

# **Energy Efficiency and Energy Saving System Project in Guyana**

**Interconnection Project (L5 Redundant Circuit and  
Conductor Upgrade Project) to install New  
Transmission Lines from the Kingston to the Old  
Sophia and New Sophia Substation**

## **Environmental and Social Impact Assessment Report**



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# **1 INTRODUCTION**

## **1.1 Overview**

Guyana's electricity sector is controlled by the state-owned Guyana Power and Light Inc. (GPL), a vertically integrated company responsible for electricity distribution, transmission and part of the country's generation portfolio (Climatescope 2017). The electricity sector also includes independent power producers, which sell their electricity to GPL (Climatescope 2017). The GPL Company is the primary supplier of electrical energy to most areas along the coastal plain of Guyana (GPL 2018). Most of the country's 203 megawatts (MW) of generated installed capacity correspond to inefficient thermoelectric diesel engine driven generators (Climatescope 2017). In addition, stability in electricity supply is very low, linked to both technical and institutional deficiencies in the sector, with total losses close to 40% and commercial losses of about 30% (World Bank 2007). This low reliability has led most firms installing their own diesel generators, which in turn leads to higher than average electricity costs.

Installed power generation capacity in Guyana was 203 MW or 0.4 kW per capita, which is lower than in other countries in the South American region and is hardly sufficient to cover the current demand for electricity in the country (Climatescope 2017). Most electricity generation uses Diesel engines to drive generators. There are plans for introduction of power generation facilities based on renewable resources, but these would still account for only a small share of the generation capacity in Guyana. Self-generation of electricity is widely spread in Guyana, where large, medium and small firms respectively own generators which supply them with electrical power. One disadvantage of self-generation of electricity is that corporate demand for electricity in some regions of Guyana has considerably decreased. And while private generation temporarily eases the pressures on the overall capacity for the sector, it also prevents the realization of economies of scale at a system level. Self-generation of electricity appears more costly to companies i.e. (up to US\$0.38 per KWh) than regional and even local tariffs i.e. (approximately US\$0.22 and US\$0.25).

Guyana's demand for electricity grew 18% in the five years to the end of 2015 and while the consumption of electricity in has increased over the years, the installed generation and distribution capacity has slowly increased (Climatescope 2017). Moreover, reliability of electricity supply is low, and characterised by frequent and long power outages, load discharges and voltage variations (World Bank 2007). Poor reliability and distribution has been linked to dependence on old and obsolete equipment for power generation, underinvestment in the distribution grid, and lack of incentives for efficient provision of service (World Bank 2005). The wide-spread provision of reliable electricity to companies and consumers is a basic necessity for a country's economic growth and development, and in Guyana poor electricity supply has become a key obstacle to growth (World Bank 2007). Losses at the distribution level account for almost 40% of the energy generated, well above the 13.5% weighted average for Latin America and the Caribbean. Therefore, there is considerable room for improvement in the reliability of

electricity supply; however, substantial investments and institutional enhancements must be made in order to achieve this goal(World Bank 2007).

As a consequence of these events the Guyana Power and Light Inc have proposed changes to improve the general distribution capacity within the capital city of Georgetown. This document highlights the development of an Interconnection Project to install New Transmission Lines from the Kingston Substation to the Old Sophia Substation and New Sophia Substation. This Project is essential to providing additional generation to meet the growth requirements of Kingston, Georgetown Generating Station and increase generation capacity in Georgetown.

## **1.2 Historical Overview of the Electricity Sector in Guyana**

In Guyana electricity generation began just before the twentieth century with a number of private or community based enterprises as well as individual entities providing their own power (GPL 2018). The capital Georgetown and the municipality of New Amsterdam received electricity from a private supplier, while the mining areas of Everton and Linden received electrical power from Alcan and Reynolds, both companies of which respectively owned the Linden and Berbice based bauxite operations(GPL 2018).The International Power Company (IPC) of Canada was in operation in Georgetown at the turn of the twentieth century. In 1925, the Demerara Electric Company was established after purchasing the assets of the IPC(GPL 2018). In 1957, another company, i.e. the British Guiana Electricity Company (BGEC) came into being, and in 1960 the BGEC purchased the assets of the Demerara Electric Company(GPL 2018). In May 1966, after Guyana gained its Independence, the BGEC was nationalised and this led to the establishment of the Guyana Electricity Company (GEC) which was owned by the state.

In 1999, the Government of Guyana divested a 50% stake of its ownership and control to AC Power, a consortium of British Commonwealth Development Corporation (CDC) and Ireland's Electricity Supply Board International (ESBI)and the company became the Guyana Power and Light Inc(GPL 2018; World Bank 2007). GPL was also privatized in the same year. ESBI was designated to manage the operation of GPL through a private management contract that determined tariff-setting mechanisms, along with aggressive targets in terms of efficiency, reliability and new investment(World Bank 2007).The Electricity Sector Reform Act of 1999, was intended to promote the redevelopment of the sector, while at the same time providing future incentives for efficiency as well as a means for profitability of the managing contractor(World Bank 2007). The Act guaranteed GPL exclusive rights over distribution and a five-year exclusivity in generation (after which period independent producers would be allowed to bid to supply power to the company)(World Bank 2007). At the beginning new management brought about significant improvements and initial capital injections translated into enhanced reliability in the supply and increased collection rates(World Bank 2007). At the same time, a five-year System Development Plan was defined, with a US\$55 million investment program intended to improve power generation and distribution. Further, the need to drastically decrease technical and commercial losses at GPL was also identified by ESBI and the reduction in losses was

expected to generate a financial cushion to offset the effects of possible oil price increases (World Bank 2007). After this positive start, GPL then faced financial constraints i.e. as tariffs lagged behind the rising oil prices revenues were lower than initially expected, and the regulator was perceived as preventing GPL from fully implementing new tariffs. In addition, the achieved reduction in technical losses was well below expectations and investments were put on hold pending funding (World Bank 2007).

As the financial position of the utility deteriorated, sources of funding for planned investments dried up thus bringing development activities to a halt (World Bank 2007). Initial improvements attained were unsustainable and system losses actually increased from 24% to 40% of net generation (World Bank 2007). In light of the performance of the utility, the regulator (PUC) imposed a heavy fine on GPL for failure to meet agreed targets for loss reduction and capital expenditure. Disputes over performance targets and tariff-setting procedures ensued, ultimately causing a complete fall out between regulator and investors.

On March, 2003, the CDC pulled out of the consortium, and AC Power sold back its 50% stake in GPL to the Government of Guyana for a nominal sum (World Bank 2007). ESBI ceased its mandate as a managing contractor, and the operation was handed back to the Government of Guyana. On May 01, 2003, the divestiture failed and GPL once again became wholly owned by the state. GPL employs over one thousand and two hundred (1200) workers countrywide, with a multitude of industrial and administrative skills (GPL 2018). The demise of the investment consortium in GPL created a price shock (electricity tariffs increased by 15% in 2003) along with additional instability in the system due to under-investment in essential maintenance during private ownership (World Bank 2007).

The Government of Guyana intends to reduce the problems of reliability, efficiency and system losses before attempting to privatize GPL again. This may prove challenging considering the large investment required and its possible effect on the fiscal stability of the country. At the same time, a prerequisite for successful privatization will be an improved contractual and regulatory framework for the sector.

### **1.3 Background of the Company**

The Guyana Power and Light Inc. (GPL) was established on October 01, 1999, the company as mentioned above was previously named the Guyana Electricity Corporation and was wholly owned by the Government of Guyana. A 50/50 equity partnership was established between the Government of Guyana and a consortium comprising of the Commonwealth Development Corporation (CDC) of the United Kingdom and the Electricity Supply Board International (ESBI) of Ireland which instituted GPL. In April, 2003 this partnership was dissolved and GPL reverted to 100% ownership by the Government of Guyana. This arrangement still stands to this day.

The Guyana Power and Light Inc. (GPL) is now the sole official supplier of electricity in Guyana with its franchise area encompassing the three counties of Demerara, Essequibo and Berbice (GPL 2018). Depending upon the area or areas of electrical distribution, GPL supplies all its customers with voltage that ranges from 110 to 220 Volts, further, GPL also has a unique voltage distribution system since it delivers both 50 and 60 cycle power. GPL has a developed infrastructure, comprising generation stations, transmission and distribution systems, maintenance facilities and offices. Presently, GPL operates nine (9) generating stations:

- The Anna Regina Generating Station
- The Wakenaam Island Generating Station
- The Bartica Generating Station
- The Garden of Eden Generating Station
- The Cane Field Generating Station
- The Onverwagt Generating Station
- The Lethem Generating Station
- The Kingston, Georgetown Generating Station
- The Leguan Island Generating Station

Each of the above sites is essentially developed to its full potential and there is insufficient space for expansion to meet future needs. Therefore, for the purpose of this document which focuses specifically on the Georgetown environs, the development of an Interconnection Project (L5 Redundant Circuit and Conductor Upgrade Project) to install New Transmission Lines from the Kingston to the Old Sophia and New Sophia Substation is therefore essential to providing additional generation to meet the growth requirements of the Kingston, Georgetown Generating Station.

#### **1.4 Scope and Rationale for Project**

The Kingston Facilities has a combined total of 58.3 MW, however, the existing 69 kV transmission line (L5) rated at 50 MVA only transmits a maximum of 45 MVA of power from Kingston to Sophia. The remaining power is distributed directly from the Station Bus. The risk of overloading the line is imminent since the power available at Kingston to be transmitted to Sophia exceeds 50 MVA. Sophia on the other hand functions as the distribution hub of the power system supplying substations at North Ruimveldt, Good Hope, Columbia and Onverwagt. Load dynamics imply that the demand at the substations may cause a corresponding increase to the demand at Kingston resulting in the overloading of the Kingston to Sophia transmission line. The additional circuit will provide 100% redundancy to GPL's largest transmission of power via a

single line. In recent times it has been experienced that a failure of L5 results in a complete system failure.

The preferred system plan, proposed by GPL, which is the subject of this Environmental Assessment, involves the following:

- Construction and commissioning of a single circuit overhead 69 kV Transmission Line of approximately 5km in length between the Kingston and Sophia Substations;
- Extension of the Kingston and Sophia Substations to accommodate the new transmission line; and
- L5 Conductor Upgrade.
- Completion of all necessary earthworks to provide a firm foundation for supporting concrete structures and STATCOM.
- Construction of protection fencing infrastructures.
- Construction of all necessary concrete supports and commissioning of a  $\pm 10\text{MVar}$  STATCOM.
- Extension of the New Sophia 69kV bus bar and installation of a 69kV bay to accommodate the connection of the STATCOM.

GPL's strategic plan is aimed at improving efficiencies and effectiveness in the use of its resources to reduce technical losses and improved quality of service to consumers, while providing for future load growth. The Company's Development and Expansion Plan (2017 – 2021) projects a 1.95% reduction in Technical Losses over the five years.

The new and upgraded transmission lines would ensure that GPL meets its current and increasing demand for power, efficiently, while at the same time meet the urgent need to optimise generation and overall operating costs. It would also ensure the efficient wheeling of bulk power from the generating plant to the load centres.

### **1.5 Rationale for an Environmental Impact Assessment (EIA)**

An Environmental Impact Assessment (EIA) can be defined as the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made (IAIA 1999). Reducing the burden of adverse environmental and social impacts is necessary if development is to be sustainable. As a result, EIA provides an avenue for the review of the likely environmental and social effects of proposals/activities/projects and provides mechanisms to ensure that agreements reached at the stage of project approval are carried through to the operation and closure (Nevill 2000).

The goal of an EIA is to provide a scheme/means through which decisions affecting the environment may be better informed and made in light of a comprehensive understanding of their effects on the environment. By predicting likely consequences of a proposed development, an EIA provides an opportunity to identify mitigation measures that may be taken in response to the harm anticipated(IUCN 2012). A satisfactory decision can no longer be made on a project with consideration of its environmental and socio-economic consequences. Consequently, the role and function of an EIA is to, effectively contribute to the decision-making process by focussing on the environmental and socio-economic issues and by ensuring that potential impacts are considered in a thorough and systematic manner; when such impacts cannot be avoided, they are with foresight, to be minimised or mitigated (UNEP 2014).

The basic outlining principles that govern the EIA process entails that the EIA should be (IAIA 1999):

1. Purposive: meet the aims and objectives and inform decision-making, and result in appropriate levels of environmental protection and community well-being.
2. Rigorous: employ the best practical methodology and techniques to address issues under investigation.
3. Practical: establish mitigation measures that can work and implemented by the proponent.
4. Relevant: provide sufficient, reliable and usable data for development planning and decision-making.
5. Cost Effective: achieve the objectives of the EIA within the limits of available information, time, resource and methodology.
6. Efficient: impose the least cost burden on the proponent, in terms of time, and finances.
7. Focused: concentrate on the significant environmental/ social effects and issues.
8. Adaptive: respond and adjust to the realities, issues and circumstances of the proposal under review without compromising the integrity of the process.
9. Participative: involve the public and stakeholders fully, by informing the interested parties and addressing their impacts and concerns.
10. Interdisciplinary: ensure the appropriate experts and techniques are employed.
11. Credible: conducted with objectivity, professionalism, rigor, fairness, impartiality and balance and be subject to independent checks and verification.
12. Integrated: address the inter-relationships of social, economic and biophysical aspects.
13. Transparent: be clear and have easily understood requirements for the content. Acknowledge limitations and difficulties. Ensure public access to the information and identify factors to be taken into account for decision-making.

14. Systematic: results in the full consideration of all relevant information on the affected environment and communities; the impacts and if applicable proposed alternatives; the measures taken; the monitoring and evaluation of residual effects.

## **1.6 Aims and Objectives of the ESIA**

The ESIA covers all construction and operation activities for the GPL's new transmission lines to transmit as much as 100MVA and this will be connected to the Interconnected System via the Substations at Kingston and Sophia, both of which will be expanded. Additionally, the conductors on the existing L5 would be upgraded to satisfy the requirement of being able to transmit 100MVA, also. These initiatives would ensure the safe and uninterrupted transfer of all available power between Kingston and Sophia and better serve the growing demands within the capital city of Georgetown. The Sophia Substation with distribution outlets will allow for more reliable distribution of power (shorter feeders and lighter loads) which would improve overall management, including maintenance and reduction in un-served energy due to line plant unavailability. The basic aim of the ESIA is to anticipate possible effects of the proposed project/activities on the natural systems (soil, air, biological, human health), socio-economic sector and cultural systems to inform the process of decision-making.

The main objectives of the ESIA are to

1. Improve environmental designs of the project. Setting the environmental terms and controls for implementing the proposal.
2. Provide an analysis of the intended project activity; incorporating and taking into account ecological matters and environmental concerns.
3. Identify and evaluate the possible key significant adverse environmental and or social effects and the measures for mitigating them.
4. Protect the right to human health, safety, life and culture.
5. Enhance social aspects and provide benefits to local socio-economic sector.
6. Facilitate participation and involvement of the communities and other stakeholders in all phases of the assessment.

## **1.7 Structure of the ESIA**

The EIA methodology is a process involving a number of steps, illustrated in figure 1:

The EIA process entails:

1. Screening: the Environmental Authority (EPA) determines whether a proposal requires an EIA to be completed or not.

2. Scoping: is undertaken to identify the significant social or environmental issues of concern and preparation of TOR.
3. Impact Analysis: the assessment team designs and conducts appropriate studies to predict the effects and evaluate their significance.
4. Impact Management: establish measures to prevent, or reduce impacts and incorporate into an EMP.
5. Reporting: prepare and compile information necessary for decision making i.e. likely impacts, significance of effects, proposal mitigation, and the concerns of stakeholders.
6. Review: the Environmental Authority checks the quality of the reports and determines if the report meets the TOR and provides a satisfactory assessment of the proposal.
7. Decision-Making: the Environmental Authority, EPA Guyana approves/ rejects the proposal and set the conditions for its implementation.
8. Follow-Up: the Authority conduct process evaluation, environmental audits, monitoring activities to ensure the approved terms and condition of project implementation are met.
9. Public Participation: public involvement and consultation occurs throughout the phases of the EIA process (scoping, impact analysis, mitigation, report preparation and review).

## 1.8 Report Organisation

The ESIA report structure is organised into twelve (12) sections. These are as follow:

**Table 1: Structure of the ESIA Report**

Section	Title	Description
1	Introduction	<ul style="list-style-type: none"> <li>• Background/overview</li> <li>• Scope of proposed Project</li> <li>• Rationale for Project</li> <li>• Rationale for EIA</li> <li>• Objectives of the EIA</li> <li>• Methodology and structure of EIA</li> <li>• Limitation/technical difficulties</li> </ul>
2	Legal Framework and Policy	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Company policy</li> <li>• National Legislation/Regulations</li> </ul>



		<ul style="list-style-type: none"> <li>• International Standards and Conventions</li> <li>• Permits/ Licenses</li> </ul>
3	Stakeholders	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Institutions/Competent Authorities</li> <li>• Communities</li> </ul>
4	Description of the Proposed Project	<ul style="list-style-type: none"> <li>• Project Site</li> <li>• Phases of Operation <ul style="list-style-type: none"> <li>▪ Production Process Description</li> </ul> </li> <li>• Operational Inputs</li> <li>• Materials/equipment</li> <li>• Capital Investment</li> <li>• Personnel Requirement</li> <li>• Est. quantity and type of expected residues and emissions</li> </ul>
5	Analysis of Alternatives	<ul style="list-style-type: none"> <li>• Project site</li> <li>• Justification for choosing site</li> <li>• Alternative areas/techniques etc.</li> </ul>
6	Description of the Existing Environment	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Climate</li> <li>• Physical</li> <li>• Biological (Biodiversity)</li> <li>• Socio Economic Environment</li> </ul>
7	Assessment of Environmental Impacts and Risks	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Method and Criteria for prediction and evaluation of effects</li> <li>• Impact Identification</li> <li>• Evaluation of significance</li> <li>• Description of Potential Impact</li> </ul>
8	Environmental Management of the	<ul style="list-style-type: none"> <li>• Introduction</li> </ul>

	Project	<ul style="list-style-type: none"> <li>• Environmental quality objectives</li> <li>• Impact Mitigation</li> <li>• Monitoring Programme</li> <li>• Site Monitoring schedule</li> <li>• Training (environmental awareness)</li> <li>• Cost estimates</li> </ul>
9	Emergency Preparedness and Response Plan	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Emergency Operation coordinator</li> <li>• Emergency Contact Directory</li> <li>• Potential Emergencies</li> <li>• List of substance and storage facilities</li> <li>• Emergency Equipment</li> <li>• Training/Drills/Exercises</li> <li>• First Aid</li> <li>• Emergency Protocols/procedures for rescue and evaluation</li> <li>• External Emergency contact information</li> </ul>
10	Conclusions	<ul style="list-style-type: none"> <li>• Summary of main findings</li> <li>• Conclusions</li> </ul>
11	Reference	<ul style="list-style-type: none"> <li>• List of Literature Reviewed</li> </ul>
12	Appendices	<ul style="list-style-type: none"> <li>• Glossary of terms</li> <li>• Terms of Reference,</li> <li>• Scope of Work</li> <li>• Baseline Studies and other reports</li> <li>• Sampling Protocols</li> <li>• Notes/Minutes of public consultations Scoping Meeting, photographs, maps, charts and other supporting documents.</li> <li>• Composition of Consultants team</li> </ul>

## **1.9 ESIA Team**

The ESIA team was led by Mr. Isidro Ubaldo Espinosa, an Environmental Engineering Specialist. The supporting team included:

- Ms.ChuvikaHarilal–Environmental Specialist
- Mr. Osbert Ellis – Natural Resources and Environmental Management Specialist
- Mr.RoopNarine–Research Assistant, Environmental Engineering Solutions
- Ms. Shameka Higgins – Student, Environmental Science, University of Guyana
- Mr.Jamal Lewis – Student, Environmental Science, University of Guyana
- Ms. Athena Lyttle – Student, Environmental Science, University of Guyana

## **1.10 Approach and Methodology**

The EIA will be completed to meet the requirements as set out in the “Environmental Impact Assessment Guidelines for Guyana, 2000” as stipulated by the Environmental Protection Agency, Guyana.

### **1.10.1 Phased Approach to Conducting the EIA**

The work was completed in a number of phases. The first phase involved the definition of the project components, collection of baseline data and information on the defined Project area. The second phase was to conduct an effects assessment of the construction and operation of the following proposed activities:

- Construction and commissioning of a single circuit overhead 69kV Transmission Line between the Kingston and Sophia Substations;
- Extension of the Kingston and Sophia Substations to accommodate the new transmission line; and
- L5 Conductor Upgrade.
- Completion of all necessary earthworks to provide a firm foundation for supporting concrete structures and STATCOM.
- Construction of protection fencing infrastructures.
- Construction of all necessary concrete supports and commissioning of a  $\pm 10\text{MVar}$  STATCOM.
- Extension of the New Sophia 69kV bus bar and installation of a 69kV bay to accommodate the connection of the STATCOM.

The EIA is based on scientific, engineering, environmental and economic parameters, professional judgement, and consultation with the public, applicable government agencies, communities, interest groups and other stakeholders directly affected by the Project. The approach includes the following steps:

Step 1 – Assembling Project Baseline Information

- Developing the Project description, including construction, and operation activities; and
- Preparing a description of existing environmental conditions to assess the potential effects of the various Project activities on the environment and the potential effects of the environment on the Project.

Step 2 – Issue Scoping

- Issues identified during development of the study;
- Ensure that the concerns of the regulatory agencies involved in the Project review are identified;
- Consider public concerns;
- Environmental issues or Environmental Components of Concern (ECC) that may be affected by the Project are identified by professionals in the field;
- Elements of the environment that could be affected by the Project and are protected by legislation or regulation are included as Valued Ecosystem Components; and
- Pathways between the ECCs and Project activities are identified. Where pathways cannot be identified, the ECC or issue is deemed not to be affected by the Project and, therefore, is no longer part of the analysis.

Step 3 – Identification of Valued Ecosystem Components

- Valued Ecosystem Components (VECs) are those environmental issues which have been identified through issues scoping and pathway analysis. The result of Step 2 of the assessment is a list of VECs on which the effect assessment focuses;
- A definition of each VEC is developed, including its scope (spatial and temporal boundaries), and description of linkages (or pathways) with the Project and with other components of the environment; and
- Identification of issues relative to the identified VECs.

Step 4 – Effects Assessment

The effects assessment considers the environmental effects of the project with the proposed abatement technologies as applied (such as air emissions controls) and inclusive of the mitigation measures as provided in the report.

In order to be considered a significant adverse environmental effect, the assessment of these potential effects must determine that the effect is adverse and significant and likely.

The term cumulative environmental effect (CEE) means the effect on the environment, which results from the effects of a project when combined with those of other past, existing and imminent projects and activities. These may occur over a certain period of time and distance. The following points provide an indication of what should be considered:

- There must be an environmental effect of the project being assessed;
- The environmental effect must also be likely;
- That environmental effect must be demonstrated to operate cumulatively with the environmental effects from other projects or activities; and
- It must be known that the other projects or activities have been, or will be, carried out and are not hypothetical.

#### Step 5 – Environmental Protection Measures

- Provide the details of environmental protection measures that would be applied to the project for construction and operations of the facilities.

#### 1.10.2 Baseline Data Collection

To provide accurate and scientific analysis of the potential environmental effects of the proposed Project on the environment, it is critical to have data that represents the state of the environment prior to developing the Project. This baseline data can be used, in conjunction with the predicted Project outputs, to complete the environmental assessment for the Project. For certain specific environmental components, it was necessary to collect more detailed and site-specific information.

In order to achieve the objectives of the project and assess the impact of the project in the city of Georgetown, the following primary and secondary data collection tasks were carried out:

##### a. Questionnaires

The questionnaire was one of the main methods used to obtain information from residents of Georgetown where the Transmission Lines are expected to be established. The aim of the questionnaire survey was to supplement the secondary data collected, with vital socio-economic information in order to provide a more comprehensive representation of the challenges posed by the Project. The questionnaires were all self-administered by the researcher, with the residents being the main target groups.

Self-administered questionnaires were chosen for four (4) basic reasons.

1. Questionnaires are used as an ideal way to obtain the opinions as well as views of a desired sample population and many persons are familiar with them.

2. Data obtained from questionnaires can be used in a format that is easy to analyze and graphically represent.
3. Self-administered questionnaires minimize the frequent issue of respondents not completing them.
4. Self-administered questionnaires ensured that if there were questions not easily understood by the respondent, they could be explained on the spot by the researcher.

b. Discussions with relevant personnel and agencies

Open-ended interviews were conducted with relevant personnel from various agencies. These discussions were undertaken because they enabled wider and more detailed responses and explanations. Additionally they allowed for clarification and flexibility, were more relaxed and conversation-like, and aided in gathering significant additional information.

The following sections outline the specific baseline programs that were conducted for this EIA.

#### 1.10.3 Ambient Air Quality

Ambient air quality monitoring was completed in the immediate vicinity of the site to confirm baseline conditions. This consisted of monitoring instruments for suspended particulate matter less than 10 microns (PM<sub>10</sub>) and 2.5 microns (PM<sub>2.5</sub>) in size over a one week period. Additional sampling of total suspended particulates matter (TSP) was also included to supplement the ambient air quality information.

#### 1.10.4 Ambient Noise Levels

Baseline ambient noise levels were established by conducting attended daily measurements in the vicinity of the site. These locations were determined in the context of the nearest sensitive receptors such as a School, Residence, and Business etc.

#### 1.10.5 Spatial and Temporal Boundaries

The effect of a specific project activity on an environment may differ in both space and time from the effect of any other activity. Certain project activities may have long-term consequences; others will be of short duration. Temporal and spatial study boundaries have been considered for the construction and operation phases of the Project.

#### 1.10.6 Methodology to Predict Environmental Effects

Methodologies used in the identification and assessment of effects may be specific to each discipline. They can be grouped in the following categories:

- Review of public literature;
- Acquisition and review of unpublished reports and data from government agencies and departments, universities and research institutions, and other relevant projects;
- Interviews with resource persons and knowledgeable individuals;
- Use of models and extrapolation from datasets and trends;
- Compilation of relevant statistical datasets;
- Site visits and evaluations;
- Formulation of effect hypothesis and linkages for each ecosystem component determined to be vulnerable to effect from Project activities.

Valued Ecosystem Components are identified through determining the pathways or linkages between the issues and the Project. Predictions are based on a combination of objective (measureable) and subjective (deduced) experience based on professional judgement and evaluation.

#### 1.10.7 Cumulative Effects

The environmental effects of the Project in conjunction with other activities and other projects that have or will be carried out in the Project Area are examined. For the purpose of identifying and assessing cumulative effects, the spatial dimensions of the areas for each Valued Ecosystem Component remain the same. The temporal boundaries, however, are extended to include activities in the past, those that are under way in the area, and known projects planned outside of the time boundaries established for the Project. A review of other similar projects that have been operational for long durations also provides insight into the potential cumulative effect of this Project.

#### 1.10.8 Consultation Process

As part of the EIA process and the social impact assessment, consultations are completed with the public and government agencies to ensure that all the relevant issues are addressed within the report.

### **1.11 Limitation and Technical Difficulties**

Limitations and technical difficulties encountered while conducting the ESIA are as follows:

#### Availability of Data

Secondary data that may be relevant to the project area is extremely limited due to the fact of very little research work has been done within this area. Therefore, the ESIA Team relied on communication with relevant stakeholders and communities to gather data.

#### Lack of cooperation

Some of the residents of Georgetown were reluctant towards answering questionnaires and this had a spin-off effect on data collection.

#### Time

The time allotted to complete all forms of data collection; surveys and data analysis was limited.

## **2 PROJECT LOCATION**

1) This project will result in the following:

- a. Construction and commissioning of a single circuit overhead 69kV Transmission Line between the Kingston and Sophia Substations.
- b. Extension of the Kingston and Sophia Substations to accommodate the new transmission line.
- c. L5 Conductor Upgrade

The Works will be located between the locations of Kingston to Sophia Sub-stations and the new transmission line will be installed along Government reserves (vacant and cleared sites), all in the Capital City of Guyana, Georgetown. See Figures 1, 2 and 3.

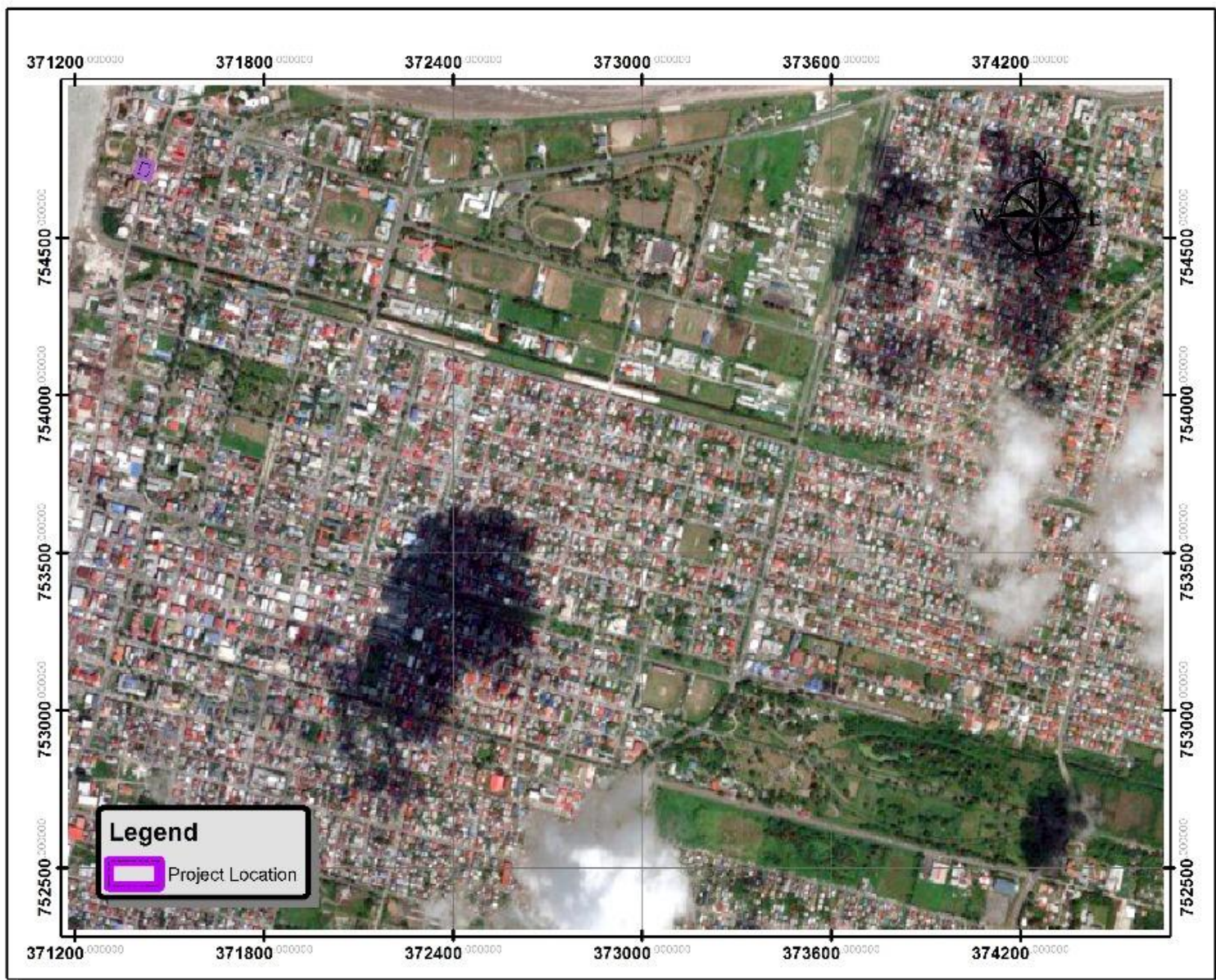
2) This project will also result in the following:

- a. Completion of all necessary earthworks to provide a firm foundation for supporting concrete structures and STATCOM.
- b. Construction of protection fencing infrastructures.
- c. Construction of all necessary concrete supports and commissioning of a  $\pm 10\text{MVAR}$  STATCOM.
- d. Extension of the New Sophia 69kV bus bar and installation of a 69kV bay to accommodate the connection of the STATCOM.

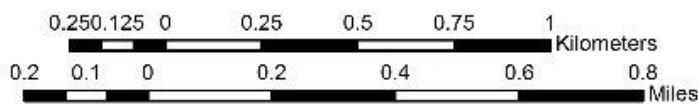
The works will be executed at New Sophia Substation, Sophia in the Capital City of Guyana, Georgetown. See Figure 4.



