing, packaging and fabrication. - There is a construction industry engaged in business such as block factories, stone quarrying and the sale of building materials. - There are a number of agro-processing establishments (Nkulenu Industries) which process fruits and vegetables on a large scale.
Kpone Katamanso	Five largest employment industries:	The main occupation in the area includes fishing, fish mongering, farming (crop production and

District	Employment Industry Profile	Economic Structure
	- Wholesale & Retail – 28.8% - Manufacturing – 19.5% - Transportation & Storage – 10.3% - Accommodation & Food service – 7.2% - Construction – 7.1%	livestock rearing) and salt mining. - The Tema Free Zone is located in District. The district can also boast many industries, both big and small. - The district is privileged to have the light industrial area in its locality. The resident artisans are involved in various activities such as car spraying, welding, fitting and vulcanizing.
Ningo Prampram	Five largest employment industries: - Agriculture, Forestry & Fishing – 29.0% - Wholesale & Retail – 17.9% - Manufacturing – 15.7% - Accommodation & Food service – 7.7% - Construction – 6.2%	- Agriculture is the largest economic sector within the district, with cassava, maize, mango, banana, vegetables and rice being produced. - Irrigation agriculture is practiced on a medium scale. - There are a number of manufacturing activities in the district – RANNAH fish feed company, MELGREP company (carpentry), block making companies and small scale aluminium industries that produce cooking utensils.
Ada West	Five largest employment industries: - Agriculture, Forestry & Fishing – 42.5% - Manufacturing – 15.8% - Wholesale & Retail – 14.1% - Mining & Quarrying – 7.2% - Accommodation & Food service – 5.8%	- Salt mining provides employment to much of the workforce. This is also the largest form of revenue for the district. - Farming is also a major economic activity in the district with cassava, maize, veggies and okra being farmed.

Source: Demacon, ex Ghana Districts (2016) and Ghana Statistical Services (2010)

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