# Project Location (Kingston) Map



**SCALE: 1:19,000**

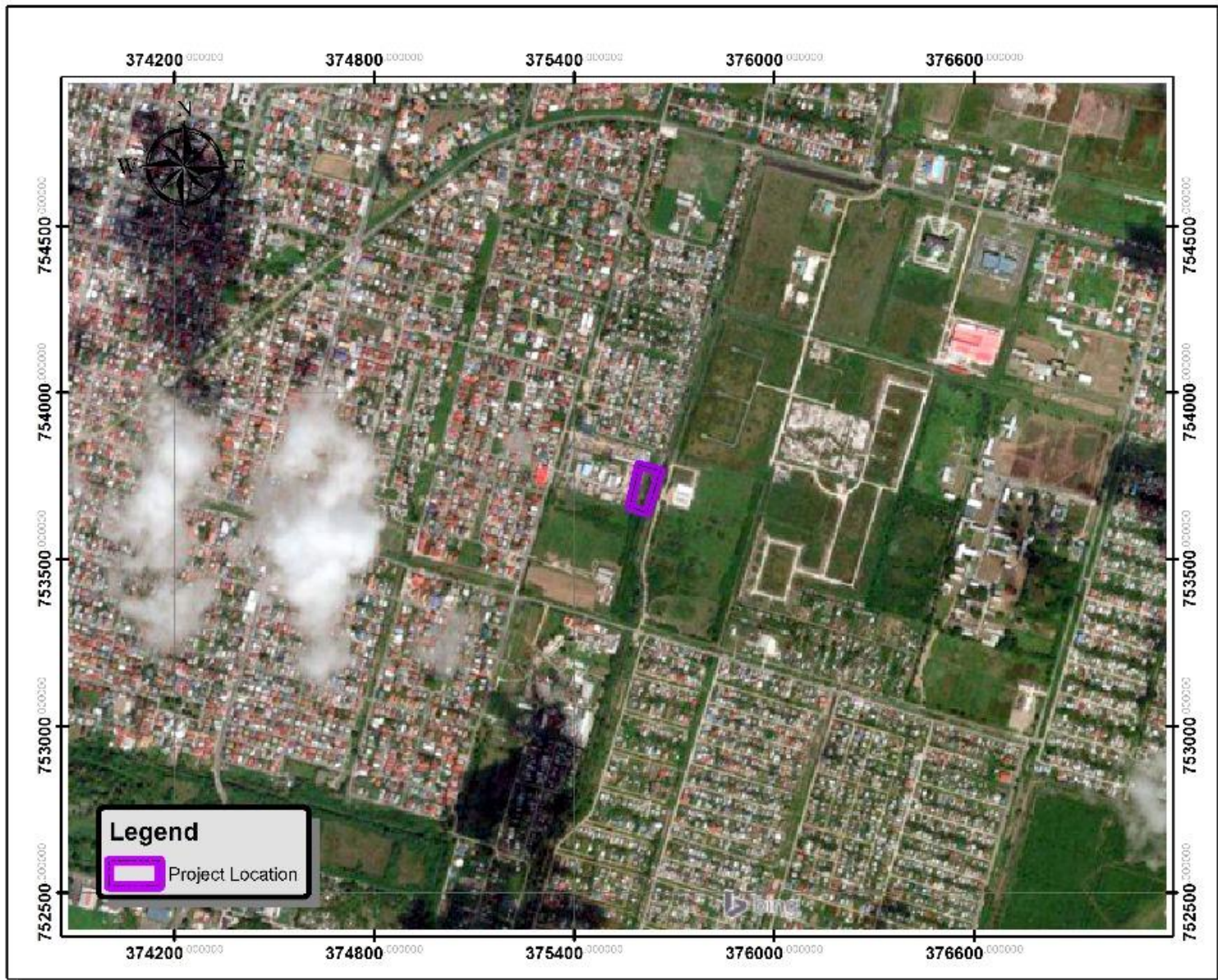


**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Kingston, Georgetown, Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

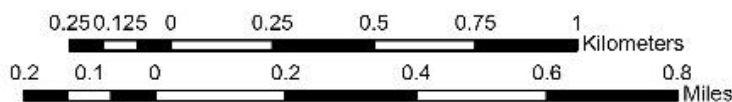
Figure 1: Location of the Kingston Sub-station (Source: Reid, 2018)



# Project Locations (Old Sophia) Map



**SCALE: 1:18,000**



**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Sophia, Georgetown, Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
ENVIRONMENTAL ENGINEERING  
SOLUTIONS (EES) 06-JUNE-2018  
**NOTE:** DRAWING PROVIDED FOR INFORMATION  
PURPOSES ONLY

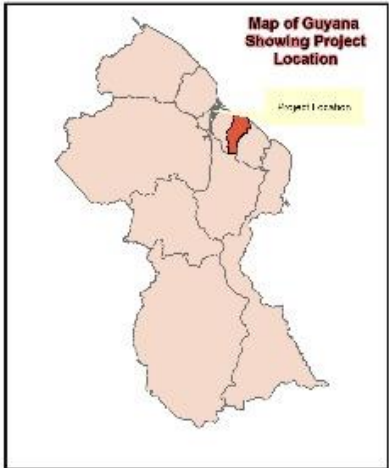
Figure 2: Location of the Old Sophia Sub-station (Source: Reid, 2018)



# Project Location of L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station



**SCALE: 1:31,301**



CLIENT:	Guyana Power and Light Inc. (GPL)
SITE:	Route from Kingston to Sophia Sub-station , Region 4 (Demerara-Mahaica)
DRAWN BY :	Samuel A. D. Reid
	ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018
NOTE:	DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

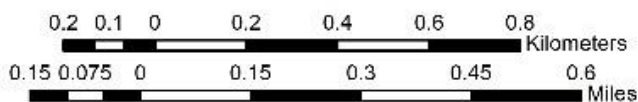
Figure 3:Proposed route of the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Old Sophia Sub-station (Source: Reid, 2018)



# Project Location (New Sophia) Map



**SCALE: 1:16,000**



**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Sophia, Georgetown, Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

Figure 4: Location of the New Sophia Sub-station (Source: Reid, 2018)

### **3 INSTITUTIONAL AND LEGAL FRAMEWORK**

#### **3.1 National Institutional and Legal Framework**

The Government of Guyana, through the Guyana Power and Light Company Inc., is looking for financing from the Inter-American Development Bank (IDB) for the implementation of strategies aimed at improving energy efficiencies and effectiveness, by reducing technical losses and improving the quality of service to consumers in Guyana. This project, which includes the construction and commissioning of a single circuit overhead Transmission Line between Kingston and Sophia Substations, the extension of the Substations to accommodate the new transmission line, and the upgrading of the L5 Conductor, will be implemented within Administrative Region 4 of the country. As an important first step in any developmental project, it is necessary that a comprehensive review of the institutional and legislative framework be conducted so as to ensure that the initiative is consistent and fully compliant with all national and international requirements. With this in mind, the specific institutional and legislative arrangements in Guyana that are of relevance to this project are:

##### *Land-related Provisions*

1. State Lands Act 1903
2. Local Democratic Organs Act 1980
3. Municipal and District Councils Act 28:01
4. Town and Country Planning Act 2001
5. National Land Use Plan 2013

##### *Environment-related Provisions*

1. Constitution of the Cooperative Republic of Guyana Act 1980
2. National Environmental Action Plan 1994
3. Environmental Protection Act 1996
4. Environmental Protection (Authorisation) Regulations 2000
5. Environmental Protection (Water Quality) Regulations 2000
6. Environmental Protection (Air Quality) Regulations 2000
7. Environmental Protection (Hazardous Wastes Management) Regulations 2000
8. Environmental Protection (Noise Management) Regulations 2000
9. Environmental Protection (Litter Enforcement) Regulations 2013
10. Pesticides and Toxic Chemicals Control Act 2000
11. Wild Birds Protection Act 1919
12. Species Protection Regulations 1999
13. Wildlife Management and Conservation Regulations 2013

14. Wildlife Conservation and Management Act 2016
15. Forests Act 2009
16. Forests Policy 2011
17. Low Carbon Development Strategy 2009
18. National Biodiversity Strategy and Action Plan 2012
19. Green State Development Strategy Framework 2017

*Health, Safety and Labour-related Provisions*

1. Labour Act 1942
2. National Insurance and Social Security 1969
3. Occupational Safety & Health Act 1997

*Energy-related Provisions*

1. Guyana Energy Policy 1994
2. Guyana Energy Act 1997
3. Electricity Sector Reform Act 1999
4. Public Utilities Commission Act 1999
5. National Development Strategy 2001-2010

### **3.2 Land-related Provisions**

#### **3.2.1 State Lands Act 1903**

The Act was enacted to provide for the proper regulation of public lands, rivers and creeks of the state. The Act was amended in 1929 and 1953, and later consolidated on January 01, 2012. All state lands fall under the jurisdiction of the Guyana Lands and Surveys Commission (GLSC) which is a national-level institution established on June 01, 2001, through the implementation of the Guyana Lands and Surveys Act, 1999. The GLSC is the custodian of all public lands, rivers and creeks of Guyana and oversees the administration of lands for the development and benefit of land owners and the state.

#### **3.2.2 Local Democratic Organs Act 1980:**

The Act specifically governs the Local Democratic system and makes provision for the establishment of a country-wide system of local democratic power as a vital aspect of socialist democracy. This Act specifically outlines the division of the country into Administrative Regions, each with its own Regional Democratic Council (RDC), responsible for the administration and governance of the prescribed area. This body also has critical responsibility in ensuring safety, health and wellbeing of the people within the respective locality.

### 3.2.3 Municipal and District Councils Act 28:01

The Act makes better provisions for Local Government in the City of Georgetown and other areas of Guyana. It also provides for the establishment and operation of City Councils, including the election of mayor and councillors as well as the acquisition and appropriation of land.

### 3.2.4 Town and Country Planning Act 2001

The Act was developed in an attempt to guide and make provisions for the orderly and progressive development of land, cities, towns and other areas (whether urban or rural) to preserve and improve the amenities within the area.

### 3.2.5 National Land Use Plan 2013

The GLSC has developed a draft National Land Use Plan (NLUP) 2013 which “provides a strategic framework to guide land development in Guyana.” As such, the NLUP is built upon a number of national policies and strategies which are of direct relevance for land use and land management, with one of its main objectives being to enable financial resources to be targeted at optimal land uses at the regional level. Although the NLUP is not prescriptive in that it does not aim to zone areas of the country for particular land uses, it does aim to provide a spatial element to development planning. Through map work, the plan displays what the current situation with regards to land use is in the country, where resources are located, where potential exists and what linkages may be necessary to develop those resources. A draft National Land Use Policy is in existence and provides the policy context for all land uses in the country. Regional land use plans are being developed through a phased process to ensure more localized and contextual land use planning and management.

## 3.3 Environment-related Provisions

### 3.3.1 Constitution of the Cooperative Republic of Guyana Act 1980

The Constitution is considered to be the supreme law of the country. Guyana’s commitment to the environment and sustainable development is enshrined in the Constitution which states that “Every citizen has a duty to participate in activities to improve the environment and protect the health of the nation” and “In the interest of the present and future generations the state will protect rational use of its flora and fauna and will take all appropriate measures to conserve and improve the environment”. Further, the Constitution charges that the wellbeing of the nation depends on preserving clean air, fertile soils, pure water and the rich diversity of plants, animals and ecosystems.

### 3.3.2 National Environmental Action Plan (NEAP) 1994

The NEAP, which was developed in 1994, outlines the Government of Guyana’s main environmental policy objectives for the sound management of the environment and natural resources. Twelve stated policy objectives were outlined in the NEAP, one of which called for the conduct of environmental assessments for proposed development activities that may significantly affect

the environment. In keeping with this environmental policy objective, the Environmental Protection Act was enacted in June 1996 and includes the legal framework for undertaking an environmental impact assessment.

### 3.3.3 Environmental Protection (EP) Act 1996

The EPA Act under which the Environmental Protection Agency (EPA) was established provides for the management, conservation, protection and improvement of the environment. It also has provisions for the prevention or control of pollution, assessment of the impact of economic development on the environment and the sustainable use of natural resources. The Act mandates the conduct of Environmental Impact Assessments for projects with potential significant impacts on the environment.

This Act was amended in 2005 to include a section on record keeping and monitoring requirements. Under this section, any person who releases or engages in the handling of hazardous substances or contaminants is required to:

1. Sample and analyze such contaminant or hazardous substance, or material contaminated by that person for specific constituents or characteristics.
2. Install, use and maintain monitoring equipment, and implement environmental audit procedures as may be specified in any environmental authorization issued pursuant to the Act.
3. Establish and maintain records regarding such sampling, monitoring, and environmental auditing activities.
4. Establish and maintain records regarding pollution control equipment on the premises (including records on control equipment parameters, production variables and other indirect data when direct monitoring is not required).
5. Submit reports including compliance reports and provide such other information as the authority may require.

The EP Act also allows for the development of regulations to govern environmental protection in Guyana. In 2000, five different regulations were enacted under the Act as follows:

- Environmental Protection Authorizations Regulations
- Environmental Protection Water Quality Regulations
- Environmental Protection Air Quality Regulations
- Environmental Protection Hazardous Wastes Management Regulations
- Environmental Protection Noise Management Regulations

### 3.3.4 Environmental Protection (Authorization) Regulations 2000

The Regulations outline the procedure and requirements for issuing Environmental Authorizations (Permit) for any developmental activity which may have adverse impacts on the environment. Due to the nature of the proposed project and the potential negative impacts that



the installation of transmission lines may have on the environment if not properly managed, the Project may be required to have an Environmental Authorisation which will stipulate permitted conditions for ensuring and maintaining environmental integrity of the area before the commencement of activities and throughout the life of the project.

#### EPA's Role in EIAs

The EPA Act mandates four functions of the EPA in relation to environmental assessments. These are:

1. To take such steps as are necessary for the effective management of the natural environment so as to ensure conservation, protection and sustainable use of natural resources.
2. To promote the participation of members of the public in the process of integrating environmental concerns in planning for development on a sustainable basis.
3. To ensure that any development activity which may cause an adverse effect on the natural environment be assessed before such activity is commenced and that such adverse effect is taken into account in deciding whether or not such activity should be authorized.
4. To coordinate environmental management activities of all persons, organizations and activities, including monitoring in accordance with the conditions of the Environmental Authorization.

Further,

the Agency is required to implement several principles of environmental management as part of this process. These include:

1. The "polluter pays principle": the polluters should bear the cost of measures to reduce pollution.
2. The "precautionary principle": where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental degradation.
3. The "strict liability" legal principle: any person who contravenes the Act or its regulations shall be liable to the penalties prescribed thereafter.
4. The "avoidance" principle: it is preferable to avoid environmental damage, as it can be impossible or more expensive to repair rather than prevent damage.
5. The "state of technology" principle: measures protecting the environment are restricted by what is technologically feasible and as technology improves, the improved technology should be used to prevent and repair environmental damage.

#### *The EIA Process*

The process is initiated when an application and a summary of the project is submitted to the EPA for an environmental authorization. The summary includes information on the site, design and size of the project, possible effects on the environment and a non-technical explanation of the project. Following this submission, the EPA provides a list of Consultants to the Developer for review and selection and prepares a project summary for public review. The EPA then publishes a notice of the project summary in at least

onedailynewspaper.Theprojectsummaryismadeavailable to members of the public for a period of 28 days. Within this period, the EPA accepts written submissions from the public including detailed questions and comments which members of the public consider relevant to the deliberation of the EIA.

If considered necessary by the EPA, public consultation meeting(s) is/are held within this 28-day period at which any additional concerns of the public are noted. The EPA then finalizes a Terms of Reference (TOR) for the project and provides it to the approved list of EIA Consultants for preparation of the EIA, which includes a social impact component.

During the EIA process, the Developers and Consultants are required to consult members of the public, interested bodies and organizations and also provide to members of the public on request, and at a reasonable cost, copies of information obtained for the purpose of the EIA. The key objectives of public involvement in the EIA process are to: give the public a voice in project planning; obtain local knowledge, information and ideas; provide information to the people on planned activities to stimulate local interest and involvement in the project; ensure early detection of environmental and social impacts arising from the project; and initiate and establish mechanisms and procedures to enable local people to participate in all phases of the project.

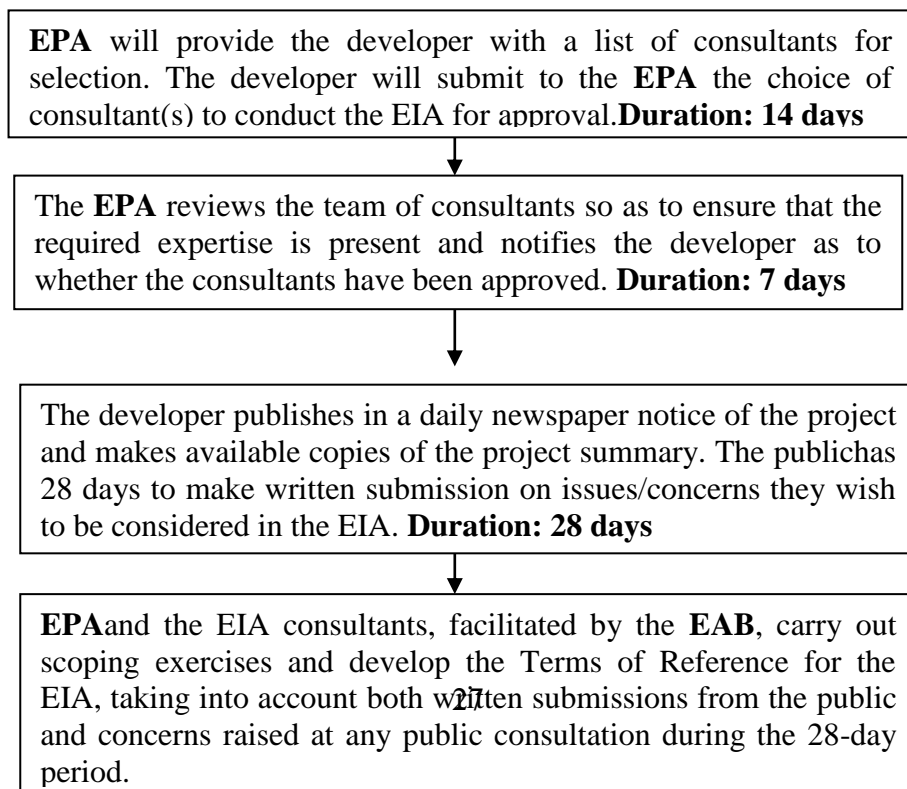
The Developer and Consultant must submit the EIA report along with an Environmental Impact Statement (EIS) to the EPA for evaluation and recommendations. Every environmental impact assessment is required to contain a description of the project, an outline of the main alternatives studied and reasons for choices, a description of significant effects of the development on the environment, an indication of any difficulties encountered by the Developer in compiling information for the EIA, a description of the best available technology, a description of any hazards or dangers which may arise and a risk assessment of same, a description of mitigation measures for any adverse effects, a monitoring plan and an emergency response/contingency plan, and a programme for rehabilitation and restoration.

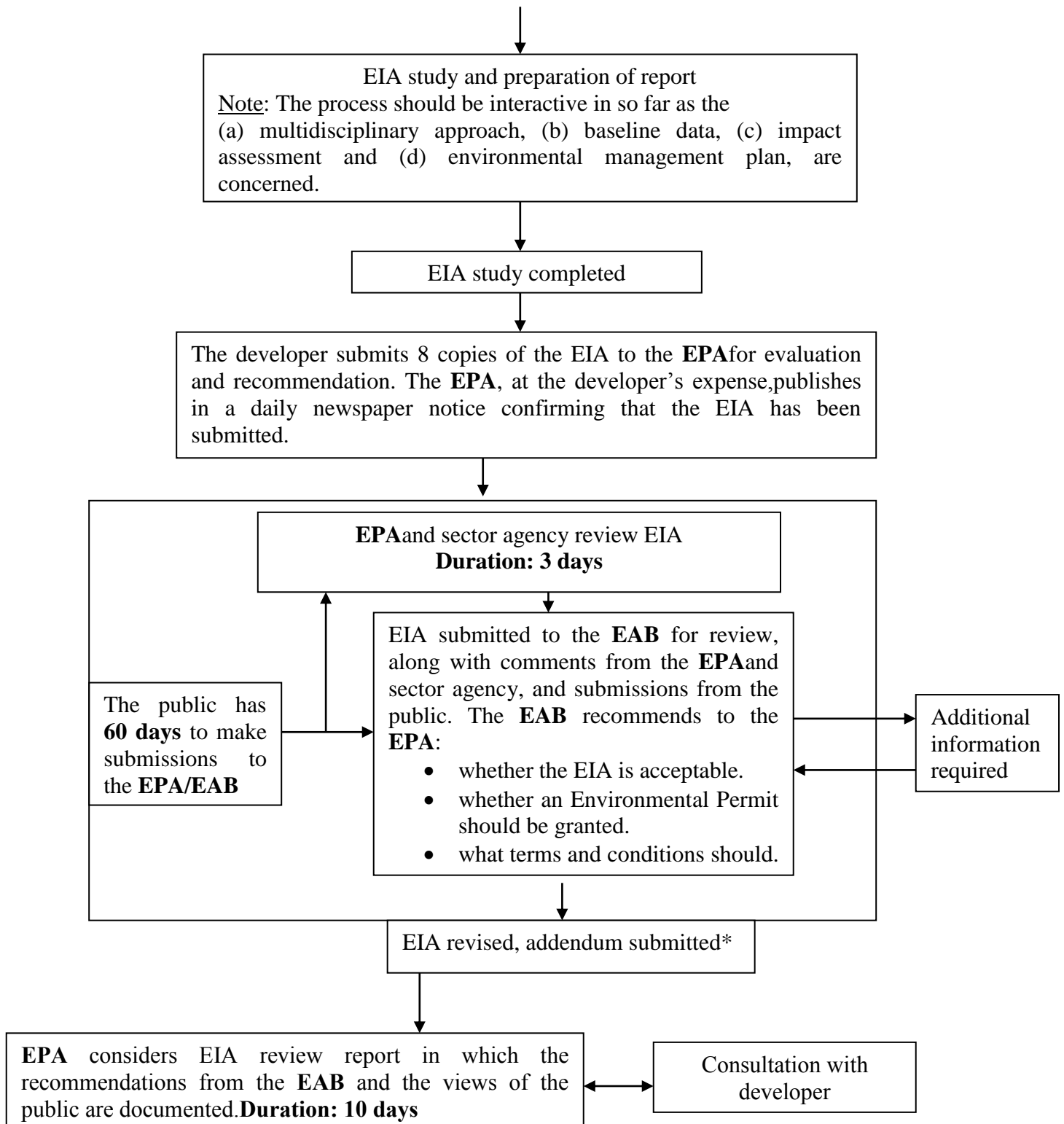
The EIA must be completed in conformation with the TOR and copies submitted to the EPA for review and public comment. The EPA subsequently publishes a notice in at least one daily newspaper notifying the public of the submission of the EIA. The public has 60 days from the publication date of the notice to make submissions to the EPA and/or the Environmental Assessment Board (EAB) related to the EIA. The EAB, being an independent body, is mandated by the EPA to recommend whether the EIA should be accepted, amended or rejected, whether an Environmental Permit should be issued by the Agency, and what terms and conditions should be included in the Environmental Permit. The decision by the Agency to grant an environmental authorization for a project shall be subject to conditions, which are reasonably necessary to protect human health and the environment.

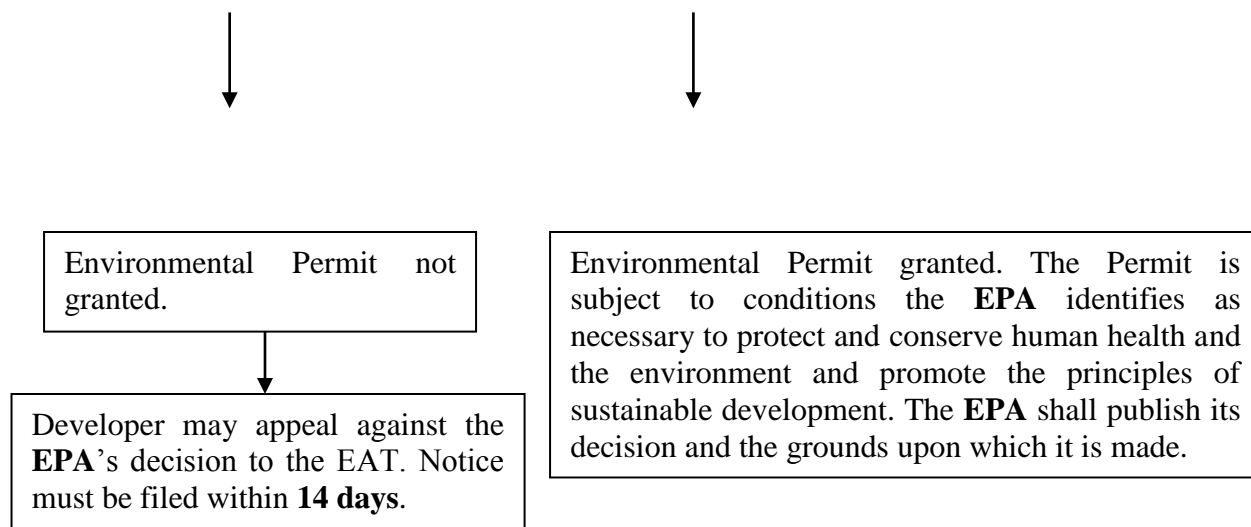
The EPA, along with other relevant sector agencies, reviews the EIA during this 60-day period to ensure that the EIA is in line with any plans, guidelines, regulations or codes of practice developed by the EPA and sector agencies. Copies of the EIA and the findings of the review by the EPA and sector agencies are then passed to the EAB for review and recommendation.

A public meeting, chaired by the EPA, may be held, if considered necessary, at the end of the 60-day period. Additional comments are provided by members of the public at this meeting. A final EIA is prepared to address the comments of the EPA, the sector agencies, the public and the EAB. The EAB will then recommend to the EPA whether the EIA is acceptable and the conditions to be attached to the Environmental Permit, should it be granted.

The EPA takes into account the recommendations of the EAB and sector agencies, comments of the public and its own review, and decides whether or not the project should be approved. For approved projects, the EPA issues an Environmental Permit with the terms and conditions necessary to effectively manage the environment. If an Environmental Permit is not granted, the Developer can file an appeal within 28 days with the Environmental Appeals Tribunal (EAT). The EAT is a superior court of record and has in addition to the jurisdiction and powers conferred by the EPA Act, all the powers inherent in such a court. The Tribunal has the power to enforce its own orders and judgements and the same power to punish contempt as the High Court of Justice. The EAT has the jurisdiction to hear and determine appeals against the refusal of an Environmental Permit, the requirement of an Environmental Permit and the cancellation or suspension of an Environmental Permit. However, while the Act mandates the EAT as the final authority in the process, an actual EAT does not currently exist. The EIA process, as described in this section is illustrated in Figure 5 below:







*\*Depending on the significance of the information requested, the EIA may need to be re-submitted either as a revised document or as an addendum to the EIA.*

**Figure 5: Flow Chart of the EIA required process established by the EPA**

### 3.3.5 Environmental Protection (Water Quality) Regulations 2000

The Regulations was established to protect the country's inland and coastal water resources by controlling and managing effluent discharge. These regulations require that any developer who is desirous of commencing any operation, construction, modification and/or extension of a facility which discharges or has the potential to discharge effluent must first apply for an Environmental Authorisation. The regulations further state that effluents discharged in inland/ coastal water or land shall not exceed established discharge parameter limits set by the Guyana National Bureau of Standards (GNBS) as follows:

**Table 2: General Environmental Guideline Values for Effluent Discharge (Source: GNBS 2002)**

CATEGORY	GNBS LIMITS	CATEGORY	GNBS LIMITS
pH	5.0 – 9.0	CN total (Cyanide)	< 1 free: 0.1
Temperature	< 40	Phosphate (PO <sub>4</sub> )	--
BOD for 5 days	< 50 mg/L	Chlorine (Cl)	< CL: 0.2
COD	< 250 mg/L	Surfactant	--
DO	--	Phenols	< 0.5 mg/L
TSS	< 50 as TSS	Coliforms	< 400 MPN per 100 mls
N as NH <sub>3</sub>	< 10 mg/L	Oil and Grease (O&G)	< 10 mg/L
Total N	--	Metals	--
Phosphorous (P)	< 2 mg/L		

The provisions reiterate that there must be the establishment of sampling points; effective record keeping, reporting on effluent discharges, water quality and biological integrity; management of spills/accidental discharges and encouragement of proper disposal/treatment of effluents discharge. This project, therefore, will ensure that there is adherence to the water quality regulations through the implementation of appropriate measures to keep possible discharge within the prescribed limits set by the GNBS. This will not only help to safeguard the environment but will also ensure that the project activities are conducted in keeping with the legal requirements of the country.

### 3.3.6 Environmental Protection (Air Quality) Regulations 2000

The Regulations outlines the allowable amount of air pollutants which may be emitted into the atmosphere. The regulations require that any developer involved in any construction, installation, operation, modification and/or extension of any facility that emits air contaminant must apply for an environmental authorization from the EPA. The regulations also include the air contaminants for which parameter limits are to be established.

Currently, no emission limits have been established in Guyana; nevertheless, this project will seek to ensure that the air contaminants emitted through the installation of the transmission line and the expansion of the substations are controlled and restricted to a minimum value through the implementation of appropriate measures to protect the residents in proximity to power generating facilities, the health of workers and the general environment. The project will also be guided by the ambient air quality standards recommended and used by the EPA.

### 3.3.7 Environmental Protection (Hazardous Waste Management) Regulations 2000

The Regulations was developed with the primary aim of protecting the environment by controlling the discharge of hazardous waste materials. The regulations require that any Developer involved in any operations that generates, transports, treats, stores or disposes of hazardous waste must submit an application for an Environmental Authorisation. The regulations also outline the provisions for reporting, record keeping, emergency preparedness planning and transportation of hazardous waste, while at the same time encouraging that Developers utilise appropriate disposal and/or treatment mechanisms of hazardous waste identified in the regulations.

It is the intention of this project to ensure that all possible precautionary measures required for the safe handling and disposal of hazardous materials/substances are observed in the different stages of development as well as operation of the various substations. This will be done in an effort to ensure that the integrity of the environment is protected and that all workers and nearby residents are protected from negative health-related implications.

### 3.3.8 Environmental Protection (Noise Management) Regulations 2000

The Regulations seeks to manage and control noise emission levels within Guyana. According to these regulations, it is required that any Developer involved in any construction, installation, operation, modification and/or extension of a facility that emits noise must apply for an environmental authorisation from the EPA. The regulations also stipulate that noise decibel levels are not to be greater than the established permissible noise levels/limits of the GNBS which have been adopted by the EPA. This project will take all measures possible so as to ensure that there is adherence to the stipulated noise regulations by implementation of measures, where necessary, to maintain minimal noise levels to protect the environment, to safeguard the health of workers and residents within and around the project site.

**Table 3: Guyana National Bureau of Standards (GNBS) Guideline Values for Noise in Specific Environment (Source: GNBS 2010)**

<b>Categories</b>	<b>Daytime Limits in dB (06:00 – 18:00h)</b>	<b>Night time Limits in dB (18:00 – 06:00h)</b>	
Residential	75	60	
Institutional	75	60	
Educational	75	60	
Industrial	100	80	
Commercial	80	65	
Construction	90	75	
Transportation	100	80	
Recreational	100	18:00- 01:00hr	100
		01:00- 08:00hr	70

### 3.3.9 Environmental Protection (Litter Enforcement) Regulations 2013

Under the Regulations, persons who are found guilty of littering will be charged. The Regulations are enforced by the EPA through its recently established Enforcement and Compliance Division. The Litter Regulations address among other aspects, litter offences, penalties and the power of the local authority to enter premises and to remove derelict vehicles. Under the Litter Regulations, it is an offence to litter in a public place, particularly:

1. To deposit litter in a public place.
2. To deposit litter from a moving vehicle unto a public place.
3. To cause or permit persons to commit offences 1 and 2 above.

Any person/persons found guilty of any of these offences under the Litter Regulations shall be liable to a fine of between fifty to one hundred thousand Guyana dollars (G\$50,000 - G\$100,000) or three months imprisonment. The absence of a waste receptacle is not an excuse under the law. Allowing litter to enter a public place from a vehicle whether it is a bus, car, truck



or trailer is an offence and any person found responsible for such an act will be fined the sum of fifty thousand Guyana dollars (G\$50,000). If the person that committed the offence cannot be determined, then the driver of the vehicle will be held responsible. If it is a company or organization committing such an offence then it shall be fined one hundred thousand Guyana dollars (G\$100,000). This Project will ensure that there is adherence to the stipulated litter enforcement regulations by implementation of measures where necessary to protect the environment from solid waste pollution at the project site.

#### 3.3.10 Pesticides and Toxic Chemicals Control Act 2000

The Act, which established the Pesticides and Toxic Chemicals Control Board, is intended to regulate the manufacture, importation, transportation, storage, sale, use and disposal of pesticides and other toxic chemicals. In the Act, toxic chemicals are considered as “any disinfectant or any other substance known to be poisonous, corrosive, irritating, capable of causing a sensitive reaction or sensitive to man or animal that is used in agriculture, the arts, commerce or industry or for any domestic or other purposes”.

#### 3.3.11 Wild Birds Protection Act 1919

The Act provides for the protection of certain wild birds, and includes stipulations for addressing the wounding, capturing or killing of wild birds, the protection of captive birds, and the issuing of licences to kill or export wild birds.

#### 3.3.12 Species Protection Regulations 1999

The Regulations seek to provide protection of particular species of prescribed flora and fauna by taking steps that are necessary for the protection of endangered species of animals and plants against over-exploitation through importation and exportation. Currently, there is no official wildlife policy, however, Guyana is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This Convention seeks to protect endangered species from over-exploitation by tightly controlling trade in live or dead animal or animal parts through a system of permits.

#### 3.3.13 Wildlife Management and Conservation Regulations 2013

The Regulations seek to provide for the management and conservation of wildlife, to regulate the capturing, gathering, collecting, hunting, killing or taking of wildlife, for any purpose and use, including but not limited to bush meat, scientific research, and medicinal purposes; and to make appropriate arrangements for the classification of wildlife and areas in Guyana.

### 3.3.14 Wildlife Conservation and Management Act 2016

The Act provides for the protection, conservation, management, sustainable use, and internal and external trade of Guyana's wildlife. It applies to all wildlife species including those that are listed under Appendix I-III of the CITES. The Act establishes the Guyana Wildlife Conservation and Management Commission, a body corporate, designated as the CITES Management Authority of Guyana and a Wildlife General Fund to fund the operations of the Commission. It also establishes the Wildlife Scientific Committee which is tasked with, among other things, advising the Commission on the importation, exportation, re-exportation and introduction from the sea, the commercial importation and exportation of wildlife, the establishment of quotas, and the conduct of relevant research for the protection of species of wild fauna and flora.

### 3.3.15 Forests Act 2009

The Act seeks to repeal and replace the Guyana Forestry Act 1979, re-establish the Guyana Forestry Commission (GFC) and provide for incidental matters relating to forest and forest resources. It focuses on the utilization and conservation of Guyana's forests and mandates the GFC to regulate the harvesting, marketing, export and transportation of timber. The Act also empowers the

Minister responsible for the forestry sector to make regulations governing the harvesting of forestry produce, the operation of sawmills, restricting the exploitation of certain species and other matters related to the state forest. Additionally, the GFC is required to consult with the GLSC before issuing any forest concession agreement.

### 3.3.16 Forest Policy 2011

The

National Forest Policy's overall objective is to conserve, protect, manage and utilize the nation's forest resources, while ensuring that the productive capacity of the forests for goods and services is maintained or enhanced. This project will include the utilisation of forest produce emanating from state forest area and as such it is intended that measures will be put in place to ensure that the sourcing and usage of these resources are assessed, and all legal requirements are strictly followed.

### 3.3.17 Low Carbon Development Strategy (LCDS) 2009

In 2009, the former President of Guyana set out a vision to forge a new low carbon economy in Guyana. The vision was translated into a national low carbon development strategy, which aims to achieve two goals. These include the transformation of Guyana's economy to deliver greater economic and social development for the people of Guyana by following a low carbon development path; and the provision of a model for the world on how climate change can be addressed through low carbon development in developing countries, if the international

community takes the necessary collective actions, especially relating to REDD Plus. Following the election of a new Government in 2015, steps have been taken to develop a Green State Development Strategy which is intended to be a more comprehensive strategy that sets out Guyana's path to achieving a green economy.

#### 3.3.18 National Biodiversity Strategy and Action Plan (NBSAP) 2012

The Government of Guyana adopted its first National Biodiversity Action Plan (NBAP I) in 1999, reviewed it in 2005, and developed its second NBAP in 2007 (NBAP II). The third NBSAP was later developed in 2012 and covers the period 2012-2020. This strategy and action plan which serves as the strategic framework for biodiversity management in the country, has nine strategic objectives. It also outlines key priority actions for implementation including the review of existing legislation and outcomes of EIAs and their roles in protecting biodiversity.

#### 3.3.19 Green State Development Strategy (GSDS) Framework 2017

The draft GSDS Framework provides an overview of the current economic, environmental and social context within Guyana. The document is a consolidation of the relevant goals and targets and an outline of the strategic areas to be developed with expert groups and through broad national multi-stakeholder consultations. The GSDS Framework is built on past strategies and lays out the elements to be examined and consulted upon during the course of the GSDS's development. These include green infrastructural transformation; development of new climate resilient infrastructure, sustainable management of natural resources including establishment of conservation areas, renewable energy transition, capacity building for human development through the acquisition of green skills, and improved institutional governance and international cooperation for green trade and investment. The process for the development of the GSDS is ongoing.

### **3.4 Health, Safety and Labour-related Provisions**

#### 3.4.1 Labour Act 1942

The Act provides for the establishment of the Department of Labour, and for the regulation of the relationship between employer and employees. The Act stipulates and establishes procedures regulating wages paid; minimum rate wages payable; hours of work; the rights and obligation of the employees; and provides for settlement of differences between employees and employers. This project intends to comply with Guyana labour laws and policies to protect and safeguard the welfare of all the staff employed by the project.

### 3.4.2 National Insurance and Social Security 1969

The Act establishes the National Insurance and Social Security system, which covers and protects workers. The persons/individuals to be insured under this Act by payment of contributions are those persons who are sixteen (16) years and older, under sixty (60) years of age, self-employed, and gainfully employed. The National Insurance and Social Security system provides benefits for old age, invalidity, survivors' benefits, sickness, maternity, funeral and industrial benefit. The National Insurance Scheme (NIS) is the social security organisation in the country, which maintains a system of social security by securing contributions from both employees and employers to generate benefits during sickness and accidents. The NIS also provides other benefits in keeping with the provisions of the Act.

### 3.4.3 Occupational Safety and Health Act 1997

The Act provides for the registration and regulation of industrial establishments/operations to ensure the occupational safety and health of all workers, and inevitably prevent, as far as possible, avoidable injuries due to negligence and/or oversights in safety. The Act stipulates that companies and employers must ensure that measures are implemented to ensure the safety of all operating facilities and machinery, the provision of sufficient ventilation, lighting, sanitary facilities and access to potable water; the identification of hazardous chemicals, physical and biological agents to be used during operations of the facility, and regulation of both the usage and storage of these. The Ministry of Labour, Human and Social Security is responsible for regulating the relationship between employers and employees. It also ensures that occupational safety and health standards are maintained in the workplace, and provides public support programmes for suicide prevention, childcare protection, and human trafficking prevention, special cases such as disabilities, domestic violence, and rape. It also provides old age pension for the elderly.

## 3.5 Energy-related Provisions

### 3.5.1 Guyana Energy Policy (Draft) 1994

The main objectives of the draft National Energy Policy of Guyana are to:

1. Provide stable, reliable and economic supply of energy.
2. Reduce dependency on imported fuels.
3. Promote where possible the increased utilization of domestic resources.
4. Ensure energy is used in an environmentally sound and sustainable manner.

Given the evolution of Government's priorities over the years, an updated Policy is prescribed. This new Policy takes into consideration the growing concerns about climate change and

environmental sustainability, the recent cost reductions in renewable energy technologies, and the maturity of energy efficiency technologies and techniques.

The suggested overall objectives of the new National Energy Policy of Guyana are to:

1. Position the energy sector as an engine of national economic growth using a green development strategy that contributes to the achievement of the Millennium Development Goals.
2. Minimize the foreign exchange cost of energy to the national economy.
3. Increase the efficiency of energy use per unit of Gross Domestic Product.
4. Diversify away from imported fossil fuels in the national economy with the deployment of indigenous renewable energy resources.
5. Enhance environmental sustainability by minimizing the local and global negative environmental impact of the energy sector.
6. Attain universal access and equitable geographical distribution of green energy services at the least cost to consumers.
7. Establish a regional export trade of green energy services and commodities.
8. Develop the oil and gas sector for export.

### 3.5.2 Guyana Energy Agency Act 1997

This Act came into effect in 1998 and established the Guyana Energy Agency (GEA), which falls under the purview of the Minister of Public Infrastructure. The GEA has responsibility for advising and recommending to the subject minister methods to secure effective management of energy and sources of energy, and for the development and utilization of alternative sources of energy. The Agency has responsibility for development and implementation of the National Energy Policy and also acts as a consultative body to the minister as it relates to instructions for compliance in energy matters. Additionally, the GEA is responsible for conducting research into more effective sources of energy and utilization of energy.

Another key function of the GEA is to monitor the performance of the energy sector. Among the parameters monitored are energy production and the importation, distribution and utilization of petroleum and petroleum products. It also reviews the exploration, production, recovery, processing, transportation, distribution, sale, purchase, exchange and disposal of energy and sources of energy. The Agency is mandated to formulate and implement measures to optimize energy utilization in Guyana. This mandate includes regulating or prohibiting the production, supply, acquisition or use of energy or sources of energy and prescribing technical standards, procedures and guidelines for the storage, production, processing and distribution of energy or sources of energy. It also establishes standards for persons employed in the energy sector and has authority to compel any producer, importer, distributor or consumer of energy to provide

information pertaining to energy or sources of energy within a reasonable time. As such, the installation of the new transmission line and the expansion of the substations will have to be regulated by the GEA in accordance with this Act.

### 3.5.3 ElectricitySectorReformAct1999

This Act established the licensing requirements to be adhered to by a commercial entity supplying electricity to any person, premises or geographical areas.

The Act further sets out the conditions which must be satisfied for the issuance of a license to an Independent Power Producer (IPP) for the generation of electricity for sale to a public supplier.

In addition to the standard terms and conditions stipulated in the Act, other key provisions that may be included in a license to supply electricity are:

- The activities permitted to the licensee i.e. generation, storage, transmission, distribution, furnishing or sale of electricity;
- The authorized area for public supply of electricity;
- In the case of a license for supply for private purposes the person or persons, or premises to which electricity may be supplied;
- Enforcement of duties by way of penalties and revocation of license; and
- Limitation on or mechanism for calculation of price to be charged by the licensee for the supply of electricity; and provisions with respect to breaking up of any street in any area or part of area and alteration of the position of any pipes or wire under the street.

The Act

further details the procedure for application, modification and extension of licenses to supply electricity. In accordance with the Act, the subject minister enforces compliance and can compulsorily acquire land for and on behalf of a supplier so as to give effect to the license. The Act also provides for the application of either North American or European technical standards to every license granted subject to modification, restriction or exception. Rates for the supply of electricity are fixed in accordance with the Act and the Public Utilities Commission Act 1999.

### 3.5.4 PublicUtilitiesCommission (PUC)Act1999

This Act established the Public Utilities Commission which is a body corporate that acts as an advisory body to the subject minister. The Act regulates persons (entities) who own or provide services which include production, generation, storage, transmission, sale, delivery, furnishing or supplying of electricity directly or indirectly to the public and the conveyance or transmission of oral, written, digital or other form of messages and telecommunications and other services as

specified by the responsible Minister. The Commission can initiate and conduct investigations into the operations and standard of service of any public utility.

The PUC performs regulatory, investigating and enforcement functions and has established an office for research. The Commission is authorized to prescribe, after a hearing on its own motion or upon a complaint that adequate and reasonable service be provided by the public utility. It may render the public utility liable in damages for loss and damages suffered by a consumer due to failure of the public utility to provide an adequate and reasonable service. Further, it has the authority to order the public utility to take appropriate measures to remedy any inadequacy in service and to approve development and expansion of facilities. The Commission can also sanction a public utility for failure to implement development and expansion programmes.

The PUC regulates rates for services provided by the public utility in accordance with written law and may also provide rules in this regard. In circumstances where the public utility does not itself produce or generate what it distributes, transmits or supplies, the Commission has the power and authority to investigate the costs of such production and generation in order to determine the reasonableness of the rates charged by the public utility. The issuing of securities by any public utility is subject to the prior approval of the Commission. The Commission may also prescribe rules relating to the form of books, accounts, papers and records to be kept by every utility.

### 3.5.5 National Development Strategy (NDS) 2001-2010

The NDS sets out priorities for Guyana's economic and social development policies up to the year 2010. It is based on a technical assessment of the issues and opportunities in all the sectors of the economy and includes components on social considerations. Chapter 39 of the document is dedicated to discussing the main issues and challenges facing the electricity sector and proposes both legislative and policy changes for the reform of the sector. The GSDS is intended to build on the measures contained, and work completed under the NDS.

## 3.6 International Conventions and Agreements

In addition to the national institutional and legal framework, there are several international conventions and agreements that may be of relevance to the project: These include:

- Rio Declaration
- Agenda 21
- United Nations Framework Convention on Climate Change
- Paris Agreement
- United Nations Convention on Biological Diversity

- Protocol Concerning Pollution from Land-Based Sources and Activities
- Protocol Concerning Specially Protected Areas and Wildlife
- Convention on International Trade in Endangered Species of Wild Flora and Fauna
- Basel Convention on the Transboundary Movement of Hazardous Waste and their Disposal
- Montreal Protocol on Substances that Deplete the Ozone Layer
- International Labour Organization Core Labour Standards

### 3.6.1 Rio Declaration

The Rio Declaration on Environment and Development resulted from the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992. The Rio Declaration consisted of 27 principles intended to guide future sustainable development around the world. It confirms the responsibilities of all countries including Guyana to among other principles:

- Use the precautionary approach to prevent environmental degradation (Principle 15)
- Undertake activities having environmental impacts with full public participation (Principle 10)
- Include indigenous peoples and their communities in development projects (Principle 22)

### 3.6.2 Agenda 21

This was also developed from the UNCED and outlines a number of environmental policy and management issues for a more sustainable pattern of development in the 21st century. Four major areas of political action were identified in Agenda 21 – social and economic development, natural resources including fragile ecosystems, major organizations and groups of people, and means of implementation (Selman, 1996). Further, 27 environmental principles for the protection of environmental resources were outlined as the Agenda 21 action programmes. These global principles have since guided the development of a national policy on environmental impact assessment.

The UNCED Conference also initiated global statements on key environmental issues. These include the Framework Convention on Climate Change and the Convention on Biological Diversity to which Guyana is signatory. More recently, Guyana also became one of the first countries to sign on to the landmark Paris Agreement and must therefore consider and comply with these global instruments during environmental impact assessments for development projects.

### 3.6.3 United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC was entered into force on November 27, 1994 to achieve stabilization of greenhouse gas concentrations at a level



that would prevent dangerous anthropogenic interference with the climate system. Further, it required that a acceptable level of greenhouse gas be achieved within a time frame that is sufficient to allow ecosystems to adapt naturally to climate change. In keeping with the provisions of the Convention, a national climate change committee was established, and a national inventory of greenhouse gases was prepared for base-year 1994. Measures related to technology transfer, capacity building requirements, vulnerability assessment and adaptation measures have also been compiled and implemented over the years. More recently Guyana, through the Office of Climate Change, which is also the National Focal Point for the Convention in Guyana, is working to develop a national climate change policy.

#### 3.6.4 Paris Agreement

The Paris Agreement, the first global legally binding climate Agreement, was entered into force on November 04, 2016, and sets out the framework for parties to take measures to limit the global increase in temperature. As a requirement under the Agreement, Guyana prepared and submitted its Nationally Determined Contributions (NDCs) which outline the actions that it will take in its fight against climate change. Under the Agreement, Guyana has made a commitment to pursue alternative energy sources, and has identified a mix of wind, solar, biomass and hydropower to supply both the demand of the national grid and the energy requirements for towns and villages in Guyana's hinterland. This energy mix is expected to help the country achieve national energy requirements and meet its international targets.

#### 3.6.5 United Nations Convention on Biological Diversity (UNCBD)

The UNCBD was entered into force on November 12, 1997 with the main objectives being the conservation of biological diversity (defined as the variability among living organisms from all sources including inland, terrestrial, marine and other aquatic ecosystems and the ecological complexities of which they are part including diversity within species, between species and of ecosystems), the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

The provisions of the Convention apply to areas within the limits of national jurisdiction of contracting parties. Contracting parties are required under Article 7 of the Convention, to identify processes and activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity and to monitor their effects through sampling and other techniques. Parties, are also required, as far as is possible and as appropriate, to establish protected areas or areas where special measures need to be taken to conserve biological diversity. In areas adjacent to these protected areas, environmentally sound and sustainable development should also be promoted. Article 8 requires that degraded ecosystems be rehabilitated and restored, and the recovery of threatened species be done through the development and implementation of plans or management strategies. Contracting parties are also required to regulate or manage relevant processes or activities where a significant adverse effect on biological diversity has been determined.

Article 10 of the Convention calls for the integration of conservation and sustainable use of biological resources in national decision-making, and the support of local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced. The avoidance or minimizing of adverse transboundary effects is also considered important and should be addressed by the introduction of environmental impact assessments of proposed projects that are likely to have significant adverse impacts on biological diversity. The same article also requires the exchange of information and consultation on activities likely to have significant adverse effects on the biological diversity of other States and notification to such States of imminent or grave danger to biological diversity within areas under the jurisdiction of such States. In observance of the Convention, Guyana established the Environmental Protection Agency in 1996, which has since been identified as the National Focal Point of the Convention, to coordinate and implement a programme for the conservation of biological diversity. A third National Biodiversity Strategy and Action Plan was also developed with stakeholders to guide biodiversity management in the country.

### 3.6.6 Protocol Concerning Pollution from Land-Based Sources and Activities (LBS)

The LBS Protocol, which was entered into force on August 13, 2010, is a regional mechanism under the Cartagena Convention (regional agreement for the protection of the Caribbean Sea) that seeks to assist United Nations member states to meet their commitments under the United Nations Convention on the Law of the Sea and the Global Plan of Action for the Protection of the Marine Environment from land-based activities. The Protocol requires contracting parties to develop and implement programmes, plans and measures to prevent, reduce or control pollution of the Convention areas from land-based sources and activities. Parties are required to address the source categories, activities and pollutants of concern listed in Annex 1 to the Convention. Extractive industries and mining are identified as priority source categories and activities while heavy metals and compounds, cyanides and fluorides are listed as primary pollutants of concern. Annex II of the Convention identifies factors to be used to determine effluent and emission limitations and/or management practices.

### 3.6.7 Protocol Concerning Specially Protected Areas and Wildlife (SPA)

The SPA Protocol, which was entered into force on June 18, 2000, is used as a means of regionalizing global conventions such as the UNCBD. The Protocol which also falls under the Cartagena Convention utilizes an ecosystem-based approach to conservation by protecting rare and fragile ecosystems and the endangered species that inhabit these areas. Through its Caribbean Regional Coordinating Unit, assistance is given for the establishment of protected areas to ensure attainment of the objectives of the SPA Protocol to significantly increase the number and improve the management of national protected areas and species in the region and assist the

Governments of the region, on request, to develop guidelines for the establishment and management of such areas.

The Protocol extends to the Convention areas as well as water courses including up to the fresh water limit or watersheds designated by the parties. In the application of protection measures, each party is urged to progressively take such measures in accordance with its national laws and international law as are appropriate for:

1. the regulation or prohibition of the dumping or discharge of wastes and other substances that may endanger protected areas.
2. the regulation or prohibition of coastal disposal or discharges causing pollution, emanating from coastal establishments and developments, outfall structures or any other sources within their territories.
3. the regulation or prohibition of fishing, hunting, taking or harvesting of endangered or threatened species of fauna and flora and their parts or products.
4. the prohibition of activities that result in the destruction of endangered or threatened species of fauna or flora and their parts and products, and the regulation of any other activity likely to harm or disturb such species, their habitats or associated ecosystems.
5. the regulation or prohibition of any activity involving a modification of the profile of the soil that could affect watersheds, denudation and other forms of degradation of watersheds, or the exploration or exploitation of the subsoil of the land part of a marine protected area.
6. the regulation or prohibition of industrial activities and of other activities which are not compatible with the uses that have been envisaged for the area by national measures and/or environmental impact assessments pursuant to Article 13.
7. any other measure aimed at conserving, protecting or restoring natural processes, ecosystems or populations for which the protected areas were established.

### 3.6.8 Convention on International Trade in Endangered Species of Wild Flora and Fauna

The CITES was entered into force on July 01, 1975 and seeks to control the international trade of live and dead animals and plants through the issuance of permits/certificates for such trade. Requirements for the establishment of Scientific and Management authorities; regulation of trade in specific species via permits and certificates and maintenance of records of trade are also detailed in the Convention. The legal obligation under this Convention was established through the development of the Species Protection Regulations 1999 and the Wildlife Management and Conservation Regulations 2013 under the Environmental Protection Act, and more recently the passage of the Wildlife Conservation and Management Act 2016.

### 3.6.9 Basel Convention on the Transboundary Movement of Hazardous Waste and their Disposal:

The Basel Convention, which was entered into force on May 04, 1992, aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes. The Convention was designed specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs). It is also intended to minimize the amount and toxicity of wastes generated. This ensures that toxic waste is managed as closely as possible to the source of generation. Examples of hazardous waste as defined by the Convention are:

- Wastes from the manufacture, formulation and use of wood preserving chemicals;
- Waste pharmaceuticals, drugs and medicines;
- Wastes from the production, formulation and use of organic solvents;
- Waste mineral oils unfit for their originally intended use;
- Waste oils/water, hydrocarbons/water mixtures, emulsions; and
- Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish.

### 3.6.10 Montreal Protocol on Substances that Deplete the Ozone Layer

The Protocol to the Vienna Convention which was entered into force on November 10, 1993 is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion. The protocol is centered around several groups of halogenated hydrocarbons that deplete stratospheric ozone. One of the main targets under the protocol are hydrochlorofluorocarbons (HCFCs), which are ozone-depleting substances that contribute significantly to climate change.

### 3.6.11 International Labour Organization (ILO) Core Labour Standards

The ILO is a United Nations-based organization comprising of trade unions, governments and companies. It produced the Declaration on Fundamental Principles and Rights at Work in which member states agreed to respect, promote and realize core labour standards. The core Labour standards consist of five standards, laid out in eight conventions. Additionally, it calls on companies to respect internationally recognized labour rights namely the right to a living wage based on a regular working week that does not exceed 48 hours; humane working hours with no forced overtime; a safe and healthy workplace free from harassment; and a recognized employment relationship with labour and social protection.

In keeping with the provisions of the legislation described above, a brief overview of the environmental and social studies required under this project, based on the level of socio-

environmental risk to ensure compliance with national, provincial, and municipal legislation is presented in Table 4 below.

**Table 4: Environmental and Social Studies required based on level of socio-environmental risk to ensure compliance with national, provincial, and municipal legislation**

<b>Legislation</b>	<b>Potential Socio-environmental Risk</b>	<b>Level of Risk (High, Medium, Low)</b>	<b>Studies Required</b>
Land-related Provisions	Impacts to Road Use and Safety during installation	Medium	Lands, Livelihood and Living Census
	Potential Impact to vulnerable groups	Low	Population and Vulnerability Census
Environment-related Provisions	Noise and Vibration Impacts from Construction Activities, including transportation of construction equipment	Medium	Noise and Vibration Surveys
	Erosion potential during construction and operation	Low	Geotechnical and Topographic Surveys
	Impacts to threatened species and endangered and ecological communities	Low	Literature Review/Rapid Biological Assessment
	Potential impacts to native vegetation and wildlife habitat	Low	Vegetation Mapping and Analysis
	Impact of dust from construction activities	Low	Air quality Surveys
	Potential impacts from waste during construction	Low	Effluent Site Surveys
Health, Safety and Labour-related Provisions	Transportation, handling and storage of hazardous materials during construction	Low	Assessment of transportation and use techniques, and emergency response schemes
Energy-related Provisions	Energy consumption and greenhouse gas emissions	Low	Energy Consumption Assessment

### **3.7 Compliance with the Directives of the IDB's Policies and Safeguards**

The IDB applies safeguards throughout the life cycle of the project to ensure that its operations are environmentally sustainable. The key requirements for the IDB Environmental and Safeguards Compliance Policy (OP-703) that are relevant to this project are as follows:

- Directive B1: The Bank will only finance operations and activities that comply with the directives of this policy and are consistent with the relevant provisions of other Bank policies.
- Directive B2: The Bank will require the borrower for that operation to ensure that it is designed and carried out in compliance with environmental laws and regulations of the country where the operation is being implemented, including national obligations established under ratified Multilateral Environmental Agreements.
- Directive B3: All operations financed by the Bank will be screened early in the preparation process and classified according to their potential environmental impacts. Any operation that is likely to cause significant negative environmental and associated social impacts, or have profound implications affecting natural resources, will be classified as a Category A. These operations will require an environmental assessment (EA), normally an Environmental Impact Assessment (EIA) for investment operations. Category A operations are considered high safeguard risk. Operations that are likely to cause mostly local and short-term negative environmental and associated social impacts and for which effective mitigation measures are readily available are classified as Category B. These operations will normally require an environmental and/or social analysis according to and focusing on the specific issues identified in the screening process and an environmental and social management plan.
- Directive B4: In addition to risks posed by environmental impacts, the Bank will identify and manage other risk factors that may affect the environmental sustainability of its operations. These risk factors may include elements such as the governance capacity of executing agencies/borrower, sector-related risks, risks associated with highly sensitive environmental and social concerns, and vulnerability to disasters.
- Directive B5: Preparation of Environmental Assessments (EA) and associated management plans and their implementation are the responsibility of the borrower. The Bank will require compliance with specified standards for Environmental Impact Assessments (EIAs) which includes as a minimum screening and scoping for impacts; timely and adequate consultation and information dissemination process; and examination of alternatives including a no project scenario. The EIA should be supported by economic cost benefit assessments of the project's environmental impacts and/or the associated protection measures.

- Directive B6: As part of the environmental assessment process, Category A and B operations will require consultations with affected parties and consideration of their views. Consultations with other interested parties may also be undertaken in order to consider a broader range of expertise and perspectives. Category A operations will be consulted at least twice during project preparation, that is, during the scoping phase of the environmental assessment or due diligence processes and during the review of the assessment reports. For Category B operations, affected parties must be consulted at least once, preferably during the preparation or review of the ESMP as agreed with the borrower.
- Directive B7: The Bank will monitor the executing agency/borrower's compliance with all safeguard requirements stipulated in the loan agreement and project operating or credit regulations.
- Directive B9: The Bank will not support operations, that in its opinion, significantly convert or degrade critical natural habitats or that damage critical cultural sites. Whenever feasible Bank-financed operations will be sited on lands already converted. In addition, the Bank will not support operations involving the significant conversion or degradation of natural habitats unless there are no feasible alternatives acceptable to the Bank; comprehensive analysis demonstrates that overall benefits from the operation substantially outweigh the environmental costs; and mitigation and compensation measures are acceptable to the Bank – that is they are adequately funded, implemented and monitored.
- Directive B10: The production, procurement, use and disposal of hazardous material and substances should be avoided whenever possible and minimised in other cases to avoid adverse impacts to the environment, and human health and safety.
- Directive B11: Bank-financed operations will include, as appropriate, measures to prevent, reduce, or eliminate pollution emanating from their activities.
- Directive B17: Where agreed with the borrower, suitable safeguard provisions for procurement of goods and services in Bank-financed projects may be incorporated into project-specific loan agreements, operating regulations and bidding documents as appropriate to ensure environmentally responsible procurement.

The key requirements for the IDB Disaster Risk Management Policy (OP-704) that are relevant to this project are as follows:

- Directive A2: Bank-financed public and private sector projects will include the necessary measures to reduce disaster risk to acceptable levels as determined by the Bank on the basis of generally accepted standards and practices. The Bank will not finance projects that according to its analysis, would increase the threat of loss of human life, significant

human injuries, severe economic disruption or significant property damage related to natural hazards.

During the project preparation process, project teams will identify if the projects have high exposure to natural hazards or show high potential to exacerbate risk. The findings will be reported to the Bank through the social and environmental project screening and classification process. The risk of exposure to natural hazards will be considered taking into account the projected distribution in frequency, duration and intensity of hazard events in the geographic area affecting the project.

Project Teams will carry out a natural hazard risk assessment for projects that are found to be highly exposed to natural hazards or have a high potential to exacerbate risk. In the analysis of risk and project viability, consideration should be given to both structural and non-structural mitigation measures. This includes specific attention to the capacity of the relevant national institutions to enforce proper design and construction standards, and of the financial provisions for proper maintenance of physical assets commensurate with the foreseen risk.

The key requirements for the IDB Operational Policy on Gender Equality in Development (OP-761) that are relevant to this project are as follows:

- The Bank will actively seek opportunities to mainstream the gender perspective as a strategic dimension of its development interventions and will incorporate actions to address the issue. Within the context of the policy, gender mainstreaming is the process that seeks to have general equality and the needs of women and men be heard and addressed in the design, implementation, monitoring and evaluation of the Bank's interventions with special emphasis on public- and private sector loan operations given their importance within the institution.
- Gender equality mainstreaming will be applied systematically in all Bank development interventions. The Bank will require an analysis of its interventions' potential contribution to general equality. When the analysis so indicates, the Bank will incorporate specific actions to strengthen that contribution.
- The Bank will conduct its financial operations so as to identify and address adverse impacts and the risk of gender-based exclusion, include women and men in consultation processes, and comply with applicable legislation relating to equality between men and women. Its financial operations must, throughout all phases of the project cycle adhere to the safeguards set forth in the policy.
- In designing its operations, the Bank will introduce measures to prevent, avoid, or mitigate any adverse impacts and/or risks of gender-based exclusion identified in the project risk analysis. These risks may include introducing unequal requirements for access to project-derived economic opportunities and benefits, including paid work,



training, credit or business opportunities. Projects will apply the principles of non-discrimination, equal treatment and equal pay for work.

- In its project-related consultations, the Bank will seek the inclusion of the women and men affected in a gender-sensitive and socio-culturally appropriate manner.

The key requirements for the IDB Operational Policy on Indigenous Peoples (OP-765) that are relevant to this project are as follows:

- In its efforts to facilitate dialogue and support the mainstreaming of indigenous issues, the Bank will seek to address the various facets of development with identity, as far as feasible and appropriate. Of particular importance is support for the participation and leadership by and protection of women, the elderly, youth and children and for the promotion of equal rights.
- The Bank will conduct its operations in a way that prevents or mitigates direct or indirect adverse impacts on indigenous peoples or their individual and collective rights or assets.
- The Bank will take into account respect for the rights of indigenous peoples and individuals as established in the applicable legal norms according to their relevance to the Bank operations.

The key requirements for the IDB Operational Policy on Involuntary Resettlement (OP-710) that are relevant to this project are as follows:

- Every effort will be made to avoid or minimize the need for involuntary resettlement. A thorough analysis of project alternatives must be carried out in order to identify solutions that are economically and technically feasible while eliminating or minimizing the need for involuntary resettlement.
- Particular attention must be given to socio-cultural considerations, such as the cultural or religious significance of the land, the vulnerability of the affected population, or the availability of in-kind replacement for assets, especially when they have important intangible implications.

According to the IDB's Policy on Involuntary Resettlement, when displacement is unavoidable, a resettlement plan must be prepared to ensure that the affected people receive fair and adequate compensation and rehabilitation. Based on the field surveys and other on-site assessments, it was determined that the different components under the project, including the expansion of the substations and the installation of the transmission line, do not necessitate involuntary resettlement, land acquisition and any associated compensation of persons, indigenous or otherwise, in the area. The area identified for the expansion of the substations at both Kingston and Sophia, which are both located in the capital city of Georgetown, are currently under the ownership and management of the GPL Company.

### 3.8 Grievance and Redress Mechanism

The IDB has recognized the need for systematic, transparent and meaningful stakeholder consultation processes to improve benefits to local communities and stakeholders and avoid delays in project design and implementation. Meaningful consultations, as a requirement of IDB policies, entails a two-way process of dialogue and engagement, instead of the one-way dissemination of information. One of ten key elements that have been identified by the IDB as critical to any meaningful stakeholder consultation process is the establishment of an appropriate and accessible grievance redress mechanism, which aims to address how stakeholders can seek remedy if they are of the opinion that the project is adversely affecting them or the environment. With this in mind, the elements of an effective grievance and redress mechanism as described and illustrated by the IDB are presented below:



**Figure 6: Elements of an Effective Grievance and Redress Mechanism. (Source: Meaningful Stakeholder Consultations (IDB, 2017))**

Currently, the GPL has grievance redress procedures particularly relating to the delivery of its services which have been used by its customers over the years. The formal process generally follows a letter to the Customer Services Manager of the GPL or the completion of a Claim Form. The GPL only processes claims for compensation from consumers who have legitimate contracts with the company and once the faults/problems are reported immediately to the company's Emergency Unit within the respective district. Additionally, the company is only responsible for damages that are a result of negligence on its part, and only processes claims that are filed within or up to thirty days of the occurrence. If negligence on the part of the Company is established, the complainant is required to provide proof of ownership of property/appliance/equipment damaged/destroyed prior to the settlement of the claim. The GPL also reserves the right to seek an independent assessment of the property/appliance/equipment to determine the extent of the damage caused. Consumers are required to provide details and proof of expenditure incurred to repair/replace property/appliance/equipment and all damaged items

should not be disposed of, until the claim is determined but in the case of perishables until inspected by the Investigators.

In cases where the complaint is not addressed to the satisfaction of the complainant, both in terms of the decision or if the complaint is not resolved within the timeframe stated in the Company's Operations Standards and Performance Targets, the complainant may make a further report to the Georgetown Office of the Public Utilities Commission (PUC) and seek redress. The process as outlined in the PUC's Act 1999 varies depending on the nature of the complaint. All complaints must be in writing and accompanied by the relevant information or documents. If a complainant is experiencing difficulties to read and write, the staff of the PUC will assist the complainant in recording the complaint following which he/she will affix his/her signature to the document. For cases that are outside the scope of the PUC, and in which direct loss or claim cannot be recovered from GPL, the affected person is entitled to compensation as determined by agreement between that person and the Government. In the absence of such an agreement, any compensation shall be determined based on the fair market value of the property or right in the nature of the property by the High Court.

For issues relating to the environment, the complainant can direct complaints to the Executive Director of the Environmental Protection Agency. The EP Act mandates the EPA to conduct investigations and inspections to ensure compliance with the Act and its regulations and investigate complaints relating to breaches of their legal provisions. Depending on the nature of the complaint, the EPA may need to conduct site visits in collaboration with other regulatory authorities such as the Regional Authorities, Mayor and City Council and the Central Board of Health (Public Health Officers and Occupational Health and Safety Department), to determine the level of impact, and outline conditions and measures to ensure the expeditious resolution of the complaint and protection of the environment.

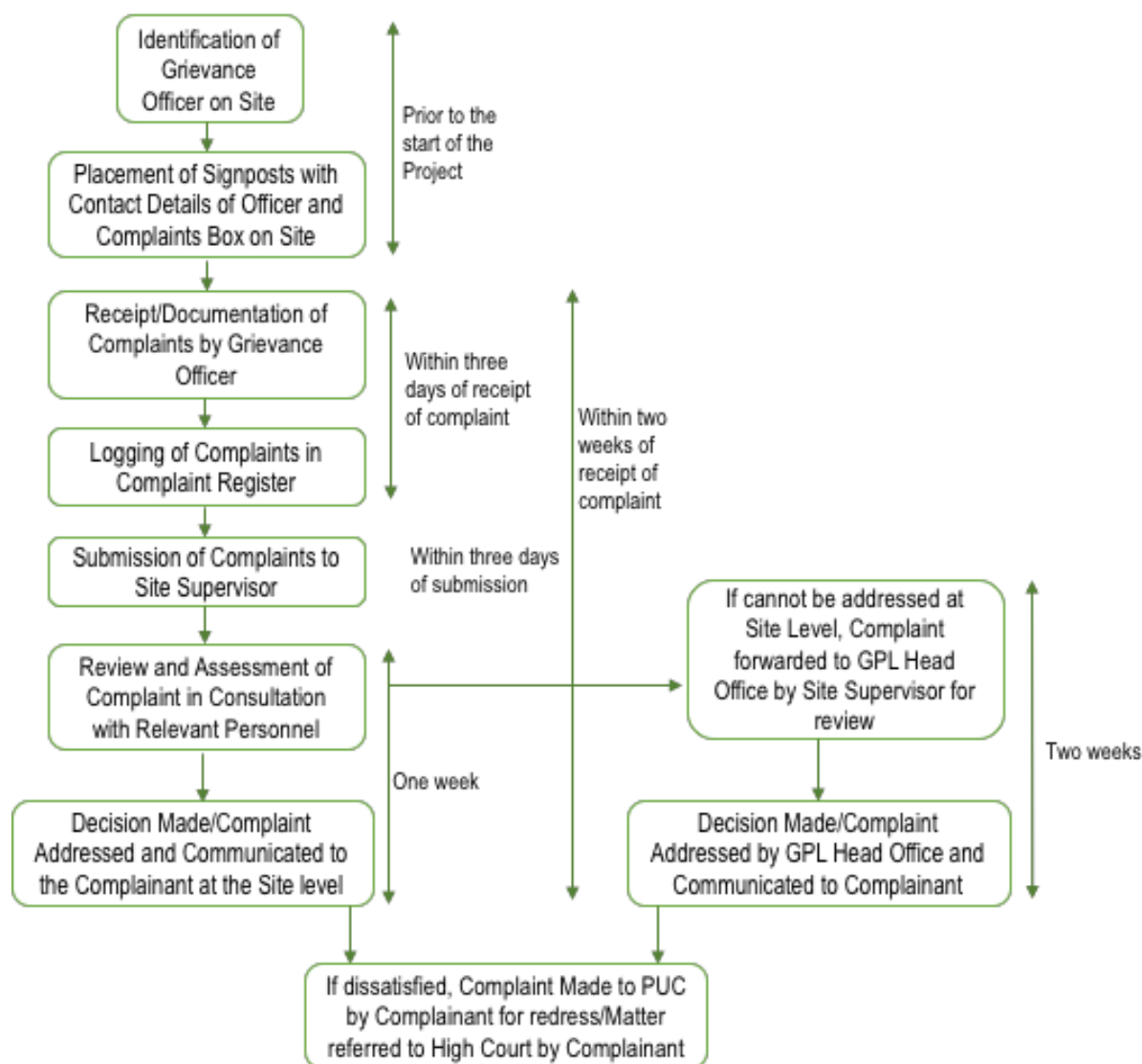
In terms of the activities planned under this project, a localized grievance process is considered to be the most appropriate approach. It is proposed that a Grievance Officer who will be based at the Project site be identified prior to the start of the project to receive all complaints that may come in during the life of the project. Signposts with the contact details of the Grievance Officer should be placed at various prominent positions at the site so as to ensure that the general public can easily access the information. In cases where complainants would prefer to remain anonymous, a grievance box can also be placed at the site to receive complaints.

For complaints that are submitted directly to the Grievance Officer, these can take the form of a letter or in cases where the complainant cannot read or write, particulars of the complainant and the grievance may be documented by the Grievance Officer in a Complaints Form. All of the complaints received by the Grievance Officer should then be logged in a complaint register which should include the date of receipt of the complaint, the complainant's contact information, the subject of the grievance and a description of the grievance. Once the complaints have been documented, these complaints can then be forwarded to the Site Supervisor on a bi-weekly basis for review and action. The complaints box at the site should also be checked at biweekly

intervals and any complaints that are deposited in the box should also be logged and forwarded to the Site Supervisor along with other submissions.

Once the complaints have been received by the Site Supervisor, the complaint should be reviewed and assessed within three days of receipt. Depending on the nature of the complaint, the Site Supervisor may need to consult with relevant personnel on site to determine whether the issues can be resolved at the site level. All complaints that can be resolved at the site level should be done within two weeks of receiving the complaint and the decision should be communicated to the complainant through the Grievance Officer. For complaints that cannot be addressed at the site level, these should be forwarded to the responsible department at the GPL Head Office for action within two weeks. The decision made by the responsible department at the Head Office should be communicated to the complainant at this time.

In cases where the complaint is not addressed to the satisfaction of the complainant, both in terms of the decision or if the complaint is not resolved within the allocated timeframe, the complainant may report the matter to the PUC for redress in keeping with the process outlined above. If the complainant is still not satisfied with the outcome of this process, the complainant may seek further redress in the High Court. The grievance and redress mechanism as described here is further illustrated in Figure 7 below.



**Figure 7: Overview of Grievance and Redress Mechanism Proposed under this Project**

## 4 NATURAL ENVIRONMENT

This section provides a detailed overview of the project's natural environment. It includes a description in relation to the general project location, that is, the capital city of Georgetown; and the specific project sites located at Kingston and Sophia. It also considers the reserves between the two areas, as they will be influenced by activities implemented under the project. As Georgetown is influenced by natural features beyond its boundaries, this chapter also considered those applicable characteristics of the natural environment to provide additional context as well as to strengthen a holistic understanding of the project area. In general, the city is situated along the Atlantic coastline, at the mouth of the Demerara River on the eastern bank. The methodology used in the development and elaboration of this section was based on: a review of existing

information contained in national reports, plans and strategies; scientific publications; and discussions with resource persons.

#### **4.1 Topography and Soils**

Georgetown is situated within the flat coastal belt of Guyana, one of the five physiographic regions mapped for Guyana by the Food and Agriculture Organisation of the United Nations in 1996 (GL&SC 2013); see map of physiographic regions in Figure 8). Georgetown is bounded to the north by the Atlantic Ocean and to the west by the Demerara River, one of Guyana's primary rivers, which flows northward into the Atlantic. The coastal belt's flat morphology characterizes the estuarine zone of lower Demerara River and extends many kilometres south of Georgetown. Another of the main characteristics of Georgetown is that its topographical height lies below mean sea level (Remmers-et.-al. 2016). In fact, much of the coastal belt lies at 0.5 to 1 meters below sea level (GL&SC 2013), necessitating a high level of infrastructure such as sea defences, kokers, canals and drains, to mitigate the risks associated with flooding and to effectively drain the city and other areas within the coastal belt. In addition to its low-elevation, the coastal belt is also narrow, ranging between 8 and 65 km in width along its 440 km stretch (from the Corentyne River in the east to Waini Point in the west). Considering this variable width, the National Land Use Plan, 2013, notes that coastal plain exhibits variation in its elevation: 'east of the Essequibo River the plain consists of recent and old sediments with recent deltaic and fluvio-marine clays and silts occurring on the coast with silty clays and sands inland. The recent plain occurs at elevations of 2m below to 3m above sea level with sandy old beach ridges forming higher ground. The older coastal plain lies at an altitude of about 3 to 9 m above sea level. The land on which present day Georgetown sits is historically associated with sugarcane plantations, which is reflected in its network of drainage canals originally developed to irrigate and drain these plantation areas. Urbanisation of the area over several decades resulted in further alteration of the landscape - for instance paving of previously pervious surfaces to build and expand road networks, conversion of navigation waterways to drainage channels, and expansion of housing and commercial infrastructure to facilitate population growth and expanding commerce.

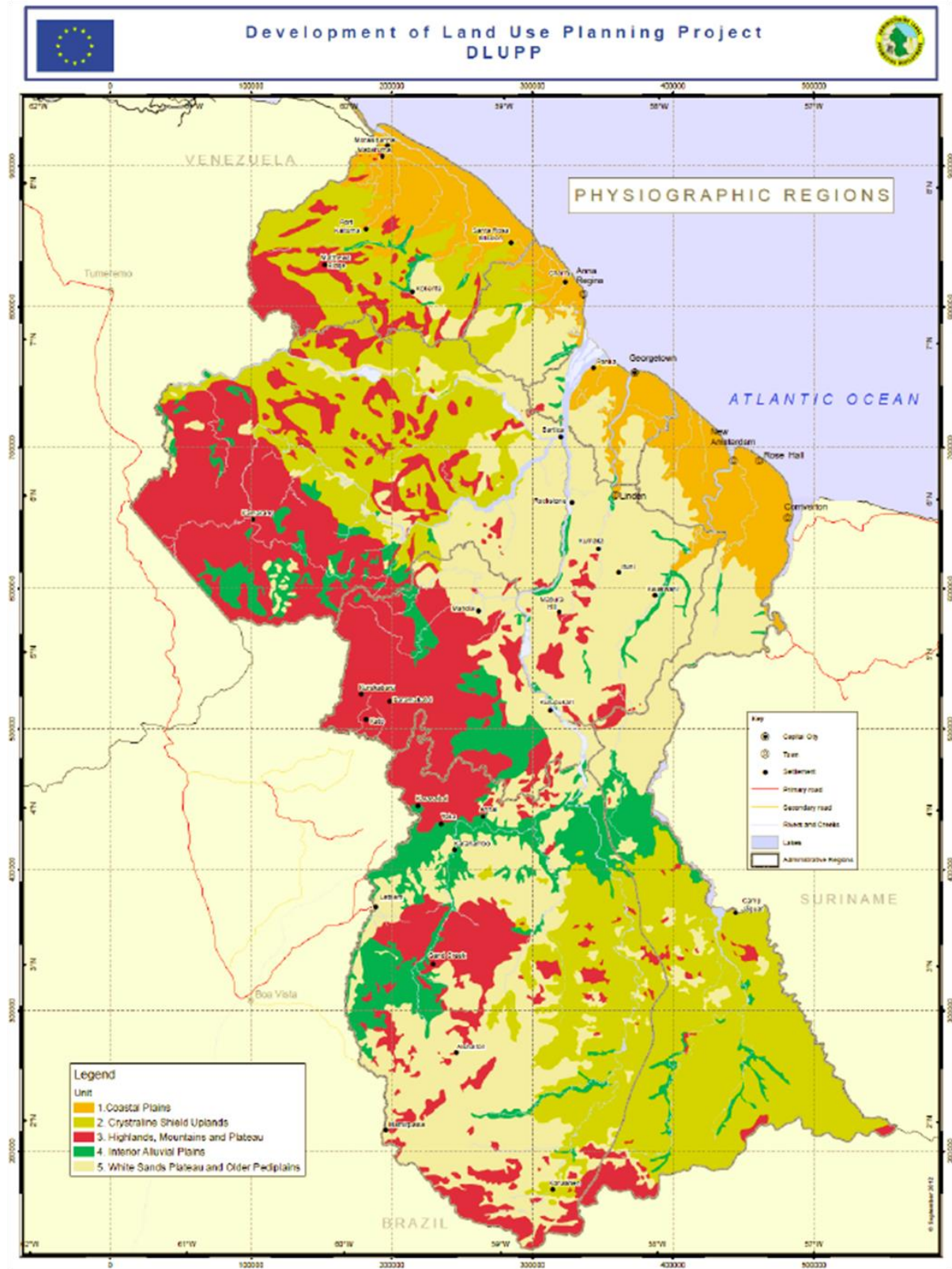


Figure 8: Physiographic regions of Guyana. Georgetown is located in the flat Coastal Plain, at the mouth of the Demerara River (GoG, 2013).



Soils are an important feature of the coastal belt. Guyana's coast is rich in alluvial soils which support agriculture (sugarcane, rice, fruit and vegetable cultivation) which is an key component of national and local-scale economies. The National Land Use Plan (2013) mapped the soils of the coastal plain as follows:

- a. **1a** Low humicgleys of high base status, marine phase "frontland clay" (Hydraquents with Sulfaquents, Fluvaquents)
- b. **2a** Low humicgleys of high and medium base status, fluvio marine phase, riverine soils (Fluvaquents with Endoaquents, Medhemists)
- c. **3a** Bog soils, peat and muck phases, deep pegasse (Medihemists with Sulfohemists, Medisaprists)
- d. **4a** Low humicgleys of low base status, including groundwater laterites and planosols (Endoaquepts with Fluavaquents, Sulfaquepts)
- e. **5a** Groundwater laterites (Humaquepts with Endoaquepts, Fluvaquents, Psammaquents)

However, types **1a** and **2a** identified above are specifically associated with Georgetown and the project sites, and are described as follows in the National Land Use Plan (2013):

***Low humicgleys of high base status, marine phase "frontland clay" (Hydraquents with Sulfaquents, Fluvaquents)***

Soils of this type mainly occur on the coastal plain of eastern Guyana from the Essequibo to the Corentyne river stretching some 32km inland in places. It consists relatively fertile, poorly drained clay soils developed on unconsolidated sediments with associated sandy 'reefs' that are old beach ridges. Some saline soils and organic 'pegasse' soils also occur in patches. The soils need drainage prior to agricultural production but are relatively fertile. The main limitations for agriculture are the need for drainage, occasional areas of salinity and acid sulphate, and aluminium toxicity. In much of the coastal plain these soils have a land use of rice and sugar with coconuts on the sandy reefs. Where not developed for agriculture the vegetation is one of mangrove and swamp forest and marshy grassland.

***Low humicgleys of high and medium base status, fluvio-marine phase, riverain soils (Fluvaquents with Endoaquents, Medhemists)***

Soils of this type are poorly drained, deep, silty loam to silty clay over clay textured soils that have developed over alluvial deposits. They occur mainly between the Berbice and Corentyne rivers, along the Demerara river as far south as Linden and 100km up the Berbice river and at the Essequibo river mouth. The soils have moderate to high fertility which decreases away from the coast. The need for drainage is the main limitation. The soils are extensively cultivated with rice



and sugar the main crops but with a natural vegetation similar to that described above(that is, mangrove forest and swamp forest and marshy grassland) where not cultivated.

## **4.2 Hydrological Situation**

Due to Georgetown's geographic location, it experiences influences of large quantities of brackish to saline water that are available along the coastal areas due to tidal influences of the rivers, streams, coastal marshes, mangrove swamps and tidal lowlands (EPA 2016). Specifically brackish to saline water can be found along the Atlantic Coast and parts of the Demerara River (this saline to brackish water is also associated with the Essequibo, Mahaica, Mahaicony and Berbice Rivers). Mangroves are a key component of these types of aquatic environments along the coast - not only for coastal protection but also for fisheries and other faunal communities which they support. This is further discussed in the section below which focuses on biological resources. However, mangroves along Georgetown's coastline are severely degraded and very limited due to decades long history of land use change resulting from the expansion of the city. Supplies of potable surface water to serve Georgetown comes from one main source - the Lama Canal. This canal feeds the water treatment plant located at the Guyana Water Inc.'s main office in Georgetown before being distributed to West Ruimveldt, Charlestown, Albouystown, La Penitence, Kitty Public Road, Kingston, Water Street, Meadow Bank, Atlantic Ville, Crown Dam, Sophia water treatment plant areas and Durban Backlands (EPA, 2016). Potable surface water supplies about 10 percent of the coastal residents(EPA, 2016).

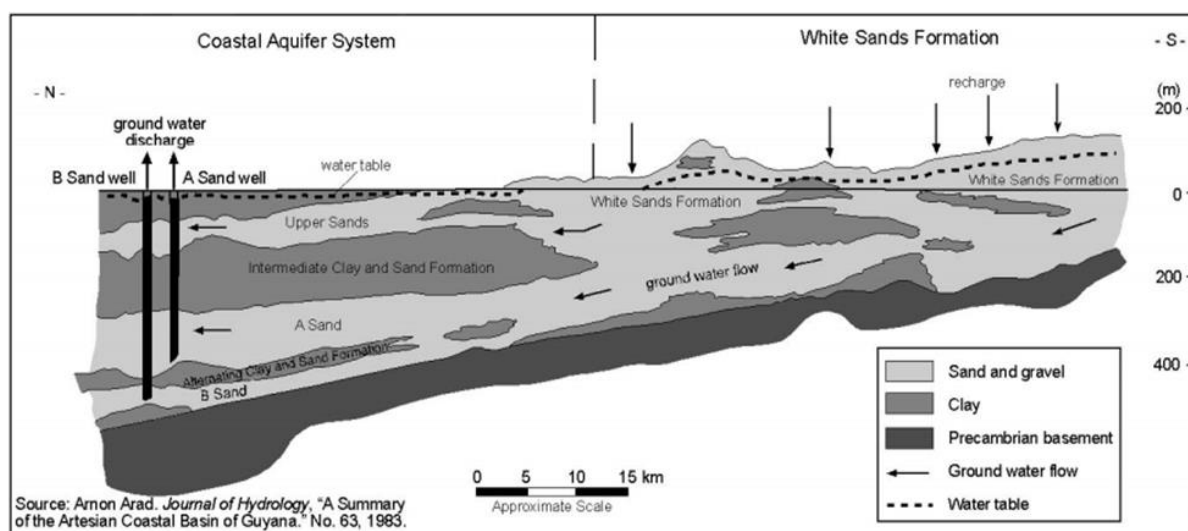
Fresh groundwater is the most important and reliable source of water for public use and is abundant along the coastal lowlands and foothills and the coastal aquifers supply water to the 90% of the population residing in the coastal area region. The coastal aquifer system consists of a series of three separate but hydro-geologically connected aquifers, which has been providing freshwater to residents for several decades. Excessive dewatering of these aquifers over the years has resulted in saline water intrusion becoming a concern in recent years (EPA, 2016). The coastal aquifer system occupies a subsurface area of about 20,000 square kilometres, extending about 250 kilometres along the Atlantic coast and 40 to 150 kilometres inland (Spillman et.al. 1998). Sediments reach a thickness of 1,800 meters onshore and become progressively thicker offshore and towards the east. The three aquifers are named, from upper to lower, the "Upper Sands", the "A Sand" and the "B Sand". Overlying layers of clays confine the lower two aquifers, protecting them from contamination from external sources (Spillman et al. 1998). The "Upper Sands" aquifer is 30 to 60 m deep and ranges in thickness from 15 to 120 m and is the shallowest of the three aquifers in the coastal system. In Georgetown in 1831, this was the initial aquifer developed for water supply. However, due to a high iron content (greater than 5 mg/L) and brackish water (total dissolved solids greater than 1,200 mg/L), the aquifer was never fully exploited and withdrawals ceased in 1913. The water from this aquifer becomes more saline toward the coast and the aquifer is composed of quartz grains, which represent former beach

dune deposits. Within 15 km of the coast, ground water in this formation is confined by the Demerara Clay, a marine clay (Spillman et al. 1998). From 15 to 35 km inland to the outcrop of the White Sands Formation, the older Coropina Formation, also a marine clay, acts as the confining unit. These confining clays have an average thickness of 45 m (Spillman et al. 1998). Thickness of the Upper Sands unit ranges from about 15 m in the Georgetown area to 90 m near the Corentyne River in the east, this unit crops out and is recharged through the White Sands Formation, 35 km south of Georgetown (Spillman et al. 1998).

The "A Sand" aquifer ranges from 150 to 215 m deep and is 12 to 27 m thick. It was first developed in 1913 and is now considered the principal water source for Georgetown and the coastal lowlands region; this aquifer yields between 4,000 and 40,000 L/min year-round (Spillman et al. 1998). The quality of water withdrawn from this aquifer is good with a low chloride content; however, its high carbon dioxide and iron content can corrode ferrous and cement-based materials, with the excessive iron requiring treatment (Spillman et al. 1998). When this aquifer was first used, it had a piezometric head 4.5 m above ground level. By 1993, dewatering of this aquifer caused the head to fall to 14 m below ground level (Spillman et al. 1998).

The "B Sand" aquifer lies below the "Upper Sands" and the "A Sand" aquifers at depths of 350 to 800 m and varies in thickness from 15 to 60 m. The "B Sand" is not exploited to the extent of the "A Sand" aquifer, but it has yields of 4,000 to 40,000 L/min year-round (Spillman et al. 1998). The water is fresh with no elevated levels of iron or chloride; however, it has a trace of hydrogen sulfide with temperatures up to 40.5 °C (105 °F); and this aquifer was first used for domestic water in 1962 (Spillman et al. 1998). From the Georgetown area, this aquifer thins toward the east in the central part of the coastal lowlands where it becomes almost undetectable (Spillman et al. 1998). Due to the lack of data, no recharge area has been definitively determined for the B Sand, but most studies indicate that the B Sand may be recharged by infiltration of precipitation in the White Sands Formation (Spillman et al. 1998). Figure 9 below illustrates the aquifer system in the coastal area.

Fresh surface and ground water supplies importantly serve approximately 90% of the population that lives along the coast. Manufacturing industries, agriculture (both large and small scale), domestic and industrial needs are also fed by these supplies. Based on data reported in the Guyana's State of the Environment Report (2016), the ground water sources for the coastal areas are accessed through one hundred and twenty five (125) wells distributed across Administrative Regions 2, 3, 4, 5 & 6. Figure 9 shows the location of these wells which are managed by the Guyana Water Inc (GWI). A number of private wells also exist, and connected with water intensive industries, however only seventeen private wells are reported as having been registered (EPA, 2016).



**Figure 9: Coastal aquifer system along associated with the Georgetown and the coastal zone and corresponding geology (Source: Spillman et al. 1998)**

## 4.3 Noise Emissions

### 4.3.1 Old Sophia Sub-Station Location

The existing sound environment throughout the Old Sophia location was characterized almost completely as sounds of nature within a Residential/Industrial/Commercial Community. Noise measurements were taken at various strategic locations within the Old Sophia Sub-Station.

Noise levels were recorded at eight (8) points within the project location (Figure 11) on May 24, 2018, using a Sound Level Meter (ExTech 407730) (Figure 10). Noise decibel levels are not to be greater than the established permissible noise levels/limits of the Guyana National Bureau of Standards (GNBS) Guideline values for Noise in specific environment (Table 5) which has been adopted by the Environmental Protection Agency (EPA).

**Table 5: Guyana National Bureau of Standards (GNBS) Guideline Values for Noise in Specific Environment (Source: GNBS 2010)**

Categories	Daytime Limits in dB (06:00 – 18:00h)	Night time Limits in dB (18:00 – 06:00h)	
Residential	75	60	
Institutional	75	60	
Educational	75	60	
Industrial	100	80	
Commercial	80	65	
Construction	90	75	
Transportation	100	80	
Recreational	100	18:00- 01:00hr	100
		01:00- 08:00hr	70

Table 6 below shows the noise conditions within the project location.

**Table 6: Noise Levels within the Old Sophia Sub-station Project Location**

Sample ID	Coordinates	Sound Level (dB)				
		Time		Data	Wind	
		Start	End	Decibel (dB)	Direction	Speed (m/s)
N1	21N - 0375594 UTM -0753684	9:36	9:38	43.7	South East	0.4
N2	21N - 0375622 UTM -0753682	9:23	9:25	44.7	South East	0.9
N3	21N - 0375626 UTM -0753713	9:30	9:32	49.2	South East	1.1
N4	21N - 0375636 UTM - 0753731	9:38	9:40	57.6	South East	2.3
N5	21N - 0375650 UTM - 0753766	9:47	9:49	62.8	South East	1.3
N6	21N - 0375612 UTM - 0753775	9:50	9:52	54.2	South East	1.3
N7	21N - 0375606 UTM - 0753747	9:54	9:54	53.0	South East	0.8
N8	21N - 0375601 UTM - 0753728	10:01	10:03	58.2	South East	0.7

Figure 10 illustrates the instrument used to test the Noise emissions.



**Figure 10: Noise Meter (Source: Ellis, 2018)**

### ***Results and Discussion (Old Sophia Sub-station)***

Noise levels within the Old Sophia Sub-Station location ranged from 43.7 dB to 62.8dB. The sampled areas never exceeded 65 decibels (dB). During the time of monitoring within the

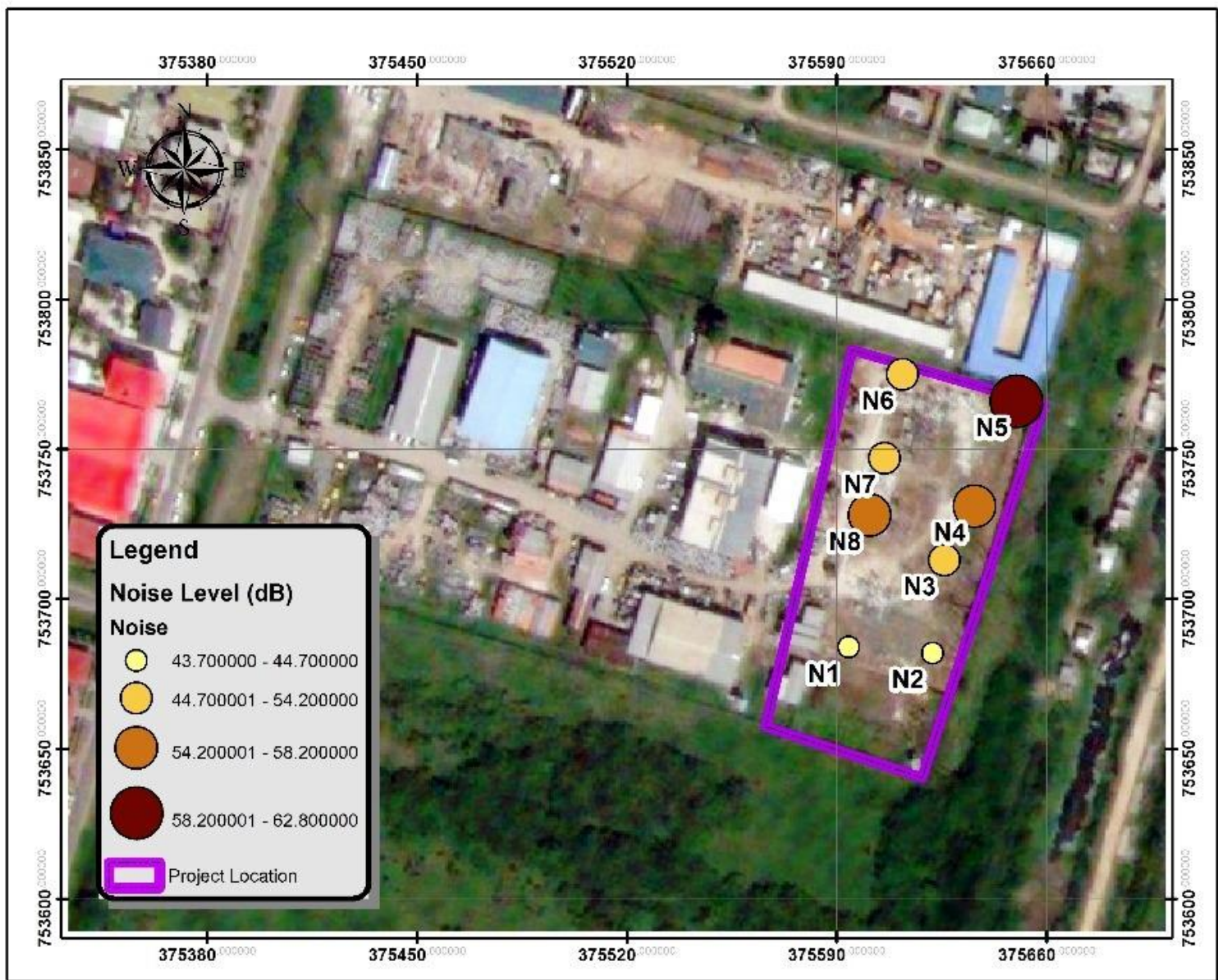
proposed project location, the highest noise level recorded was at N5 (62.8 dB). It is important to note that the noise measurement recorded at N5 was negligible (i.e. below 75 dB Residential Daytime limits, 100 dB Industrial Daytime limits and 80 dB Commercial Daytime limits).

The noise measurements of the other seven (7) areas recorded within the proposed site were as follows: N1 (43.7 dB), N2 (44.7 dB), N3 (49.2 dB), N4 (57.6 dB), N6 (54.2 dB), N7 (53.0 dB), and (58.2 dB). These sample points showed small increments in noise levels and was as a result of sounds from nature. However, these levels were all below the 75 dB Daytime (06:00 h - 18:00 h) Residential limits, 100 dB Daytime (06:00 h - 18:00 h) Industrial limits, and 80 dB Daytime (06:00 h - 18:00 h) Commercial limits of the Guyana National Bureau of Standards (GNBS) Guidelines for the Measurement and Assessment of Noise in the Environment.

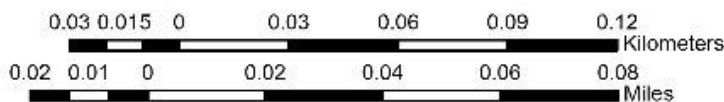
Figure 11 illustrates the locations where noise levels were monitored at the Old Sophia Substation location.



# Noise Level Sample Locations Map



**SCALE: 1:2,000**



**CLIENT:** Guyana Power and Light Inc.(GPL)  
**SITE:** Sophia, Georgetown, Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

Figure 11: Noise Measurement Sample Points within the Old Sophia Project Location (Source:(Reid 2018))

#### 4.3.2 Kingston Sub-Station Location

The existing sound environment throughout the Kingston Generating Station location was characterized as sounds of nature within a Town. Noise measurements were taken at various strategic locations within the Kingston Substation.

Noise levels were recorded at eight (8) points within the proposed project location (Figure 12) on June 04, 2018, using a Sound Level Meter (ExTech 407730). Noise decibel levels are not to be greater than the established permissible noise levels/limits of the Guyana National Bureau of Standards (GNBS) Guideline values for Noise in specific environment which has been adopted by the Environmental Protection Agency (EPA).

**Table 7: Noise Levels within the Kingston Sub-station Location**

Sample ID	Coordinates	Sound Level (dB)				
		Time		Data	Wind	
		Start	End	Decibel (dB)	Direction	Speed (m/s)
N1	21N - 0371412 UTM - 0754746	15:56	15:58	72.9	South East	1.2
N2	21N - 0371425 UTM - 0754740	16:04	16:06	71.3	South East	1.4
N3	21N - 0371411 UTM - 0754726	16:11	16:13	71.4	South East	0.5
N4	21N - 0371407 UTM - 0754705	16:17	16:19	69.9	South East	0.4
N5	21N - 0371411 UTM - 0754713	16:26	16:28	68.9	South East	1.2
N6	21N - 0371442 UTM - 0754696	16:32	16:34	69.8	South East	0.8
N7	21N - 0371448 UTM - 0754718	16:36	16:38	70.2	South East	0.4
N8	21N - 0371459 UTM - 0754724	16:42	16:44	71.4	South East	0.8

#### ***Results and Discussion (Kingston Sub-station)***

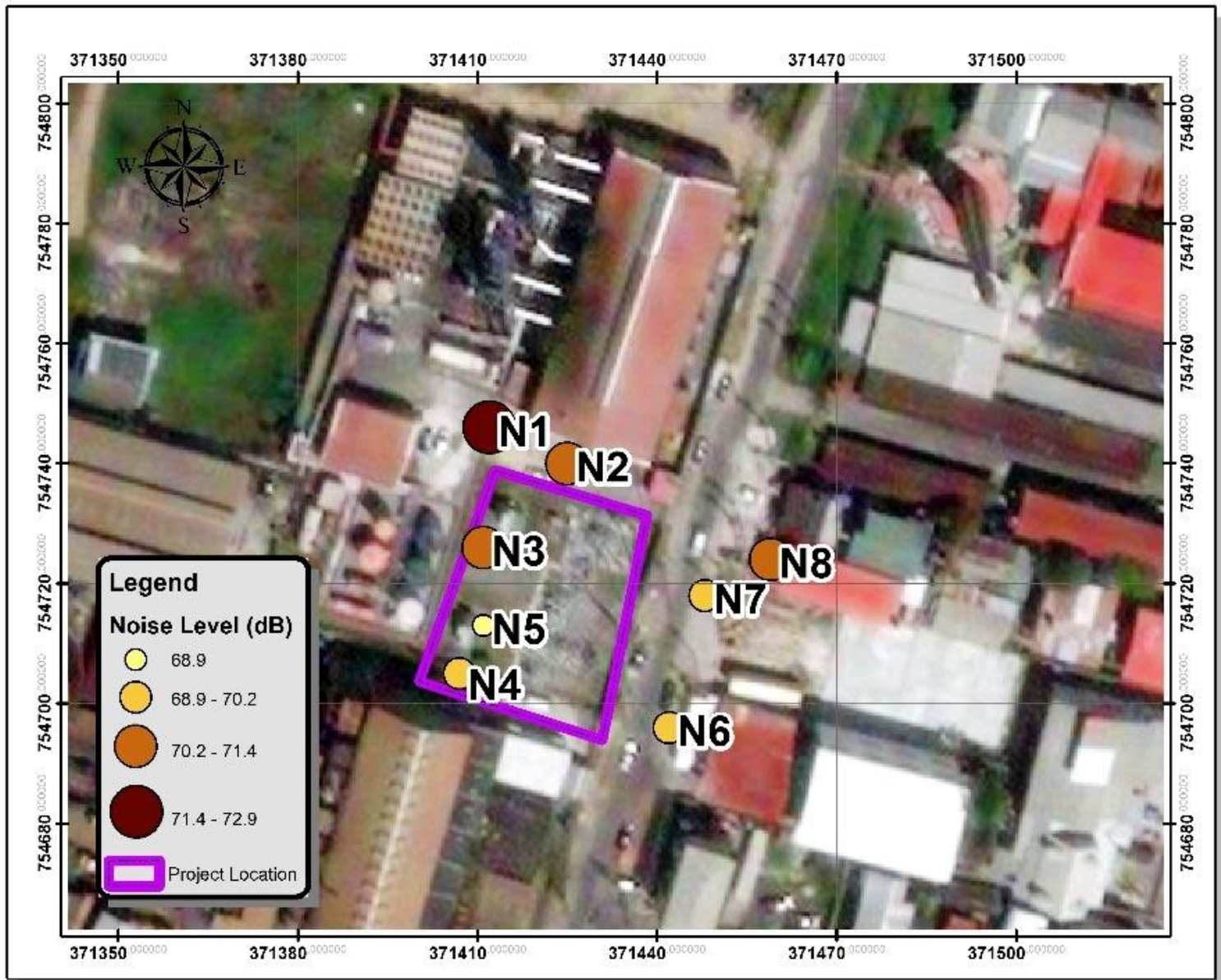
Noise levels within the Kingston Sub-station location ranged from 68.9 dB to 72.9dB. The sampled areas never exceeded 75 decibels (dB). During the time of monitoring within the project location, the highest noise level recorded was at N1 (72.9 dB). Other high noise level measurements were N3 (71.4 dB), N8 (71.4 dB), N2 (71.3 dB) and N7 (70.2). These noise measurements (i.e. N1, N3, N8, N2, and N7) were high but negligible (i.e. below 75 dB Residential Daytime limits, 100 dB Industrial Daytime limits and 80 dB Commercial Daytime limits).

The noise measurements of the other three (3) areas recorded within the site were as follows: N4 (69.9 dB), N5 (68.9 dB), and N6 (69.8 dB). These sample points showed small increments in noise levels and was as a result of sounds from generator, high winds and vehicular traffic. However, these levels were all below the 75 dB Daytime (06:00 h - 18:00 h) Residential limits, 100 dB Daytime (06:00 h - 18:00 h) Industrial limits, and 80 dB Daytime (06:00 h - 18:00 h) Commercial limits of the Guyana National Bureau of Standards (GNBS) Guidelines for the Measurement and Assessment of Noise in the Environment.

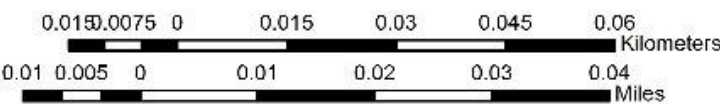
Figure 12 illustrates the locations where noise levels were monitored at the Kingston, Sub-station location.



# Noise Level Locations Map



**SCALE: 1:1,000**



**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Kingston, Georgetown, Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

Figure 12: Noise Measurement Sample Points within the Kingston Sub-station Location (Source: Reid, 2018)

#### 4.3.3 New Sophia Sub-Station Location

The existing sound environment throughout the New Sophia Sub-station location was characterized as sounds of nature within a Town. Noise measurements were taken at various strategic locations within and around the New Sophia Sub-station.

Noise levels were recorded at nine (9) points within the proposed project location (Figure 13) on June 04, 2018, using a Sound Level Meter (ExTech 407730). Noise decibel levels are not to be greater than the established permissible noise levels/limits of the Guyana National Bureau of Standards (GNBS) Guideline values for Noise in specific environment which has been adopted by the Environmental Protection Agency (EPA).

**Table 8: Noise Levels within and around the New Sophia Sub-station Location**

Sample ID	Coordinates	Sound Level (dB)				
		Time		Data	Wind	
		Start	End	Decibel (dB)	Direction	Speed (m/s)
N1	21N - 0375794 UTM - 0753649	17:20	17:22	58.6	South East	0.7
N2	21N - 0375781 UTM - 0753653	17:28	17:30	48.1	South East	0.8
N3	21N - 0375763 UTM - 0753659	17:34	17:36	48.7	South East	0.2
N4	21N - 0375742 UTM - 0753665	17:38	17:40	51.3	South East	0.4
N5	21N - 0375736 UTM - 0753690	17:46	17:48	49.2	South East	0.2
N6	21N - 0375720 UTM - 0753691	17:50	17:52	31.4	South East	1.4
N7	21N - 0375706 UTM - 0753663	17:54	17:56	50.8	South East	0.3
N8	21N - 0375694 UTM - 0753624	18:01	18:03	49.4	South East	1.8
N9	21N - 0375687 UTM - 0753591	18:05	18:07	50.3	South East	0.9

#### ***Results and Discussion (New Sophia Sub-station)***

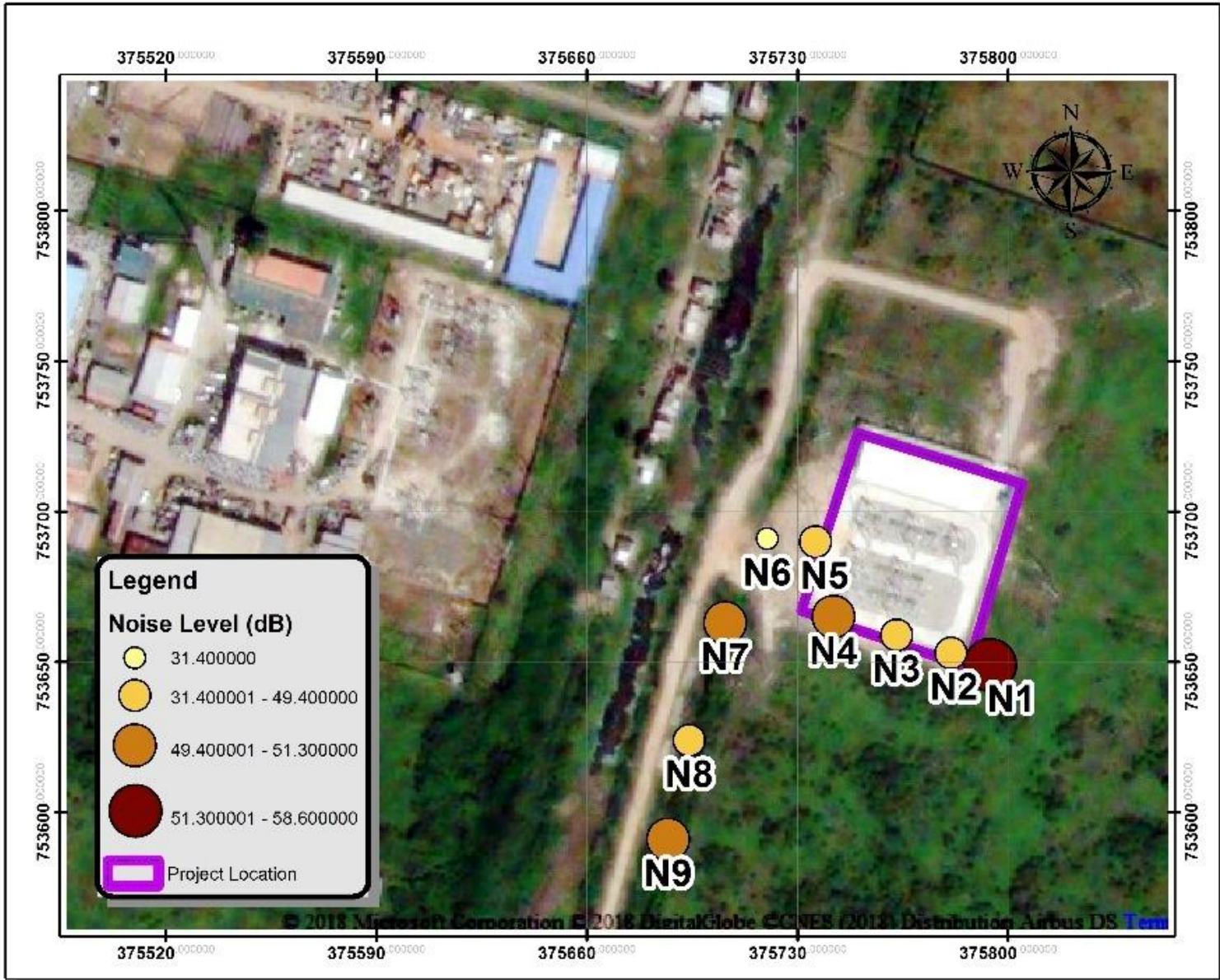
Noise levels within the New Sophia Sub-station location ranged from 31.4 dB to 58.6dB. The sampled areas never exceeded 75 decibels (dB). During the time of monitoring within the project location, the highest noise level recorded was at N1 (58.6 dB). Other high noise level measurements were N4(51.3 dB), N7 (50.8 dB), and N9 (50.3 dB). These noise measurements (i.e. N1, N4, N7 and N9) were high but negligible (i.e. below 75 dB Residential Daytime limits, 100 dB Industrial Daytime limits and 80 dB Commercial Daytime limits).

The noise measurements of the other five (5) areas recorded within and around the site were as follows: N2 (48.1 dB), N3 (48.7 dB), N5 (49.2 dB), N6 (31.4 dB) and N8 (49.4 dB). These sample points showed small increments in noise levels and was as a result of sounds from high winds. However, these levels were all below the 75 dB Daytime (06:00 h - 18:00 h) Residential limits, 100 dB Daytime (06:00 h - 18:00 h) Industrial limits, and 80 dB Daytime (06:00 h - 18:00 h) Commercial limits of the Guyana National Bureau of Standards (GNBS) Guidelines for the Measurement and Assessment of Noise in the Environment.

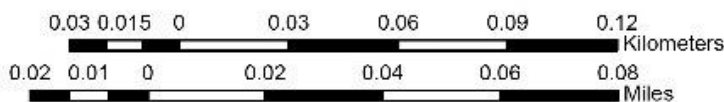
Figure 13 illustrates the locations where noise levels were monitored at the New Sophia Substation location.



# Noise Level Locations Map (New Sophia)



**SCALE: 1:2,000**



**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Sophia, Georgetown, Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

Figure 13: Noise Measurement Sample Points within the New Sophia Sub-station Location (Source: Reid, 2018)

#### 4.3.4 L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station

The existing sound environment throughout the proposed route for the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station were characterized as sounds of nature and traffic within a Town. Noise measurements were taken at various strategic locations throughout the proposed route.

Noise levels were recorded at thirty four (34) points within the proposed project location (Figure 14) on May 18<sup>th</sup>, 19<sup>th</sup>, 21<sup>st</sup>, 22<sup>nd</sup>, and 23<sup>rd</sup>, 2018, using a Sound Level Meter (ExTech 407730). Noise decibel levels are not to be greater than the established permissible noise levels/limits of the Guyana National Bureau of Standards (GNBS) Guideline values for Noise in specific environment which has been adopted by the Environmental Protection Agency (EPA).

**Table 9: Noise Levels within the proposed Route L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station**

Sample ID	Coordinates	Sound Level (dB)				
		Time		Data	Wind	
		Start	End	Decibel (dB)	Direction	Speed (m/s)
N1	21N - 0371454 UTM - 0754738	15:03	15:05	64.8	South East	1.6
N2	21N - 0371417 UTM - 0754488	15:29	15:31	55.6	South West	0.9
N3	21N - 0371382 UTM - 0754440	15:47	15:49	59.8	South West	0.4
N4	21N - 0371700 UTM - 0754403	16:00	16:03	57.6	South West	0.3
N5	21N - 0371866 UTM - 0754358	16:08	16:10	54.3	South West	1.1
N6	21N - 0371925 UTM - 0754348	16:14	16:16	55.1	South West	0.5
N7	21N - 0371902 UTM - 0754332	16:20	16:22	58.0	South West	1.5
N8	21N - 0371933 UTM - 0754245	13:29	13:32	58.8	South West	1.6
N9	21N - 0372126 UTM - 0754117	14:36	14:39	63.1	South West	0.5
N10	21N - 0372324 UTM - 0754143	15:02	15:05	69.8	South West	1.3
N11	21N - 0372505 UTM - 0754057	15:57	15:59	60.4	South West	3.5
N12	21N - 0372590 UTM - 0754058	16:13	16:16	61.5	South West	1.7
N13	21N - 0372758 UTM - 0754041	10:26	10:29	71.3	South	0.5
N14	21N - 0372935	13:34	13:36	58.6	South West	3.8

	UTM - 0754020					
N15	21N - 0373065 UTM - 0753931	14:02	14:05	50.2	South	0.8
N16	21N - 0373212 UTM - 0753901	14:32	14:34	57.2	South	0.5
N17	21N - 0373333 UTM - 0753762	15:08	15:11	51.8	South	0.4
N18	21N - 0373553 UTM - 0753825	15:30	15:33	64.5	South West	0.9
N19	21N - 0373702 UTM - 0753795	16:26	16:28	54.5	South West	0.4
N20	21N - 0373801 UTM - 0753771	16:35	16:37	66.8	South	0.3
N21	21N - 0373971 UTM - 0753727	16:42	16:44	68.5	South	0.2
N22	21N - 0374179 UTM - 0753676	16:51	16:53	58.4	South West	0.4
N23	21N - 0373839 UTM - 0753809	12:46	12:48	49.7	South West	1.6
N24	21N - 0373923 UTM - 0753788	12:58	13:01	49.4	South West	0.0
N25	21N - 0373954 UTM - 0753869	13:07	13:09	64.2	South West	1.8
N26	21N - 0374086 UTM - 0753923	13:17	13:19	47.9	South West	1.5
N27	21N - 0374227 UTM - 0754034	13:36	13:38	57.4	South West	1.4
N28	21N - 0374329 UTM - 0753984	15:28	15:30	63.2	South West	0.5
N29	21N - 0374443 UTM - 0753954	15:40	15:42	62.5	South West	0.5
N30	21N - 0374568 UTM - 0753912	10:46	10:48	67.5	South West	0.8
N31	21N - 0374716 UTM - 0753874	12:28	12:30	64.8	South West	0.3
N32	21N - 0374852 UTM - 0753839	12:39	12:41	53.3	South	1.5
N33	21N - 0374977 UTM - 0753805	12:42	12:44	54.8	South	1.6
N34	21N - 0375098 UTM - 0753770	12:57	12:59	52.8	South	0.8

***Results and Discussion (L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station)***

Noise levels within the proposed route of the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station ranged from 47.9 dB to 71.3dB. The

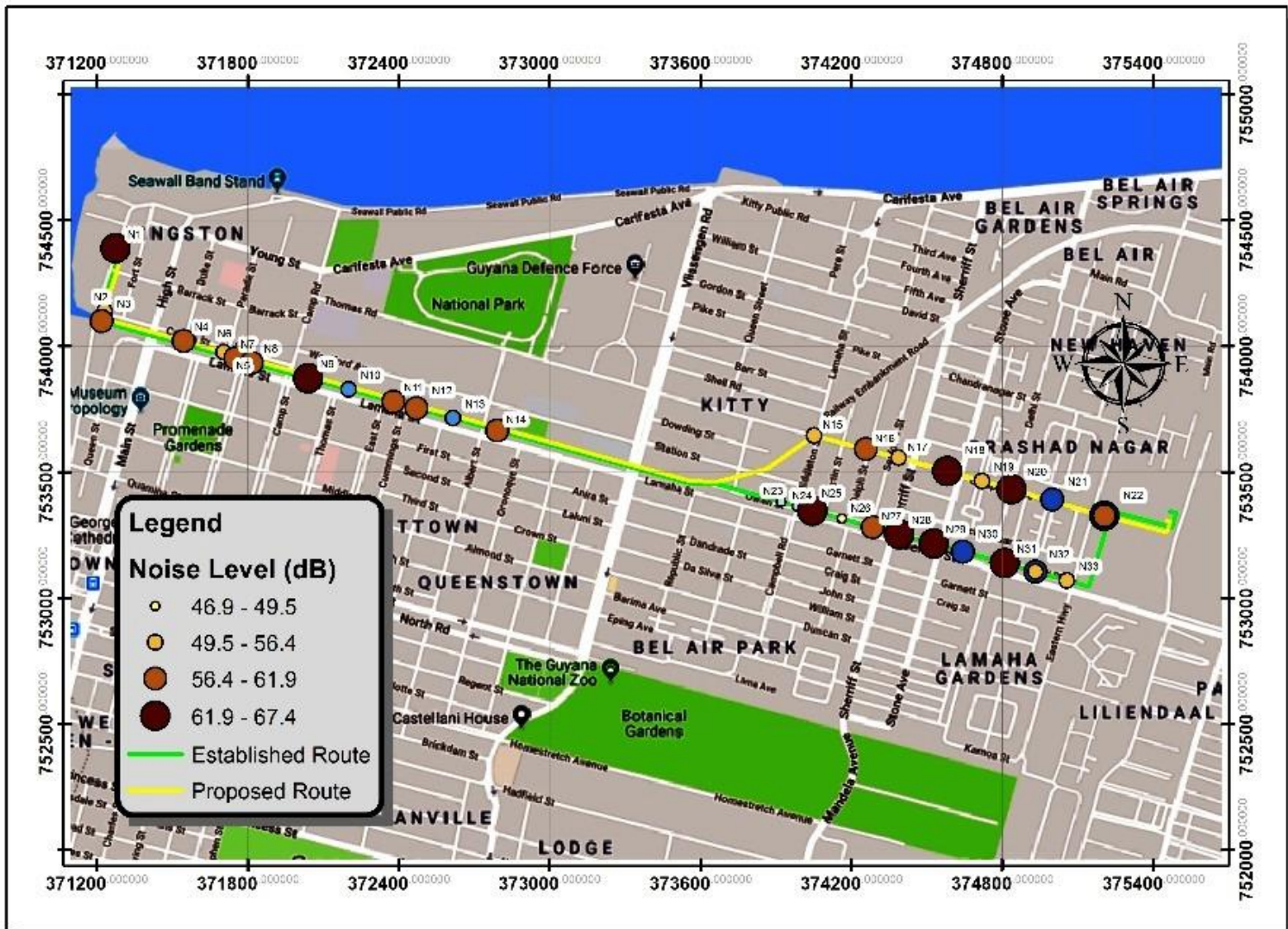
sampled areas never exceeded 75 decibels (dB). During the time of monitoring within the project location, the highest noise level recorded was at N13 (71.3 dB). Other high noise level measurements were N10 (69.8 dB) and N21 (68.5 dB). These noise measurements (i.e. N13, N10, and N21) were high but negligible i.e. below 75 dB Residential Daytime limits, 100 dB Industrial Daytime limits, 80 dB Commercial Daytime limits, and 100 dB Transportation Daytime Limits.

The noise measurements of the other thirty one (31) areas recorded within the route showed small increments in noise levels and were as a result of sounds from high winds and vehicular traffic. However, these levels were all below the 75 dB Daytime (06:00 h - 18:00 h) Residential limits, 100 dB Daytime (06:00 h - 18:00 h) Industrial limits, 80 dB Daytime (06:00 h - 18:00 h) Commercial limits and 100 dB Daytime (06:00 h - 18:00 h) Transportation limits of the Guyana National Bureau of Standards (GNBS) Guidelines for the Measurement and Assessment of Noise in the Environment.

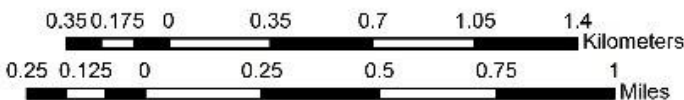
Figure 14 illustrates the locations where noise levels were monitored at the proposed route of the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station.



# Noise Level Locations Map



SCALE: 1:25,000



**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Route from Kingston to Sophia Sub-station , Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

Figure 14: Noise Measurement Sample Points monitored at the proposed route of the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station(Source: Reid, 2018)



#### 4.4 Air Quality

Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere (World Health Organization 2012). This is becoming an increasingly significant problem to growth and development of cities and communities. The air pollutants of major public health concern include: particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulphur dioxide and metals, such as lead (Hedges 2004)(World-Health-Organization 2012).

**Particulate Matter (PM)** - This is the term for a mixture of solid particles (dust, dirt, soot, and smoke) and liquid droplets suspended in the air. These PM emissions originate from a variety of sources, such as vehicles, factories, industrial sites, construction sites, tilled fields, unpaved roads, stone crushing, and burning of wood (Hedges 2004, p.58). Particulate Matter comprises both coarse and fine particles. The coarse particles ( $PM_{10}$ ) have an aerodynamic diameter between  $2.5\mu m$  and  $10\mu m$ . They are formed by mechanical disruption (e.g. crushing, grinding, abrasion of surfaces); evaporation of sprays, and suspension of dust. Fine particles have an aerodynamic diameter less than  $2.5\mu m$  ( $PM_{2.5}$ ). These particles are formed from gas by chemical reactions; and condensation of high-temperature vapours during combustion (Fierro 2000).

**Total Suspended Particulates (TSP)** - This refers to all particles in the atmosphere that are less than 100 micrometers. The amount of  $PM_{10}$  and  $PM_{2.5}$  are related to the amount of total suspended particulates (TSP) in the air (Alias, Hamzah, and Kenn 2007).

Particulate Matter guidelines and standards are instituted (Table 7) due to short term and long term health effects including premature mortality, chronic respiratory disease, acute respiratory systems, decreased lung functions and aggravated asthma, persistent cough, phlegm, wheezing and physical discomfort (Fierro 2000, p.5)(Alias, Hamzah and Kenn 2007, p.258). These health effects are especially associated with  $PM_{10}$  and  $PM_{2.5}$ . The  $PM_{10}$  fraction from TSP is able to reach the lower regions of the respiratory tract. On the other hand,  $PM_{2.5}$  is able to absorb more toxic and carcinogenic compounds than larger particles and penetrate more easily deep into the lungs (Alias, Hamzah and Kenn 2007, p.256). Additionally, there is increased harm to the environment as PM is a major source of haze that reduces visibility, causes changes to nutrient and chemical balance of the soil and aquatic environment, erosions and staining of structures (residential, commercial, or cultural monuments) (Hedges 2004, p.58).

##### *Air Quality Standards/Guidelines*

The purpose of the ambient air quality standards are to establish maximum limits on parameters of air quality considered desirable for the preservation and enhancement of the quality of air resources and health (Mecklenburg-County-NC 2012). Air quality standards, are set by each country to protect the public health of their citizens and as such are an important component of national risk management and environmental policies. National standards will vary according to the approach adopted for balancing health risks, technological feasibility, economic considerations and various other political and social factors, which in turn will depend on, among other

things, the level of development and national capability in air quality management (World-Health-Organisation 2006).

Air quality data in Guyana is extremely limited given the constraints relating to the unavailability of equipment and cost associated with this type of data collection. There was no historical air quality data for the areas i.e. in Kingston, Georgetown and Sophia, Georgetown, however, a preliminary assessment of air quality was done on May 18<sup>th</sup>, 19<sup>th</sup>, 21<sup>st</sup>, 22<sup>nd</sup>, and 23<sup>rd</sup>, 2018, May 24, 2018, and June 04, 2018, and it reflected the Particulate Matter (PM<sub>2.5</sub> and PM<sub>10</sub>) and Total Suspended Particles (TSP) concentration of the Project locations.

### ***Monitoring Procedure***

The Particulate Matter (PM) measurements were taken using the Temtop Airing-1000 Air Quality Monitor Real Time Display High Accuracy PM<sub>2.5</sub>/PM<sub>10</sub> Detector. PM<sub>2.5</sub> and PM<sub>10</sub> measurements recorded in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ), were taken at various sample locations after a log interval of 5 minutes. After the log time, the PM<sub>2.5</sub> and PM<sub>10</sub> concentration in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) were recorded from each sample site. The Total Suspended Particulate (TSP) measurements were taken using the Thermo pDR-1000AN personalDataRAMTM Particulate Monitor. TSP measurements recorded in milligram per cubic meter ( $\text{mg}/\text{m}^3$ ), were taken at various sample sites after a log interval of 5 minutes (Thermo-Electron-Corportation 2005). After the 5 minute interval log time, the real time Concentration value, the Maximum Concentration value and the Time Weighted Average (TWA) concentration in milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ) were recorded from each sample site. The wind direction and temperature at time of monitoring at each site was recorded. Conversions from milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ) to micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) were done by taking the milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ) measurements x 1000 (Hedges 2004, p.23). Micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) results were then compared to the United States Environmental Protection Agency (USEPA) 1971- 2012 National Ambient Air Quality Standards (NAAQS) for Particulate Matter, as a current PM<sub>2.5</sub>, PM<sub>10</sub> and TSP limit permissible utilised (See Table 7). Quality assurance and quality control (QA/QC) was practiced, as well as routine parts of the air quality monitoring during the calibration, operation and maintenance of the monitoring equipment.

**Table 10: National Ambient Air Quality Standards for Particular Matter  
During the Period 1971 - 2012. (Source:(USEPA 2016)**

Indicator	National Ambient Air Quality Standards (NAAQS) 1971 - 2012	Averaging Time	Level ( $\mu\text{g}/\text{m}^3$ )	Form
PM <sub>2.5</sub>	Primary	Annual	12.0 $\mu\text{g}/\text{m}^3$	Annual arithmetic mean, averaged over 3 years.
	Secondary	Annual	15.0 $\mu\text{g}/\text{m}^3$	Annual arithmetic mean, averaged over 3 years.

	Primary and Secondary	24-hour	35 µg/m <sup>3</sup>	98 <sup>th</sup> percentile, averaged over 3 years.
PM <sub>10</sub>	Primary and Secondary	24-hour	150 µg/m <sup>3</sup>	Not to be exceeded more than once per year on average over a 3-year period.
Total Suspended Particles (TSP)	Primary	24-hour	260 µg/m <sup>3</sup>	Not to be exceeded more than once per year.
		Annual	75 µg/m <sup>3</sup>	Annual geometric mean.
	Secondary	24-hour	150 µg/m <sup>3</sup>	Not to be exceeded more than once per year.
		Annual	60 µg/m <sup>3</sup>	Annual geometric mean.

### Data

The following tables and maps show the results of Particulate Matter and Total Suspended Particulates concentration taken within the Old Sophia Sub-station, Kingston Sub-station and the proposed route of the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station. Table 11 below contains the PM<sub>2.5</sub>, PM<sub>10</sub>, Average Concentration, Time Weighted Average (TWA) and Maximum Concentration of the air quality during the monitoring period.

#### 4.4.1 Old Sophia Sub-station

**Table 11: Results of Particulate Matter and TSP Measurement at the Old Sophia Sub-station**

Sample ID	Coordinates	Time		Data µg/m <sup>3</sup>					Wind		Temperature (°C)
		Start	End	TWA	Max. Con	Avg. Con	PM <sub>2.5</sub>	PM <sub>10</sub>	Direction	Speed (m/s)	
AQ1	21N - 0375594 UTM - 0753684	9:36	9:41	123	132	129	12.8	18.2	South East	0.4	27.9
AQ2	21N - 0375622 UTM - 0753682	9:23	9:28	95	128	115	11.3	15.7	South East	0.9	32.3
AQ3	21N - 0375626 UTM - 0753713	9:30	9:35	109	181	112	9.5	11.0	South East	1.1	32.1
AQ4	21N - 0375636 UTM - 0753731	9:38	9:43	115	123	114	8.9	13.9	South East	2.3	30.5
AQ5	21N - 0375650 UTM - 0753766	9:47	9:52	122	147	121	12.1	17.1	South East	1.3	33.1
AQ6	21N - 0375612 UTM - 0753775	9:50	9:55	114	126	114	9.9	13.8	South East	1.3	31.8
AQ7	21N - 0375606 UTM - 0753747	9:54	9:59	120	129	120	10.4	14.7	South East	0.8	31.1
AQ8	21N - 0375601 UTM - 0753728	10:01	10:06	120	119	112	8.6	13.2	South East	0.7	30.7

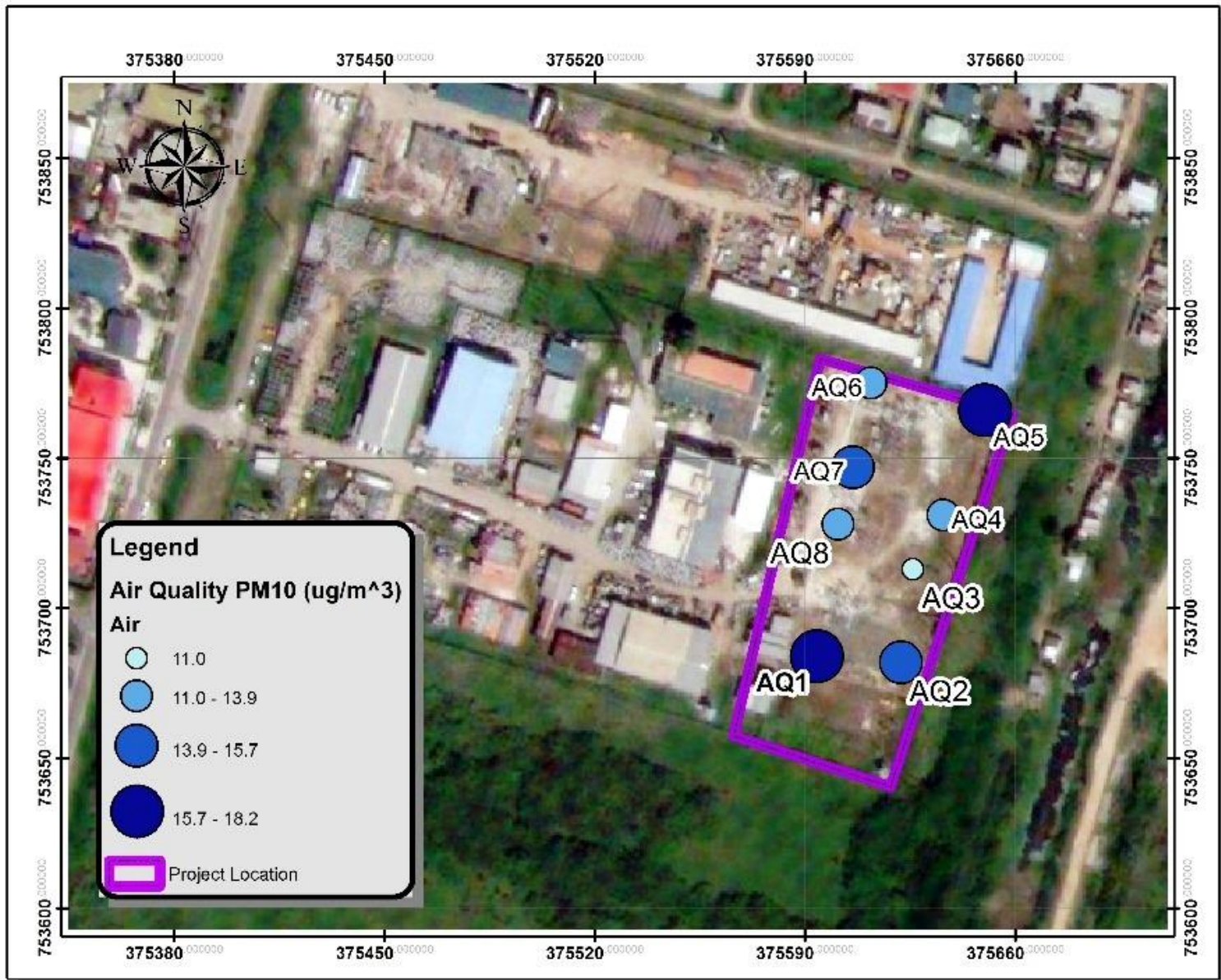
### ***Results and Discussion (Old Sophia Sub-station)***

Under clean atmospheric conditions; the TSP level can be as low as  $0 - 10 \mu\text{g}/\text{m}^3$ . In a very dusty environment, TSP concentration can be as high as  $1500 \mu\text{g}/\text{m}^3$  (Alias, Hamzah and Kenn 2007, p.258).

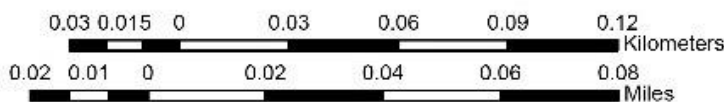
- Monitoring showed Particulate Matter ( $\text{PM}_{2.5}$  and  $\text{PM}_{10}$ ) concentration during the period.  $\text{PM}_{2.5}$  concentration of the monitored area ranged from  $8.6 - 12.8 \mu\text{g}/\text{m}^3$ , during the monitoring period. The highest  $\text{PM}_{2.5}$  measurement was recorded at AQ1 ( $12.8 \mu\text{g}/\text{m}^3$ ), this value was below the  $\text{PM}_{2.5}$  USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS)  $35 \mu\text{g}/\text{m}^3$  24-hours average along with the other seven (7) values.
- $\text{PM}_{10}$  concentration of the monitored area ranged from  $11.0 - 18.2 \mu\text{g}/\text{m}^3$ , during the monitoring period. The highest  $\text{PM}_{10}$  measurement was recorded at AQ1 ( $18.2 \mu\text{g}/\text{m}^3$ ), this value was below the  $\text{PM}_{10}$  USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS)  $150 \mu\text{g}/\text{m}^3$  24-hours average along with the other six (6) values.
- Monitoring also showed the TSP levels of TWA and Maximum Concentration (Max. Conc.). TWA of the monitored area ranged from  $95 - 123 \mu\text{g}/\text{m}^3$ , while maximum concentration ranged from  $119 - 181 \mu\text{g}/\text{m}^3$  respectively, during the monitoring period (Table 11). The TWA readings varied among the eight (8) sites, with the highest TWA concentration recorded at AQ1 ( $123 \mu\text{g}/\text{m}^3$ ). In comparison with the TSP USEPA 1971 - 2012 National Ambient Air Quality Standard (NAAQS)  $150 \mu\text{g}/\text{m}^3$  24-hours average, the values recorded at AQ1 was below the TSP Air Quality Standard. TWA levels for the other seven (7) sample points were all below the limit during the monitoring period.
- The highest Maximum Concentration was recorded at AQ3 ( $181 \mu\text{g}/\text{m}^3$ ). The Maximum Concentration is the highest value detected by the sensor during the monitoring time (5 minutes); therefore this does not represent the average maximum concentration. In comparison with the USEPA 1971 - 2012 NAAQS  $150 \mu\text{g}/\text{m}^3$  24-hours average, measurements showed that AQ3 was above the USEPA 1971 - 2012 NAAQS - TSP AQS during the time of monitoring while the other seven sample points were all below the limit.
- The highest average concentration values recorded at AQ1 ( $129 \mu\text{g}/\text{m}^3$ ), this value was below the USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS)  $150 \mu\text{g}/\text{m}^3$  24-hours average along with the other seven (7) values.

The majority of the TWA, Average and Maximum concentration readings were below the USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS)  $150 \mu\text{g}/\text{m}^3$  24-hours with the exception of the maximum concentration of AQ3 perhaps due to higher human activity during the time of monitoring.

# Air Quality Sample Locations Map



**SCALE: 1:2,000**



**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Sophia, Georgetown, Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

Figure 15: Air Quality Sample Locations for Old Sophia Sub-station Project (Source: Reid, 2018)



#### 4.4.2 Kingston Sub-station

**Table 12: Results of Particulate Matter and TSP Measurement at the Kingston Sub-station**

Sample ID	Coordinates	Time		Data $\mu\text{g}/\text{m}^3$					Wind		Temperature ( $^{\circ}\text{C}$ )
		Start	End	TWA	Max. Con	Avg. Con	PM <sub>2.5</sub>	PM <sub>10</sub>	Direction	Speed (m/s)	
AQ1	21N - 0371412 UTM - 0754746	15:56	16:01	105	147	98	8.7	11.8	South East	1.2	28.9
AQ2	21N - 0371425 UTM - 0754740	16:04	16:09	94	121	109	6.5	9.7	South East	1.4	31.8
AQ3	21N - 0371411 UTM - 0754726	16:11	16:16	94	103	90	4.5	6.2	South East	0.5	31.6
AQ4	21N - 0371407 UTM - 0754705	16:17	16:22	97	105	89	9.3	12.4	South East	0.4	30.7
AQ5	21N - 0371411 UTM - 0754713	16:26	16:31	89	100	91	5.3	7.1	South East	1.2	31.8
AQ6	21N - 0371442 UTM - 0754696	16:32	16:37	104	136	108	15.3	20.1	South East	0.8	31.9
AQ7	21N - 0371448 UTM - 0754718	16:36	16:41	127	172	110	31.4	47.2	South East	0.4	32.7
AQ8	21N - 0371459 UTM - 0754724	16:42	16:47	117	172	139	28.1	38.2	South East	0.8	31.4

#### *Results and Discussion (Kingston Sub-station)*

PM<sub>2.5</sub> concentration of the monitored area ranged from 4.5 – 31.4  $\mu\text{g}/\text{m}^3$ , during the monitoring period. The highest PM<sub>2.5</sub> measurement was recorded at AQ7 (31.4  $\mu\text{g}/\text{m}^3$ ), this value was below the PM<sub>2.5</sub> USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 35  $\mu\text{g}/\text{m}^3$  24-hours average along with the other seven (7) values.

PM<sub>10</sub> concentration of the monitored area ranged from 6.2 - 47.2  $\mu\text{g}/\text{m}^3$ , during the monitoring period. The highest PM<sub>10</sub> measurement was also recorded at AQ7 (47.2  $\mu\text{g}/\text{m}^3$ ), however, this value was below the PM<sub>10</sub> USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 150  $\mu\text{g}/\text{m}^3$  24-hours average along with the other seven (7) values.

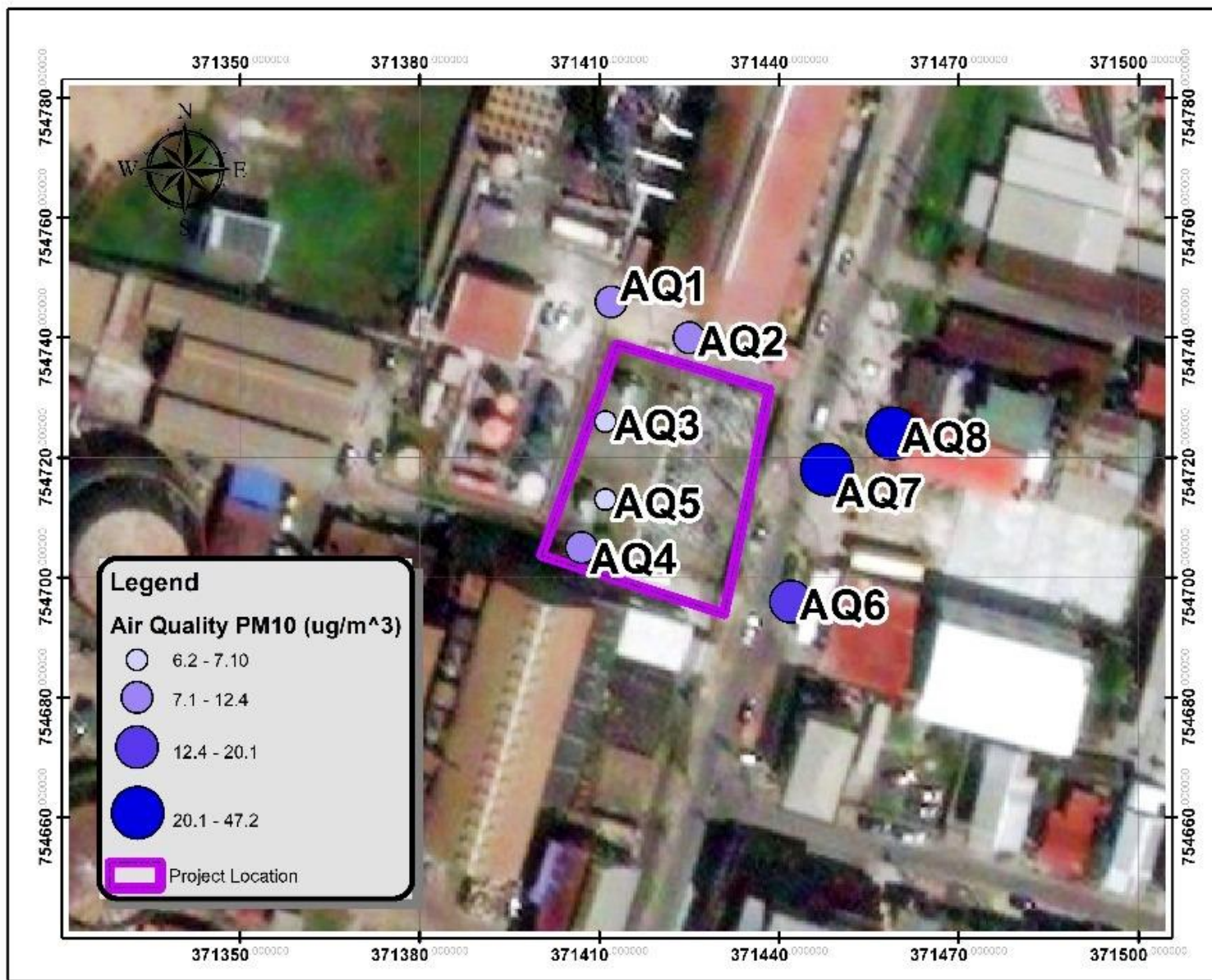
- TWA of the monitored area ranged from 89 – 127  $\mu\text{g}/\text{m}^3$ , respectively, during the monitoring period. The TWA readings varied among the eight (8) sites, with the highest TWA concentration recorded at AQ7 (127  $\mu\text{g}/\text{m}^3$ ). In comparison with the TSP USEPA 1971 - 2012 National Ambient Air Quality Standard (NAAQS) 150  $\mu\text{g}/\text{m}^3$  24-hours average, the value recorded at AQ7 was below the TSP Air Quality Standard. TWA levels for the other seven (7) sample points were all below the limit during the monitoring period.
- Maximum concentration ranged from 100 – 172  $\mu\text{g}/\text{m}^3$ . The highest Maximum Concentrations were recorded at AQ7 and AQ8 (172  $\mu\text{g}/\text{m}^3$ ). In comparison with the USEPA 1971 – 2012 NAAQS 150  $\mu\text{g}/\text{m}^3$  24-hours average, measurements showed that

AQ7 and AQ8 were above the USEPA 1971 - 2012 NAAQS - TSP AQS during the time of monitoring while the other seven sample points were all below the limit.

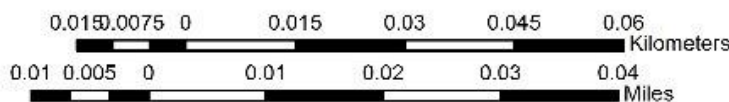
- The highest average concentration value was recorded at AQ8 ( $139\mu\text{g}/\text{m}^3$ ), this value was below the USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS)  $150\mu\text{g}/\text{m}^3$  24-hours average along with the other seven (7) values.

All the TWA, Average and Maximum concentration readings were below the USEPA 1971 – 2012 TSP National Ambient Air Quality Standards (NAAQS)  $150\mu\text{g}/\text{m}^3$  24-hours with the exception of the maximum concentration of AQ7 and AQ8 perhaps due to higher human activity during the time of monitoring.

# Air Quality Locations Map



**SCALE: 1:1,000**



**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Kingston, Georgetown, Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY

Figure 16: Air Quality Sample Locations for the Kingston Sub-station Project (Source: Reid, 2018)



#### 4.4.3 New Sophia Sub-station

**Table 13: Results of Particulate Matter and TSP Measurement at the New Sophia Sub-station**

Sample ID	Coordinates	Time		Data $\mu\text{g}/\text{m}^3$					Wind		Temperature ( $^{\circ}\text{C}$ )
		Start	End	TWA	Max. Con	Avg. Con	PM <sub>2.5</sub>	PM <sub>10</sub>	Direction	Speed (m/s)	
AQ1	21N - 0375794 UTM - 0753649	17:20	17:25	83	87	84	6.8	13.2	South East	0.7	27.4
AQ2	21N - 0375781 UTM - 0753653	17:28	17:33	83	98	83	4.6	6.8	South East	0.8	27.5
AQ3	21N - 0375763 UTM - 0753659	17:34	17:39	83	87	82	4.3	6.2	South East	0.2	28.4
AQ4	21N - 0375742 UTM - 0753665	17:38	17:43	84	89	87	4.6	6.8	South East	0.4	28.6
AQ5	21N - 0375736 UTM - 0753690	17:46	17:51	85	87	83	4.3	6.1	South East	0.2	28.0
AQ6	21N - 0375720 UTM - 0753691	17:50	17:55	84	85	85	4.3	6.5	South East	1.4	27.6
AQ7	21N - 0375706 UTM - 0753663	17:54	17:59	84	85	87	4.7	6.5	South East	0.3	27.4
AQ8	21N - 0375694 UTM - 0753624	18:01	18:06	84	89	84	5.5	7.9	South East	1.8	27.8
AQ9	21N - 0375687 UTM - 0753591	18:05	18:10	85	86	87	4.7	6.8	South East	0.9	26.8

#### *Results and Discussion (New Sophia Sub-station)*

PM<sub>2.5</sub> concentration of the monitored area ranged from 4.3 – 6.8  $\mu\text{g}/\text{m}^3$ , during the monitoring period. The highest PM<sub>2.5</sub> measurement was recorded at AQ1 (6.8  $\mu\text{g}/\text{m}^3$ ), this value was below the PM<sub>2.5</sub> USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 35  $\mu\text{g}/\text{m}^3$  24-hours average along with the other eight (8) values.

PM<sub>10</sub> concentration of the monitored area ranged from 6.1 - 13.2  $\mu\text{g}/\text{m}^3$ , during the monitoring period. The highest PM<sub>10</sub> measurement was also recorded at AQ1 (13.2  $\mu\text{g}/\text{m}^3$ ), however, this value was below the PM<sub>10</sub>USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 150  $\mu\text{g}/\text{m}^3$  24-hours average along with the other eight (8) values.

- TWA of the monitored area ranged from 83 – 85  $\mu\text{g}/\text{m}^3$ , respectively, during the monitoring period. The TWA readings varied among the nine (9) sites, with the highest TWA concentration recorded at AQ5 and AQ9 (85  $\mu\text{g}/\text{m}^3$ ). In comparison with the TSP USEPA 1971 - 2012 National Ambient Air Quality Standard (NAAQS) 150  $\mu\text{g}/\text{m}^3$  24-hours average, the value recorded at AQ5 and AQ9 were below the TSP Air Quality Standard. TWA levels for the other seven (7) sample points were all below the limit during the monitoring period.

- Maximum concentration ranged from 85 – 98 $\mu\text{g}/\text{m}^3$ . The highest Maximum Concentrations was recorded at AQ2 (98 $\mu\text{g}/\text{m}^3$ ). In comparison with the USEPA 1971 – 2012 NAAQS 150  $\mu\text{g}/\text{m}^3$  24-hours average, measurements showed that AQ2 was below the USEPA 1971 - 2012 NAAQS - TSP AQS during the time of monitoring while the other eight sample points were all below the limit.
- The highest average concentration values were recorded at AQ4, AQ7 and AQ9 (87 $\mu\text{g}/\text{m}^3$ ), these values were below the USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 150  $\mu\text{g}/\text{m}^3$  24-hours average along with the other six (6) values.

All the TWA, Average and Maximum concentration readings were below the USEPA 1971 – 2012 TSP National Ambient Air Quality Standards (NAAQS) 150  $\mu\text{g}/\text{m}^3$  24-hours during the time of monitoring.

# Air Quality Locations Map (New Sophia)

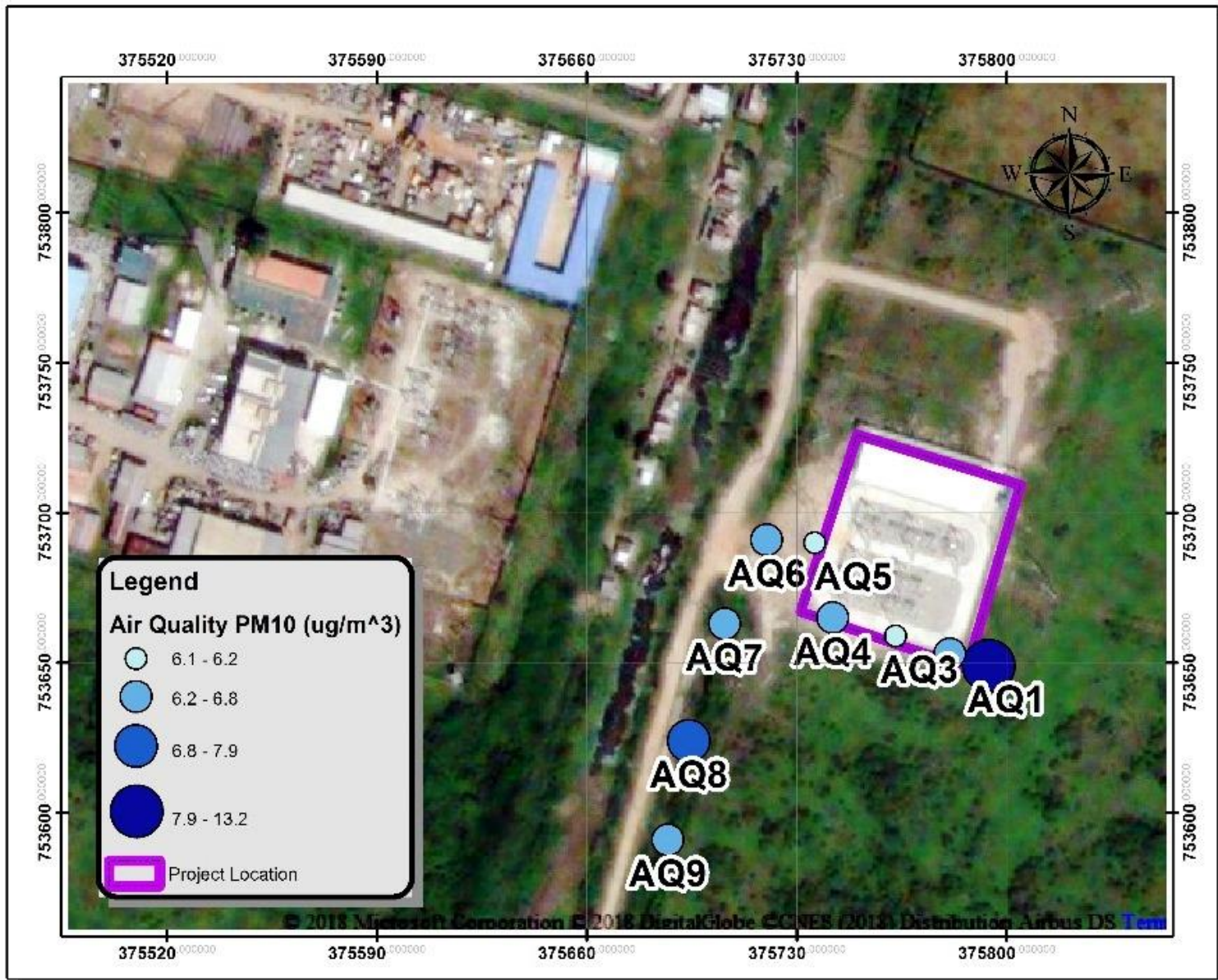


Figure 17: Air Quality Sample Locations for the New Sophia Sub-station Project (Source: Reid, 2018)

4.4.4 Route of the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station.

**Table 14: Results of Particulate Matter and TSP Measurement at the Kingston Sub-station**

Sample ID	Coordinates	Time		Data $\mu\text{g}/\text{m}^3$					Wind		Temperature ( $^{\circ}\text{C}$ )
		Start	End	TWA	Max. Con	Avg. Con	PM <sub>2.5</sub>	PM <sub>10</sub>	Direction	Speed (m/s)	
AQ1	21N - 0371454 UTM - 0754738	15:03	15:08	136	169	124	12.6	17.6	South East	1.6	30.4
AQ2	21N - 0371417 UTM - 0754488	15:29	15:34	122	148	115	14.9	18.1	South West	0.9	33.4
AQ3	21N - 0371382 UTM - 0754440	15:47	15:52	131	193	112	13.7	22.5	South West	0.4	34.1
AQ4	21N - 0371700 UTM - 0754403	16:00	16:05	128	166	130	11.5	16.7	South West	0.3	34.4
AQ5	21N - 0371866 UTM - 0754358	16:08	16:13	118	136	115	12.2	17.1	South West	1.1	35.4
AQ6	21N - 0371925 UTM - 0754348	16:14	16:19	119	150	112	10.7	14.8	South West	0.5	34.8
AQ7	21N - 0371902 UTM - 0754332	16:20	16:25	119	126	122	11.6	16.2	South West	1.5	33.2
AQ8	21N - 0371933 UTM - 0754245	13:29	13:34	119	123	121	11.3	16.7	South West	1.6	26.5
AQ9	21N - 0372126 UTM - 0754117	14:36	14:41	132	139	133	13.7	17.6	South West	0.5	27.9
AQ10	21N - 0372324 UTM - 0754143	15:02	15:07	118	178	118	13.5	17.0	South West	1.3	27.2
AQ11	21N - 0372505 UTM - 0754057	15:57	16:02	127	137	134	11.8	16.5	South West	3.5	25.9
AQ12	21N - 0372590 UTM - 0754058	16:13	16:18	135	139	139	13.9	19.0	South West	1.7	26.0
AQ13	21N - 0372758 UTM - 0754041	10:26	10:31	125	121	121	10.2	15.3	South	0.5	27.5
AQ14	21N - 0372935 UTM - 0754020	13:34	13:39	109	111	111	8.3	10.6	South West	3.8	26.7
AQ15	21N - 0373065 UTM - 0753931	14:02	14:07	110	110	110	7.4	12.9	South	0.8	26.7
AQ16	21N - 0373212 UTM - 0753901	14:32	14:37	111	114	114	8.7	12.2	South	0.5	26.1
AQ17	21N - 0373333 UTM - 0753762	15:08	15:13	118	116	116	7.8	10.9	South	0.4	27.3
AQ18	21N - 0373553 UTM - 0753825	15:30	15:35	140	135	135	18.3	25.7	South West	0.9	27.3
AQ19	21N - 0373702 UTM - 0753795	16:26	16:31	128	134	134	11.7	16.4	South West	0.4	27.6
AQ20	21N - 0373801 UTM - 0753771	16:35	16:40	127	132	132	16.3	22.9	South	0.3	29.8
AQ21	21N - 0373971 UTM - 0753727	16:42	16:47	138	137	137	13.7	19.2	South	0.2	29.0

<b>AQ22</b>	<b>21N - 0374179</b> <b>UTM - 0753676</b>	16:51	16:56	134	132	132	20.4	28.6	South West	0.4	29.3
<b>AQ23</b>	<b>21N - 0373839</b> <b>UTM - 0753809</b>	12:46	12:51	117	118	118	7.9	12.1	South West	1.6	32.0
<b>AQ24</b>	<b>21N - 0373923</b> <b>UTM - 0753788</b>	12:58	13:03	116	119	119	9.6	13.4	South West	0.0	32.0
<b>AQ25</b>	<b>21N - 0373954</b> <b>UTM - 0753869</b>	13:07	13:12	116	123	123	15.2	21.2	South West	1.8	30.0
<b>AQ26</b>	<b>21N - 0374086</b> <b>UTM - 0753923</b>	13:17	13:22	117	124	114	9.2	12.9	South West	1.5	30.4
<b>AQ27</b>	<b>21N - 0374227</b> <b>UTM - 0754034</b>	13:36	13:41	118	134	121	7.6	10.5	South West	1.4	29.0
<b>AQ28</b>	<b>21N - 0374329</b> <b>UTM - 0753984</b>	15:28	15:33	121	130	124	12.2	17.1	South West	0.5	27.8
<b>AQ29</b>	<b>21N - 0374443</b> <b>UTM - 0753954</b>	15:40	15:45	117	126	119	11.6	16.2	South West	0.5	29.0
<b>AQ30</b>	<b>21N - 0374568</b> <b>UTM - 0753912</b>	10:46	10:51	124	157	118	11.2	19.8	South West	0.8	32.0
<b>AQ31</b>	<b>21N - 0374716</b> <b>UTM - 0753874</b>	12:28	12:33	125	137	128	12.6	17.6	South West	0.3	30.0
<b>AQ32</b>	<b>21N - 0374852</b> <b>UTM - 0753839</b>	12:39	12:44	127	141	126	13.6	20.6	South	1.5	28.6
<b>AQ33</b>	<b>21N - 0374977</b> <b>UTM - 0753805</b>	12:42	12:47	125	136	126	11.1	15.6	South	1.6	28.0
<b>AQ34</b>	<b>21N - 0375098</b> <b>UTM - 0753770</b>	12:57	13:02	128	152	123	10.0	14.0	South	0.8	29.8

***Results and Discussion (Route of the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station)***

PM<sub>2.5</sub> concentration of the monitored area ranged from 7.4 – 20.4µg/m<sup>3</sup>, during the monitoring period. The highest PM<sub>2.5</sub> measurement was recorded at AQ22 (20.4µg/m<sup>3</sup>), this value was below the PM<sub>2.5</sub> USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 35µg/m<sup>3</sup> 24-hours average along with the other thirty three (33) values.

PM<sub>10</sub> concentration of the monitored area ranged from 10.5 – 28.6µg/m<sup>3</sup>, during the monitoring period. The highest PM<sub>10</sub> measurement was also recorded at AQ22 (28.6µg/m<sup>3</sup>), however, this value was below the PM<sub>10</sub>USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 150µg/m<sup>3</sup> 24-hours average along with the other thirty three (33) values.

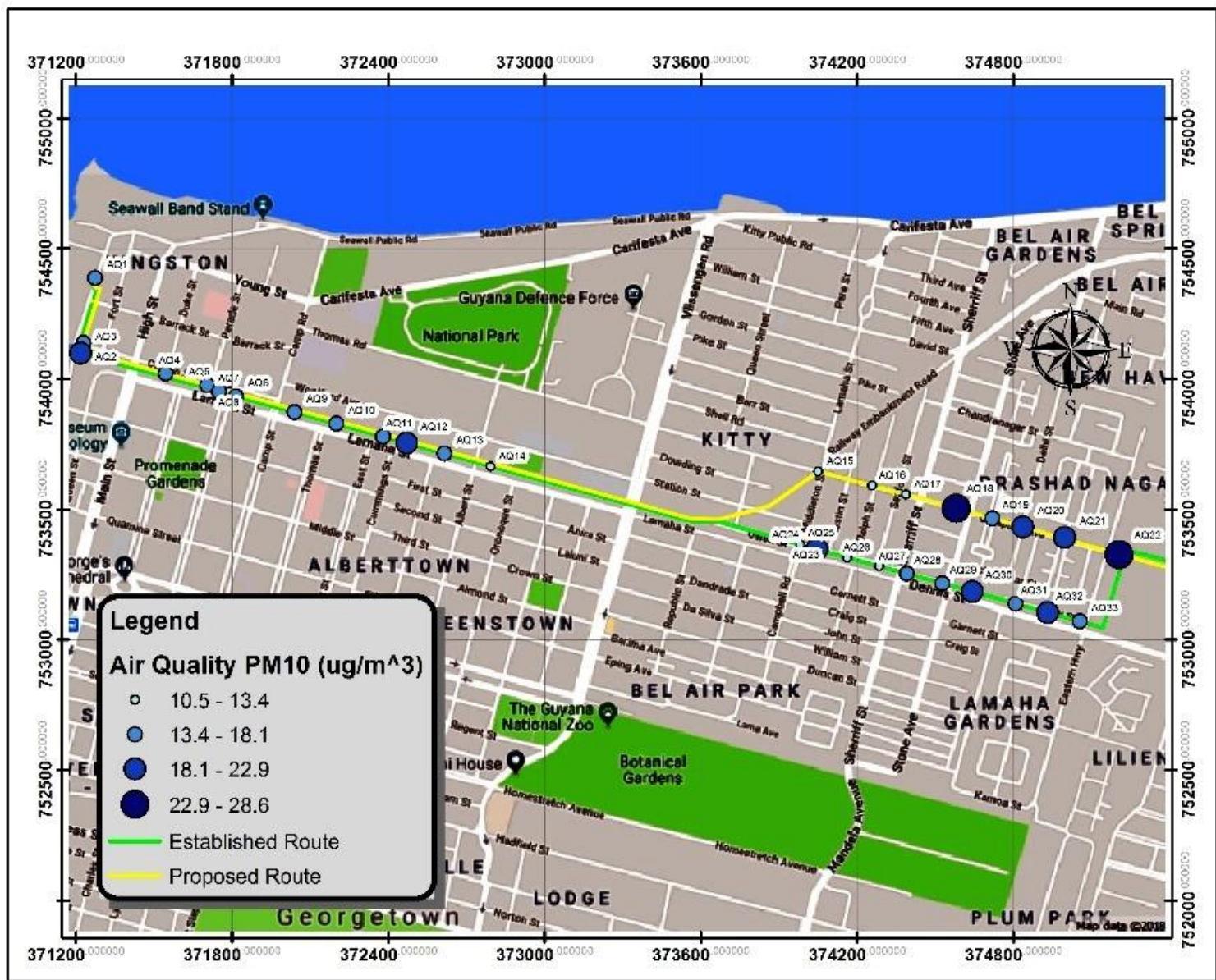
- TWA of the monitored area ranged from 109 – 140µg/m<sup>3</sup>, respectively, during the monitoring period. The TWA readings varied among the thirty four (34) sites, with the highest TWA concentration recorded at AQ18 (140µg/m<sup>3</sup>). In comparison with the TSP USEPA 1971 - 2012 National Ambient Air Quality Standard (NAAQS) 150 µg/m<sup>3</sup> 24-hours average, the value recorded at AQ18 was below the TSP Air Quality Standard. TWA levels for the other thirty three (33) sample points were below the limit during the monitoring period.



- Maximum concentration ranged from 110 – 193 $\mu\text{g}/\text{m}^3$ . The highest Maximum Concentration was recorded at AQ3 (193 $\mu\text{g}/\text{m}^3$ ). In comparison with the USEPA 1971 – 2012 NAAQS 150  $\mu\text{g}/\text{m}^3$  24-hours average, measurements showed that AQ3, AQ34 (152  $\mu\text{g}/\text{m}^3$ ), AQ30 (157  $\mu\text{g}/\text{m}^3$ ), AQ10 (178  $\mu\text{g}/\text{m}^3$ ), AQ6 (166  $\mu\text{g}/\text{m}^3$ ), and AQ1 (169  $\mu\text{g}/\text{m}^3$ ) were all above the USEPA 1971 - 2012 NAAQS - TSP AQS during the time of monitoring while the other twenty eight(28) sample points were all below the limit.
- The highest average concentration value was recorded at AQ12 (139 $\mu\text{g}/\text{m}^3$ ), this value was below the USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 150  $\mu\text{g}/\text{m}^3$  24-hours average along with the other thirty three (33) values.

The majority of the TWA, Average and Maximum concentration readings were below the USEPA 1971 – 2012 National Ambient Air Quality Standards (NAAQS) 150  $\mu\text{g}/\text{m}^3$  24-hours with the exception of the maximum concentration for AQ3, AQ34, AQ30, AQ10, AQ6 and AQ1 due to human activity.

# Air Quality Locations Map



**CLIENT:** Guyana Power and Light Inc. (GPL)  
**SITE:** Route from Kingston to Sophia Sub-station , Region 4 (Demerara-Mahaica)  
**DRAWN BY :** Samuel A. D. Reid  
**ENVIRONMENTAL ENGINEERING SOLUTIONS (EES) 06-JUNE-2018**  
**NOTE:** DRAWING PROVIDED FOR INFORMATION PURPOSES ONLY



Figure 18: Air Quality Sample Locations monitored along the proposed route of the L5 Conductor Upgrade and New Transmission Line from Kingston Sub-station to Sophia Sub-station (Source: Reid, 2018)

## **4.5 Biological Resources**

### **4.5.1 Biogeographic Province, Habitats and Flora.**

The project sites are located in the capital city of Georgetown, which lies in the coastal biogeographical province. This province is situated in the Low Coastal Plain and is characterized by the following biotic communities: (a) the marine ecosystem (which includes mudflats, mangrove forests and shell beaches). The mangroves protect the shoreline against erosion; (b) the estuarine ecosystem, which is characterized by wetlands which occur at the mouths of the rivers; (c) the riverine ecosystem, which is characterized by tidal wetlands which occur along river banks; (d) the palustrine ecosystem - comprises marshes and swamps in river flood plains, as well as 'water savannahs'; and (e) the lacustrine ecosystem which consists of natural lakes and the water conservancies (NARI 1995).

Georgetown is situated close to the mouth of the Demerara River and much of its primary vegetation and natural habitats have been lost over many decades of infrastructure development and the expansion of housing, commercial and industrial activities. Several types of modified habitats are associated with the project sites:

1. Small patches of mangroves. Mangroves are part of the coastal environment and their importance is recognizable in aspects such as forestry, fisheries, coastal defence and environmental protection. As with other natural resources in the capital, mangroves also declined because of the influence of human interventions and disturbance. Analysis of data from a 5 year period over 2004-2009, carried out by the Guyana Forestry Commission (GFC) and National Agricultural Research and Extension Institute (NAREI), showed that mangrove forest cover was the lowest in Region 4, with 91.9 hectares. Considering Georgetown only, this coverage declines significantly, with few mangroves being found at the city's boundary with the Demerara River, such as behind GPL's Kingston facility (see Figures 19 and 20). These mangroves are not expected to be disturbed as a result of construction activities on the site.



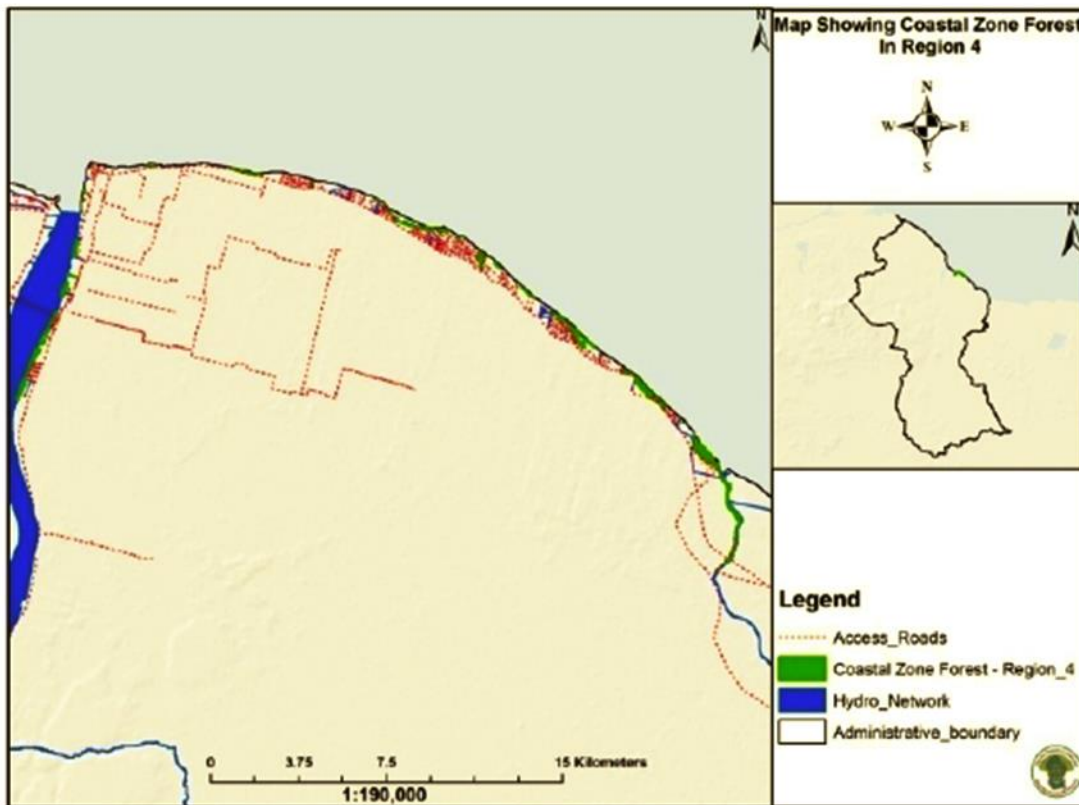


Figure 19: Coastal zone forest within Region 4 based on 2004-2009 data (GFC and NAREI, 2011).

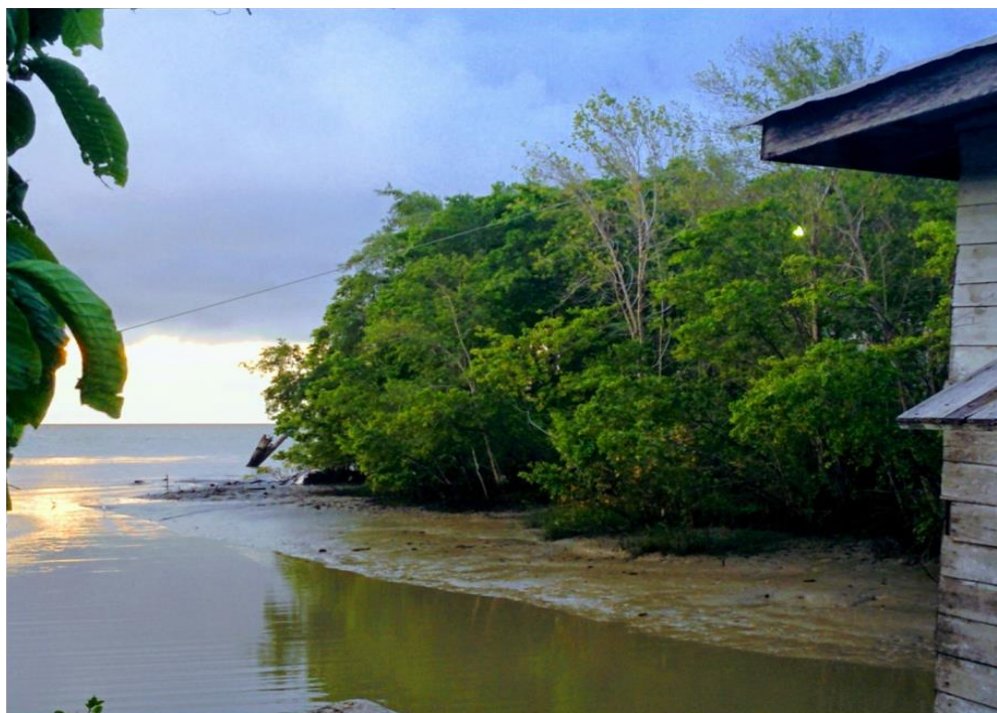


Figure 20: Mangrove trees within the vicinity of GPL's Kingston Facility

2. Patches of secondary vegetation in managed and unmanaged green spaces. Within the city, regulated or managed green spaces include parks and gardens (Figure 21). In particular, the botanical gardens and eastern portion of the zoological park, serve as important natural refuges for many species, including avifauna. Its diversity is considered impressive for an urban area and the botanical gardens are actively marketed as a birding hotspot and are component of the tourism experience offered in Georgetown. The patchy matrix of trees beyond these managed areas in pastures and open areas such as roadsides and reserves; and cultivated trees on private lands support avian diversity by providing room for dispersal and feeding, breeding and nesting habitats. In large part, the majority of remaining open areas such as along roadways, canals and vacant private and public lands, between the project sites hosts vegetation characteristic of highly disturbed landscapes primarily shrubs, herbaceous plants and several species of grasses. Some common species include: black sage or wild sage (*Cordia curassavica*), lantana or white/sweet sage (*Lantana sp.*), razor grass (*Paspalum virgatum*), carrion crow bush (*Senna alata*), morning glory (*Ipomoea hederifolia*), moko-moko (*Montrichardia arborescence*) and tanner grass (*Brachiaria radicans*). These are all considered weeds and are quite common. Larger species of trees include samaan or rain tree (*Samanea saman*), cannonball (*Couroupitaguianensis*), flamboyant (*Delonix regia*) and Crape Myrtle Tree (*Lagerstroemia sp.*) and a variety of palms.



**Figure 21: Vegetation within a managed green space located between the project sites.**

Commonly cultivated species in the city includes: mango (*Mangifera indica*), malacca cashew (*Eugenia malaccensis*), guava (*Psidium guajava*), sapodilla (*Manilkara zapota*), jamoon (*Syzygium cumini*), breadfruit (*Artocarpus alticola*), carambola (*Averrhoa carambola*), golden apple (*Spondias dulcis*) and papaya (*Carica papaya*). These provide an excellent food sources for some faunal species.

### 3. Canals and waterways.

There are a series of waterways and canals which facilitate drainage and provision of freshwater. The Lama Canal feeds the water treatment plant located at the main office of the Guyana Water Authority Inc. before being distributed to various areas of the city including Kingston and Sophia (EPA 2016). Others are primarily for the purpose of drainage and are considered highly disturbed ecosystems. Aquatic vegetation commonly associated with or occurring in the drainage canals include: sacred lotus (*Nelumbo nucifera*), lavender water hyacinth (*Eichhorniacaerulea*), wild eddo (*Colocasia sp.*), common water moss (*Salvinia auriculata*), water lettuce (*Pistia stratiotes*), common water hyacinth (*Eichhorniacrassipes*), water poppy (*Hydrocleysnymphoides*), and various species of aquatic grasses and sedges including bisi-bisi (*Eleocharis elegans*), antelope grass (*Echinochloa pyramidalis*) and para grass (*Brachiariamutica*). This vegetation often requires removal by those in-charge of maintaining good drainage and irrigation, as they grow and spread rapidly, clogging drains and impeding the flow of water. Examples of freshwater habitat and vegetation along the reserves, between the project sites, are shown in Figure 22 and 23, below. Canals and waterways may be affected due to construction activities and mishandling of construction materials. The topic is further discussed in Chapter 6 and 7.



**Figure 22: Freshwater habitat and vegetation along reserves between the project sites in Georgetown - Lamaha Street.**





**Figure 23: Freshwater habitat and vegetation along the reserves between the project sites in Georgetown - Sophia/Liliendaal**

4. Coastal beaches. This habitat is associated with and is influenced by the ocean. The majority of vegetation in this area has been lost. Grasses and herbaceous plants are most common and serve to hold the uppermost layer of soil together.
5. Dense urban spaces. Such areas are best typified by industrial and commercial zones of the city. Here, significant floral diversity is nearly absent, but some groups of fauna such as birds are can be observed.

#### 4.5.2 Fauna

The most notable aspect of faunal diversity within and around the project areas is avian diversity. There have been some efforts over the years to document the species, such as those by researchers and local organizations like the Guyana Amazon Tropical Bird Society. As mentioned above the number recorded is considered considerable for a city landscape and is part of the urban tourism experience marketed by local guides and tour operators. Based on research conducted in 2017, a total of 98 species were documented but as many as 198 are likely to occur in Georgetown (Narine 2018). This diversity is due primarily to the presence of green spaces, whether managed or unmanaged; and canals and waterways, which support important aspects of their biology such as breeding and foraging. The following species are commonly observed within and around the project sites: greater kiskadee (*Pitangussulphuratus*), rock pigeon (*Columba livia*), ruddy ground dove (*Columbinatalpacoti*), pale-vented pigeon (*Patagioenascayennensis*), smooth-billed ani (*Crotophaga ani*), blue-gray tanager (*Thraupisepiscopus*), cattle egret (*Bubulcus ibis*), yellow oriole (*Icterus nigrogularis*), wattled jacana (*Jacana jacana*), striated heron (*Butoridesstriata*), southern lapwing (*Vanellus chilensis*), snail kite (*Rostrhamussociabilis*) and Carib grackle (*Quiscaluslugubris*). Psittacids such as the yellow-crowned parrot (*Amazonaochrocephala*), Orange-winged parrot (*Amazonaamazonica*),

and red shouldered macaw (*Diopsittacanobilis*) have been recorded in unmanaged spaces, residential areas and in areas where there are freshwater bodies canals, ponds, and as such are likely to be found in and around Sophia. Species which are characteristic of the Kingston site include: scarlet ibis (*Eudocimus ruber*); snowy egret (*Egretta thula*) and magnificent frigatebird (*Fregata magnificens*). None of the species that are listed have special status on International Union for Conservation of Nature Red List (that is, identified as near threatened, vulnerable, endangered or critically endangered).

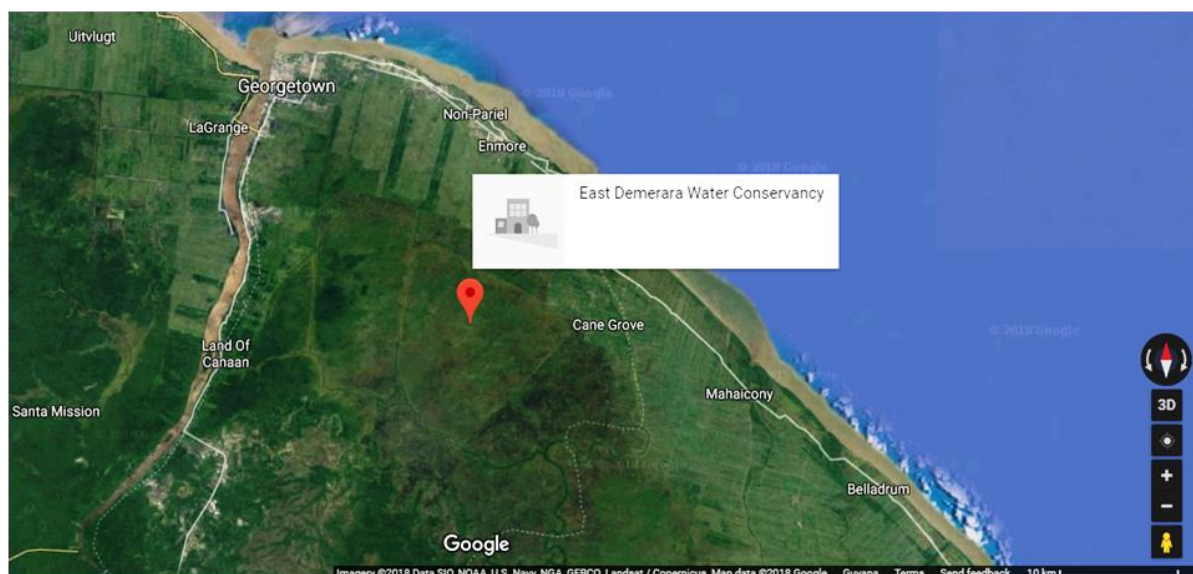
Given the level of habitat disturbance at both project sites mammalian fauna is limited. In urban settings, characteristic mammal species include, mongoose (*Herpestes*), common opossum (Order: Didelphimorphia), bats (Order: Chiroptera); and rodents such as the brown rat (*Rattus norvegicus*) and black rat (*Rattus rattus*).

Reptiles such as caimans and boas are reported to inhabit drainage canals in some areas within the city and, within these water bodies, fishes such as hassar (*Hassar orestis*) and patwa (*Cichlasoma bimaculatum*) are known to occur.

#### 4.5.3 Areas of Recognized Importance to Biodiversity

Georgetown is not contained within any areas designated nationally as important biodiversity areas, including protected areas or forest reserves as identified in the National Land Use Plan 2013 (see Figure 24 below). As per the National Protected Areas Act, 2011, the Kaieteur National Park, Iwokrama International Forest Reserve, Shell Beach, Kanuku Mountains and Konashen Community Protected Area are legally designated protected areas in Guyana. The latter three have been declared within the past decade, in an effort to ensure greater protection for biodiversity, ecosystem services and livelihoods of local people who depend on resources of these area to support subsistence activities. Shell Beach is the only protected area located in the coastal biogeographic province, but is located along the Atlantic Coast in the Barima - Waini administrative region. Forest Reserves such as Mabura Hill and Moraballi, established under forestry legislation, are also conserved for their biodiversity. For example, the National Forest Policy Statement 2011 relates that areas such as the Moraballi Forest Reserve have been excised from the forest estate to be protected in perpetuity through the careful monitoring and management. The Moraballi Forest Reserve is a major seed bank for one of Guyana's most valuable timber species, Greenheart (*Chlorocardium rodiei*). Over the years biodiversity priority setting exercises have identified several additional areas have been considered as areas of biological interest. The National Biodiversity Strategy and Action Plan I identifies: Mount Roraima and upper Cuyuni River Area, Essequibo Islands, South Eastern Forests, Karanambu and Orinduik. The National Strategy for the Establishment of a System of Protected Areas (2002) identifies other potential areas for conservation including: Bartica Triangle, Shiriri Mountains, Amakokopai, Barabina, some areas of the Canje River, Pakaraima Mountains, and some parts of the Coastal Zone. However the strategy notes that further studies are needed on these areas before further determination can be made on these potential areas (EPA 2002).

Important human-made/semi-natural wetland areas lie along the coastline including the East Demerara Water Conservancy (EDWC), Mahaica-Mahaicony-Abary (MMA) Conservancy and Lower Canje Basin. The EDWC has substantial fish species including many carnivorous species such as the lukanani (*Cichlaocellaris*) and birds – the most unique of which is the Hoatzin or Canje pheasant (*Opisthocomushoazin*). Maguari storks (*Ciconia maguari*), kingfishers, herons, ducks, swallows and flycatchers are also common (EPA 2016 based on WWF-Guianas, 2012). Large aquatic mammals such as the neotropical otter (*Lontralongicaudis*; IUCN: Near Threatened), giant river otter (*Pteronurabrasiliensis*; IUCN: Endangered), west-indian manatee (*Trichechus manatus*; IUCN: Vulnerable), and capybara (*Hydrochaerishydrochaeris*) are known to inhabit the EDWC (EPA 2016 based on WWF-Guianas, 2012), Biodiversity within the MMA and Lower Canje is comparable. Many terrestrial species are closely associated with the areas including the Brazilian tapir (*Tapirusterrestris*; IUCN Vulnerable), jaguar (*Panthera onca*; IUCN: Near Threatened) and white-lipped peccary (*Tayassupeccari*; IUCN Vulnerable) (EPA 2016 based on IUCN 2018; WWF-Guiana 2012). The image below shows the site in relation to the EDWC.



**Figure 24: Map Showing Georgetown, Region 4**

Mangrove forests are considered critical habitat in the coastal zone; mangroves have been declared a protected species in Guyana (NARI 2018). Mangrove forests are the first line of defence against many of the effects of climate change and climate related extreme events (Persaud 2011). They protect vulnerable coastlines from wave action because they hold the soil together and prevent coastal erosion. They also play an important role as wildlife habitat and in supporting marine fisheries. Mangroves serve as fish nurseries as they provide a source of food for fish, shrimp and crabs that live in rivers and the shallow areas of the ocean, and provide a safe haven for juvenile fish, shrimp and crab located on Guyana's coastline (NARI, 2018). In all

coastal regions (Administrative Regions 1, 2, 3, 4, 5, and 6) mangrove forests covers a total of 22,632.4 hectares (Persaud, 2011). In Region 1 mangrove forests are protected as part of the Shell Beach Protected area. In Region 4, (Demerara - Mahaica; in which Georgetown is located) mangroves account for 0.41% or 91.9 hectares (Persaud, 2011). Within the city itself, mangrove cover is lower; while in other communities within Region 4, such as Victoria and Le Resouvenir/Felicity have higher coverage. Guyana has pursued mangrove rehabilitation, protection and sustainable use in order to address the threats to these forests and to mitigate the effects of climate change. There are no direct expected impacts to mangroves as a result of the project. The topic is further discussed in Chapters 7 and 8.

There are no officially designated areas in Guyana identified as Important Bird Areas (Birdlife-International. 2018). However, there are ten proposed sites: Shell Beach, Karaw/Aruka (Barima Waini); Ireng River, North Rupununi - Karanambu Ranch, Mapari - Kanuku Mountain, South Central Rupununi, Karasabai (Upper Takutu - Upper Essequibo); Iwokrama (Potaro-Siparuni); Northeast Coastline (Mahaica- Berbice); and Pacaraima Mountains (Cuyuni - Mazaruni) (Narine et al. 2009). The project sites do not fall in any of the proposed areas.







## 4.6 Natural Disasters and Hazards

In the period from 1900 to 2013, the main disasters in the country were due to floods and these affected the coastal areas in particular (Green 2013). The flood risk specifically is exacerbated by vulnerability. There exists a complex and dynamic interplay between high tides, high rainfall and the network of drainage and irrigation canals, conservancy dams and sluices designed to support agriculture, which makes the coastal zone susceptible to high risk of flooding. This risk is also increased by the quality of sea defences along the coastal zone. As stated previously most of the coastal plain including Georgetown is below sea level and this necessitates a system of sea defences and drainage and irrigation canals that protect the area from flooding (GoG, 2013).

### 4.6.1 Sea Level Rise and Storm Surges

Guyana's Second National Communication (SNC) to the UNFCCC (2012) indicates that the country projected to face serious challenges from sea-level rise brought on by climate change. This impact will be felt by in the low-lying coastal belt. Any impact on the coastlands will have consequences for the economic sectors such as agriculture and fisheries which define the area and are highly sensitive to changes in climate. The Initial National Communication (INC) report to the UNFCCC (2002), based on existing tide gauge data for the period 1951 to 1979 for Stabroek Port, Georgetown, found that the rate of mean relative sea level rise was 10.2 mm/yr using linear extrapolation; and high tide change was been calculated to be 9.7mm yr<sup>-1</sup> with the low tide change being 11.1mm yr<sup>-1</sup>. This rate of relative sea level rise is approximately more than five (5) times the global average (GoG, 2002). However, similar observations in Trinidad suggests that some mechanism other than eustatic sea level rise, such as ocean floor sediment loading and land subsidence due to water extraction may be responsible for the accelerated rise in sea levels. (GoG, 2002). In the long term, by 2071, relative sea-level rise goes from 25 cm to 51 cm; and in the medium-term, by 2031, the sea-level rise projections 14 cm to 26 cm, under two different modelling scenarios (GoG, 2012). Results of modelling storm surge scenarios in the SNC (2012) indicate that for the year 2031 the final storm surge height varies from 2.82 m to 2.94 m, under minimum storm surge scenario, to 5.82 m to 5.94 m, under the maximum scenario (Figure 26 and 27)

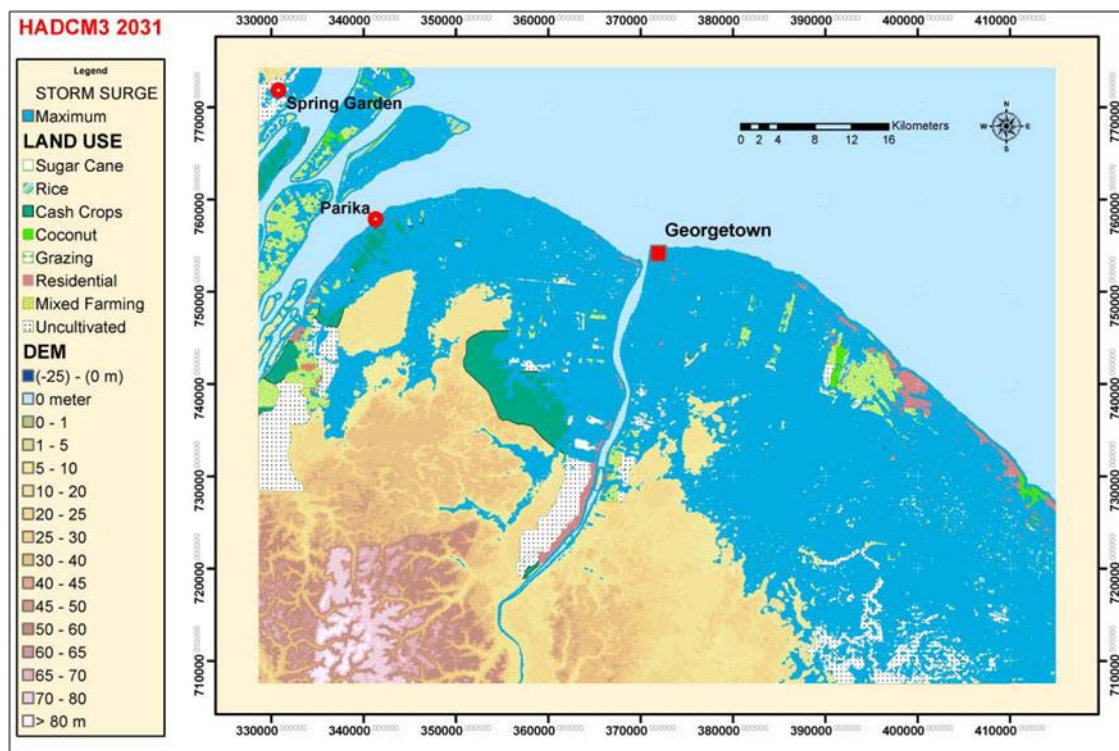


Figure 26: Inundation of the coastland along the Atlantic coastal zone of Guyana due to sea level rise and flooding, according to maximum storm surges scenario (Source: GoG: SNC, 2012)

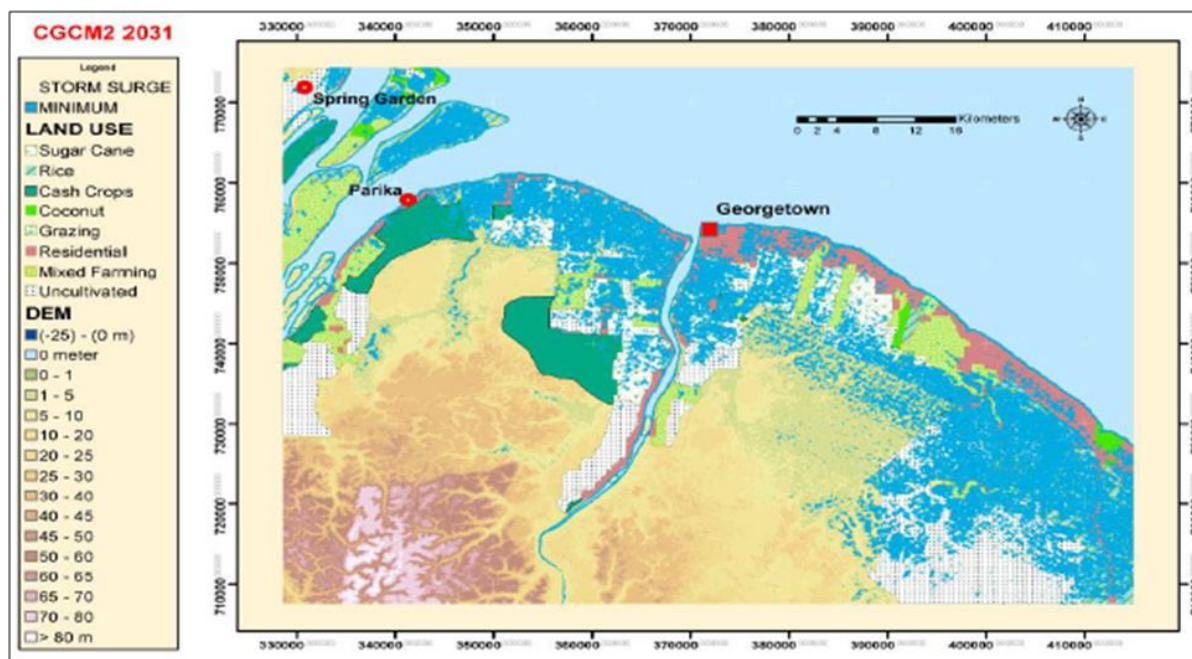


Figure 27: Inundation of the coastland along the Atlantic coastal zone of Guyana due to sea level rise and flooding, according to minimum storm surges scenario (Source: GoG: SNC, 2012)

The capacity of the natural and man-made systems to deal with rising sea levels is an important consideration for authorities. Not only would it impact the drainage infrastructure in Georgetown, but also structures such as conservancies which lie outside the city, which, if impacted, could pose major challenges for the city. For instance, the SNC 2016 report that as sea-level rises, the drainage relief capacity of the East Demerara Water Conservancy (EDWC) will be compromised, placing the dams, particularly the EDWC dam, at increased risk of failure. Because drainage infrastructure is principally gravity based, the drainage relief capacity is dependent on the difference in height between water in the system and the sea-level. Therefore, release of water from the conservancies is possible only when the water in the system is higher than the sea. As sea levels rise, the hydraulic head difference between the EDWC water control structures and sea outlets is expected to be significantly reduced. This effectively reduces both the flow rate and the discharge window available for water level management. The impact of a compromised EDWC dam (brought on by excessive rainfall) is demonstrated by the events of 2005 where there wide spread flooding along the coastline and the city.

#### 4.6.2 Excessive Precipitation, Flooding and Droughts

Guyana has experienced a number of climate related disasters due particularly to extreme weather events. Short-term weather variability such as high intensity rainfall or wind or tidal/wave activity is the usual cause of floods. It is also important to note that the extent of flooding is also influenced by human factors such as the management of solid waste, and the maintenance of physical infrastructure for drainage and irrigation, conservancies and sea defences (GoG, 2012).

In January 2005, the coastal plain, including Georgetown, experienced the worst flooding event in Guyana's history. It resulted in thirty-four (34) deaths and an estimated loss and damage totalling sixty percent (60%) of the Gross Domestic Product (EPA, 2016). This was as a result of excessive rainfall which compromised the EDWC. The following year in 2006 another major flood event was experienced costing USD\$30.1 million in damages and further set back the economy which was still recovering from the 2005 flooding (EPA, 2016). The most recent flooding event occurred in 2015, after receiving more than 100mm of rain in 24 hours This heavy rainfall event resulted in flooding of parts of Guyana's coast affecting areas along the Demerara-Mahaica (Region 4), including Georgetown, East Berbice-Corentyne (Region 6), and some areas of Mahaica-Berbice (Region 5) (EPA, 2016). The frequency of flooding events are a major concern (from many perspectives including health, economic, and social) and these experiences in the years show that the weather patterns have changed significantly in terms of both intensity and duration of periods of high and low rainfall. Although the flooding events are managed by the network of drainage and irrigation infrastructure which exists in Georgetown and along the coastland, the current system is unable to deal with the challenges.

Projections indicate that precipitation that falls in heavy events may increase (GoG, 2012). At the same time, however, the climate scenarios show that the country could experience mean annual rainfall decrease which not only affects the coast, but also inland areas.

#### 4.6.3 Other Climate - Related Considerations

Guyana is located well south of the active hurricane belt in the northern Atlantic. However, it is not uncommon for swells and storm surges, triggered by these northerly storms, to affect the Atlantic coastal zone of Guyana, which have been described in section 4.6.1 above.

#### 4.6.4 Seismic Activity

Seismicity in the northern part of the South America continent is largely controlled by plate boundary events occurring along the southern rim of the Caribbean Basin (GSEC, 2014). Major earthquakes frequently occur along the plate boundary between the South American and Caribbean Plates and earthquake activity is concentrated in a circular pattern around the perimeter of the Caribbean tectonic plate (GSEC 2014).

Earthquakes are identified as a risk for Guyana - for example within the National Integrated Disaster Risk Management Plan and Implementation Strategy (2013), National Multi-Hazard Disaster Preparedness and Response Plan (2013) and Disaster Risk Management Plan for the Agriculture Sector 2013 - 2018. However the risk is low. While official information regarding their occurrence is limited there are several reports of tremors following earthquakes in the Caribbean (Guyana-Chronicle 2015; Stabroek-News 2007).

## **5 DIAGNOSTIC OF AREA OF INFLUENCE (DIRECT AND INDIRECT) AND STAKEHOLDERS OF THE OPERATION**

### **5.1 Socio-economic Factors**

#### **5.1.1 Level of Urbanization**

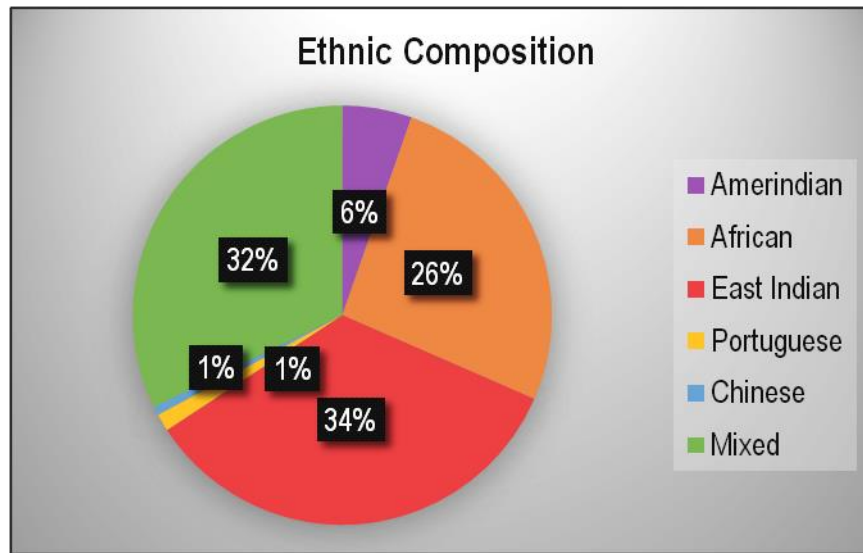
The project will be implemented entirely within Georgetown, the capital city of Guyana. The city, which covers an area of 51.8km<sup>2</sup> is located on the Atlantic Ocean at the mouth of the Demerara River within Administrative Region 4 (Demerara-Mahaica). Georgetown, which was established in 1781 and named in 1812, has a population of 239,277 persons (New World Encyclopaedia 2017). It is considered to be Guyana's main seaport and serves as the retail, administrative and financial services centre of the country. The city is governed by a mayor and city council which is the legislative branch of the city government.

#### **5.1.2 Social Environment Survey**

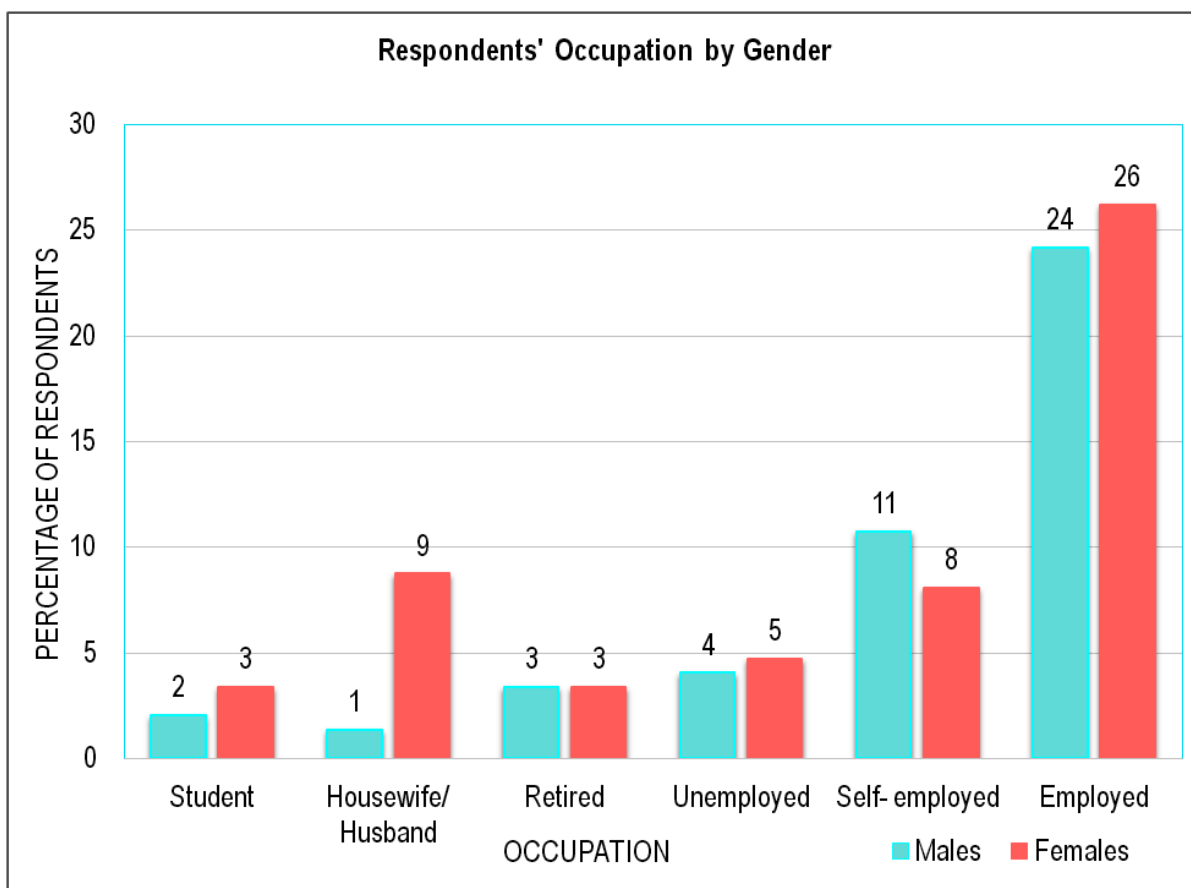
In order to offer concise information on socio-economic factors and characterisation, a social environment survey was designed and carried out within the project area. A total of 149 households were targeted during the survey and data were collected on various parameters including, among other things, cost of living indicators, health and education indicators, health and sanitation infrastructure (water, sewage, and solid waste), energy, cultural sites, community well-being, and gender and social issues.

Of the 149 households that were surveyed, East Indians comprised the largest ethnic grouping at 34%. This was followed by persons of mixed ethnic grouping at 32% and Africans at 26%. Six percent of the surveyed households comprised of Amerindians. This ethnic minority group is recognised as Guyana's first peoples, and currently make up approximately 9% of the country's population. While there are special laws in place for the protection of indigenous peoples in Guyana and internationally, the individuals within the project area currently reside in the capital city, and not within an Amerindian community, and as such indigenous land ownership rights are not applicable under this project. The Portuguese and Chinese made up the remaining surveyed households at 1% each (Figure 28).

In terms of household composition, 28% of the households comprised of four persons, 7% percent comprised of only one person while 18% comprised of six or more persons. As it relates to the respondents who participated in the study, 19% were self-employed and 50% were employed by either government or private entities. Five percent of the respondents were students while 10% were housekeepers. Thirty-five percent of the respondents who were employed (including self-employed) were males as compared to 34% who were females (Figure 29). Further analyses of the data in accordance with the categories mentioned above are presented below.



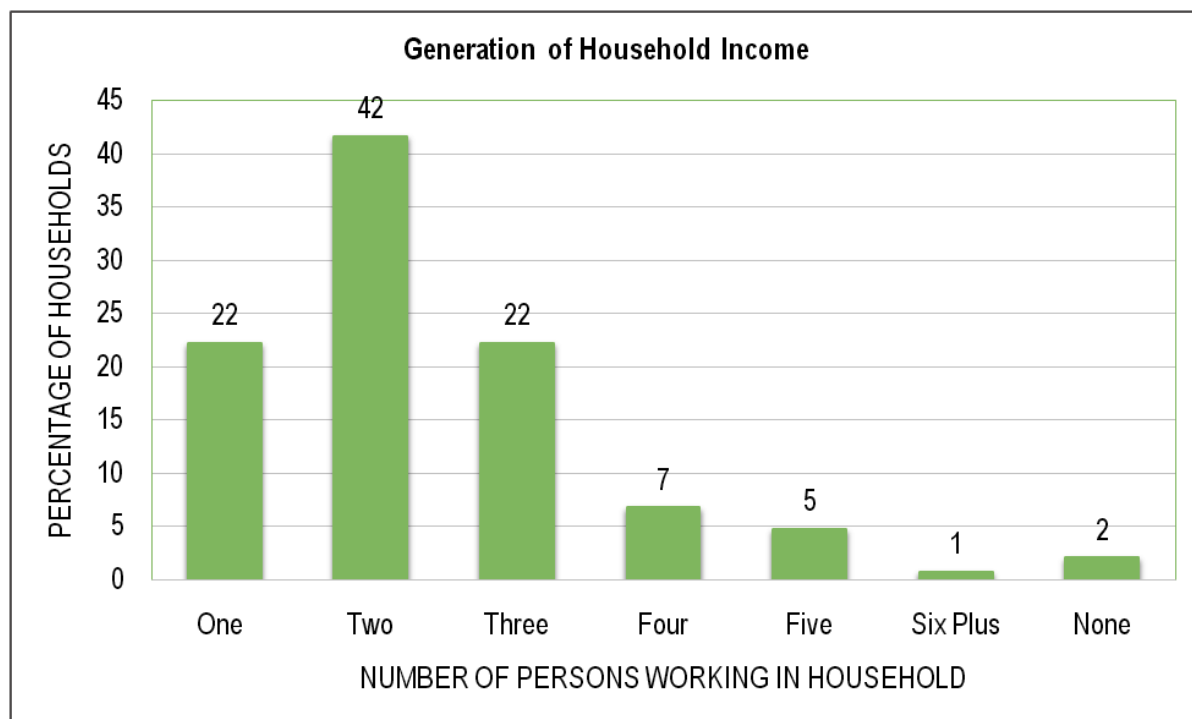
**Figure 28: Ethnic Composition of the Surveyed Households**



**Figure 29: Comparison of Respondents' Occupation by Gender**

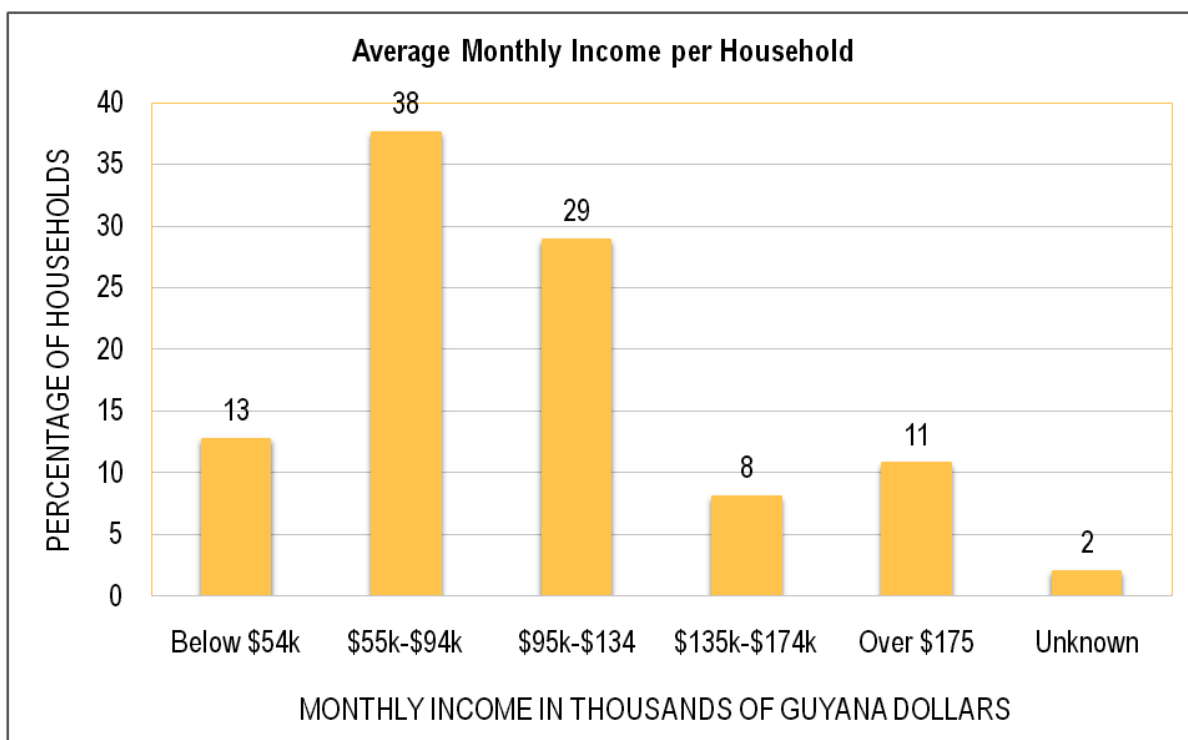
### 5.1.3 Cost of Living

A livelihood census was carried out to determine the productive systems, work, level of income, and overall living standards of the residents in the project area. Of the 149 households that were surveyed, it was found that 22% only had one person who was employed. Forty-one percent had two persons employed, while a further 22% had three persons employed. Only 1% of the surveyed households had six or more persons in employment while two percent of the households had no form of steady income (Figure 30). As it relates to the income generated by each household, 11% received an income of more than \$175,000. Currently, the national minimum wage in Guyana is \$55,000 while private sector minimum wage stands at \$44,200 (Guyana-Chronicle 2016; Newsroom 2017). The income tax threshold is currently \$60,000 per month (GRA 2017). Based on the survey, 13% of the households were working for below a monthly income of \$54,000 (Figure 31) which is considered to be within the low-income bracket. Not surprisingly, there is a positive correlation between the number of employed persons in a household and the average monthly income generated per household.



**Figure 30: Number of Persons Generating Household Income**



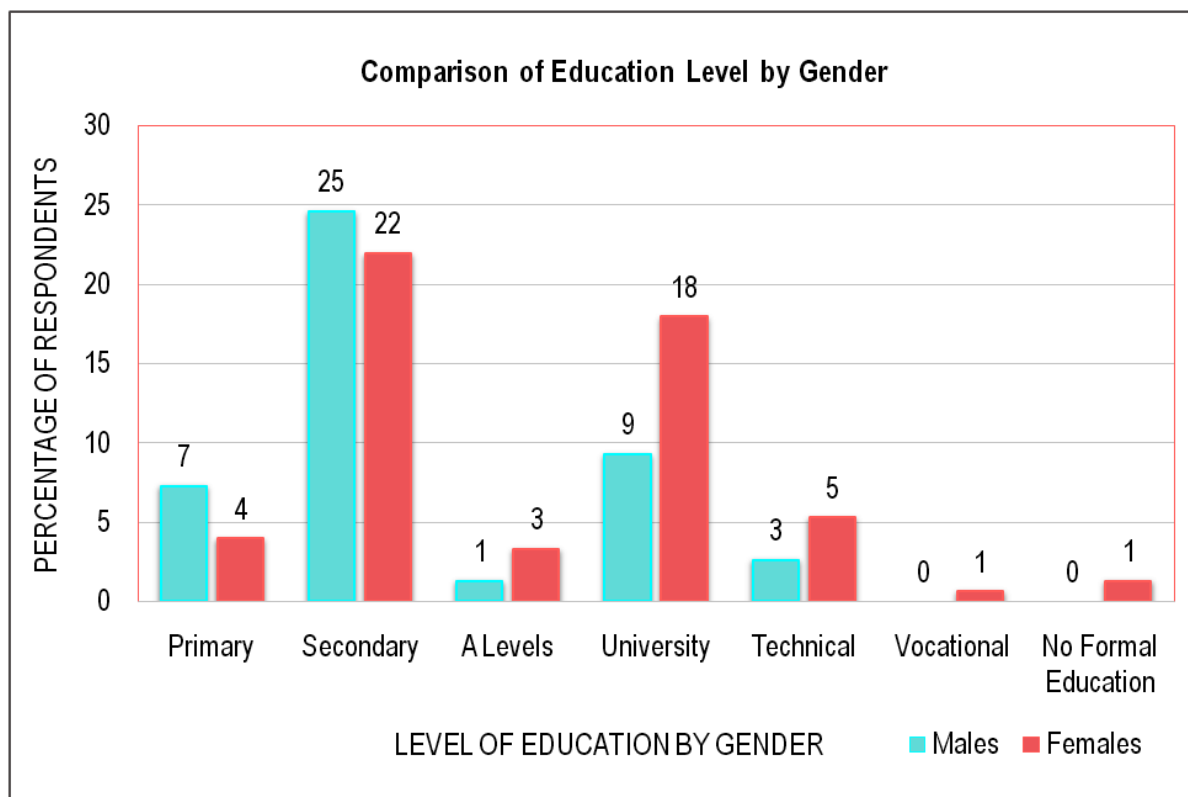


**Figure 31: Average Monthly Income by Household**

#### 5.1.4 Health and Education

Good health and well-being has been identified as the third of the 17 sustainable development goals set by the United Nations and its member states including Guyana (UN 2018). Ensuring healthy lives and promoting the well-being for all at all ages is considered to be essential for achieving sustainable development. Further, the IDB considers the promotion of better health conditions to be an important component of its vision and operations. Within the project area, 17% of the households surveyed cited that they had health concerns within their respective families. Most noted among these health concerns were injuries, respiratory illnesses, skin infections, and blood/immune infections.

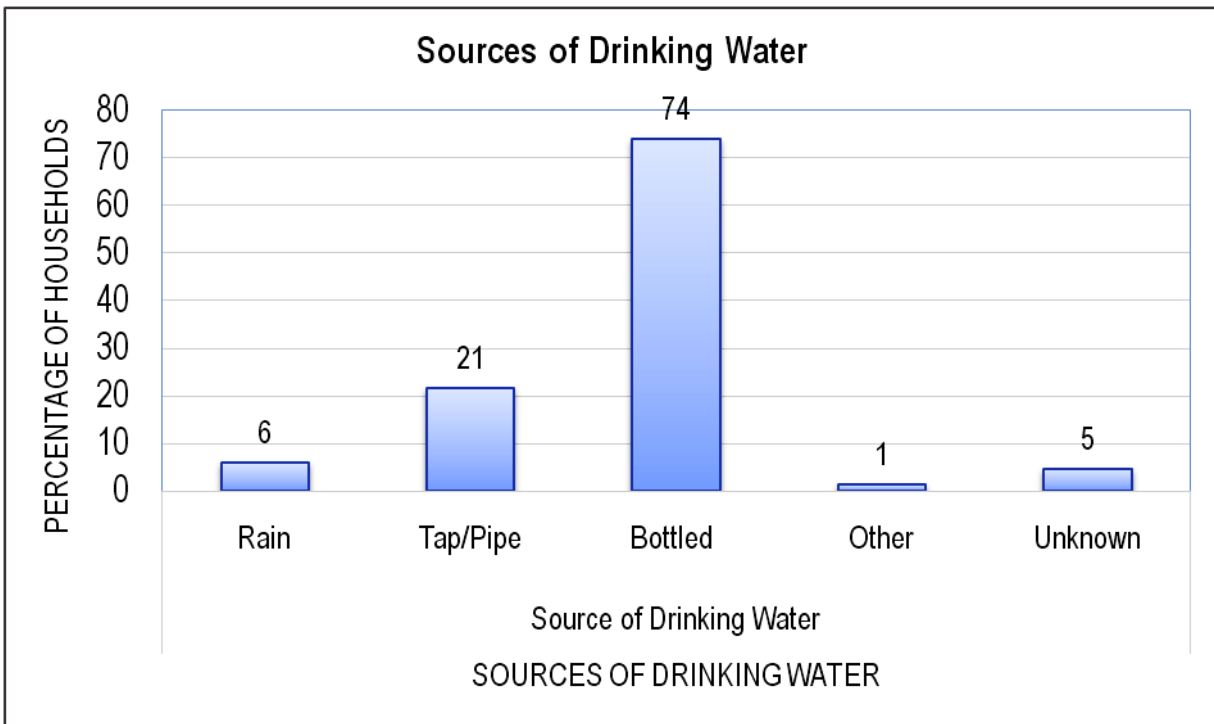
The United Nations has also identified education as the fourth of its sustainable development goals. Obtaining a quality education is considered to be the foundation to improving people's lives and sustainable development. Further, girls' education and advancing skills and job opportunities for young girls and young women are considered important pillars of societal development. Of the households surveyed, it was noted that a higher percentage of females completed school at the Sixth Form, Tertiary, Technical and Vocational levels. However, more males completed primary and secondary levels, and one percent of the female respondents surveyed did not have any formal education (Figure 32).



**Figure 32: Comparison of Level of Education by Gender in Surveyed Households**

#### 5.1.5 Health and Sanitation Infrastructure

Access to safe water and sanitation is considered to be essential to human health and to environmental sustainability and economic development. Goal 6 of the United Nations sustainable development goals speak to ensuring the availability and sustainable management of water and sanitation. Within the project area, 97% of the residents currently have access to water from the Guyana Water Incorporated (GWI). Of these households, 70% consider the water provision services to be good or fair, while a mere 3% consider it to be excellent. Twenty-six percent of the surveyed households classified the water quality and service to be poor. Almost three-quarters of the households (74%) within the project area consume bottled water. A further 21% also use the tap water provided by the GWI for drinking purposes while another 6% utilize rain water (Figure 33).

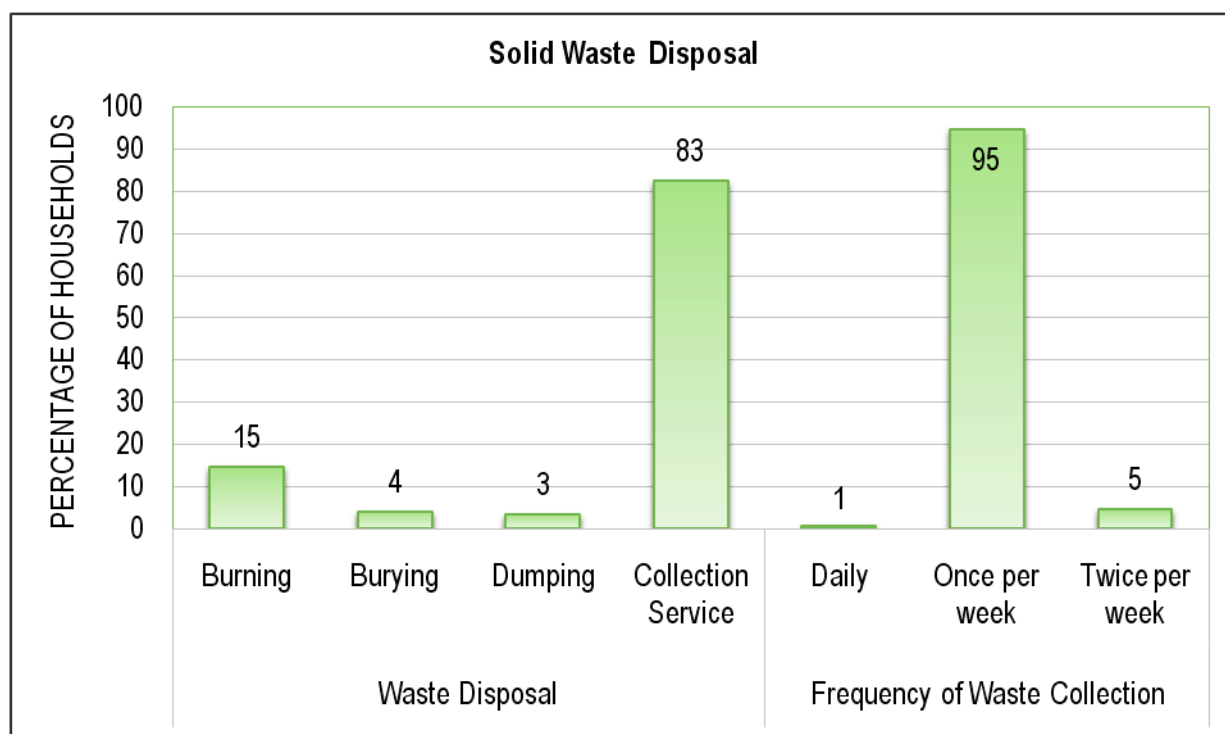


**Figure 33: Sources of Drinking Water in Surveyed Households**

In terms of sanitation, 64% of the surveyed households have septic tank systems for the disposal of sewage while 36% utilize a centralized system for sewage disposal. The majority of households within the project area (83%) utilize the city council and private collection services for the disposal of solid wastes. However, 22% of the households also engage in burning, burying and dumping of their solid wastes. Of the households that utilize the collection service, most of the respondents (95%) have their solid wastes collected on a weekly basis (Figure 34).

The major public health concerns identified by the respondents during the survey include dumping of solid wastes, flooding, and the prevalence of mosquitoes and rodents. The households were equally concerned about flooding and mosquitoes (37%) in the project area. Dumping of solid wastes accounted for 14% of the concerns while rodents accounted for 10%.

The Mayor and City Council is responsible for drainage and irrigation works throughout Georgetown and maintaining government reserves in front of private properties. Within the project area, 72% of the respondents were aware that cleaning works were conducted at the front portion of their property while 14% indicated that no works were completed. The remaining 14% of respondents were unaware of any cleaning being done.



**Figure 34: Solid Waste Disposal in Surveyed Households**

#### 5.1.6 Energy

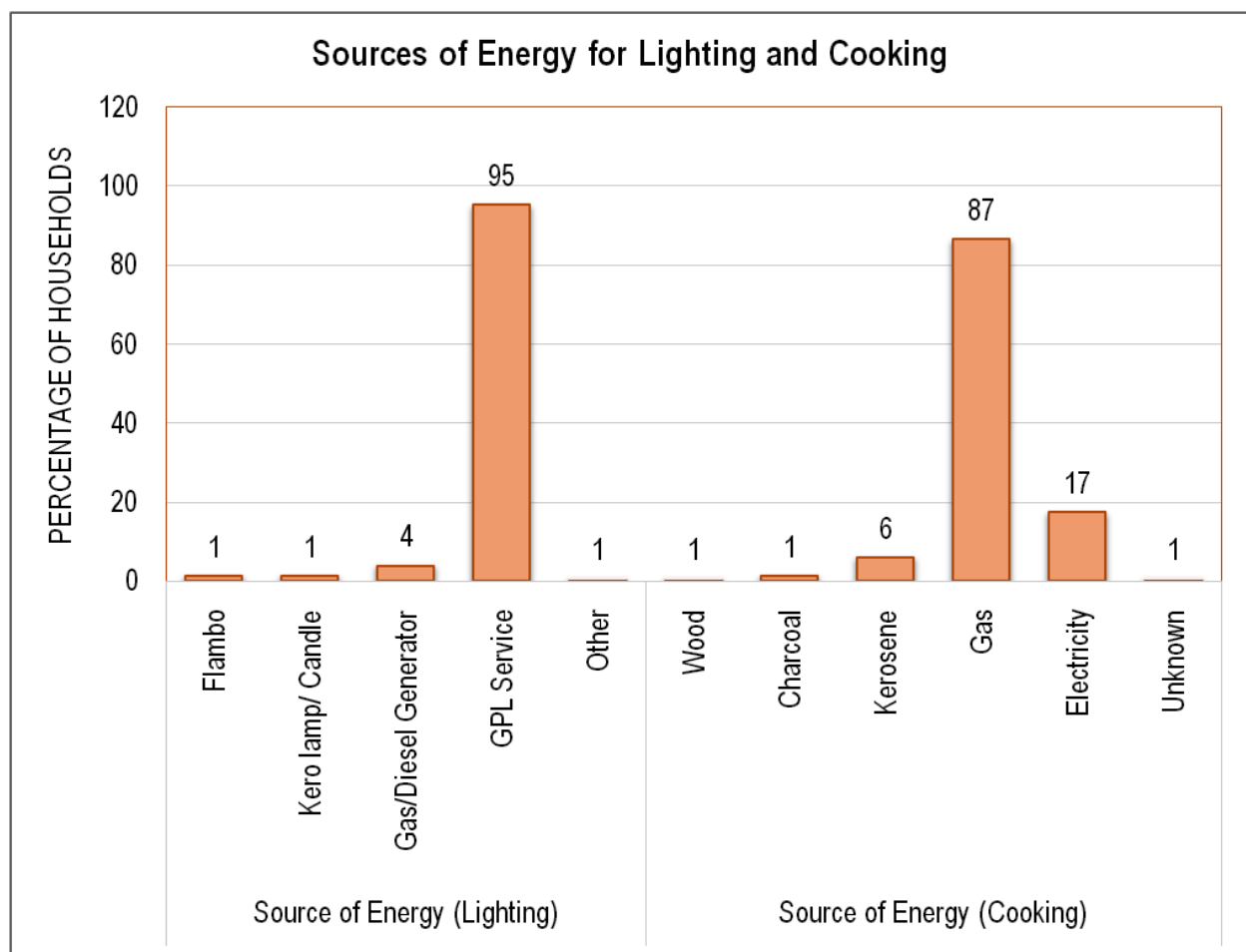
Goal 7 of the sustainable development goals speak to the supply of clean and affordable energy. Energy is considered to be crucial for achieving almost all of the Sustainable Development Goals. This includes its role in the eradication of poverty through improvements in health, education, water supply and industrialization, and in climate change adaptation. Within the project area, the vast majority of households (97%) had access to power provided by the GPL, while a further 7% of the households also utilised kerosene lamps/candles, gas/diesel generator, flambo and other energy sources. Of the households that had access to GPL power, 68% considered the quality of the service to be either good or fair, while 31% considered it to be poor.

For cooking purposes, the household use of liquefied petroleum gas (LPG) has been identified as one of several pathways to meet the goal of universal access to clean cooking and heating. In the project area, it was found that 87% of the respondents utilised gas for cooking, while 17% also utilised electricity and 8% utilised kerosene, firewood and charcoal (Figure 35).

In terms of perception of renewable energy, 47% of the respondents within the project area indicated that they are aware of the term while 53% have never heard of renewable energy. Of the respondents that heard of renewable energy, 14% reported having knowledge of it, 65% indicated that they had some knowledge of it, while 21% did not have any knowledge of renewable energy. Twenty-five percent of these respondents believed that renewable energy uses petroleum to generate power, while 45% were unsure of petroleum use in power generation.

Further, 24% of the respondents perceived renewable energy to be harmful to the environment as compared to 53% who believed that it did not have any adverse environmental effects. Eighty-six percent expressed that solar energy was a form of renewable energy. As it relates to the need for renewable energy in Guyana, 42% of the respondents that knew about renewable energy strongly agreed with this statement, while a further 39% indicated their agreement. A mere 3% indicated that renewable energy was not necessary for Guyana. Seventy-nine percent of the respondents was in favour of focusing on renewable energy sources while 2% strongly disagreed.

In terms of investment in renewable energy, 77% of the respondents believed that this will bring benefits to consumers, while 2% felt that it will not bring benefits. Eighty-seven percent of the respondents were willing to support renewable energy development in Guyana, while 3% were against renewable energy development. In terms of increasing knowledge on renewable energy, 87% of the respondents were willing to learn more about the subject, while 4% of the respondents expressed that they did not have any interest in learning more about renewable energy.



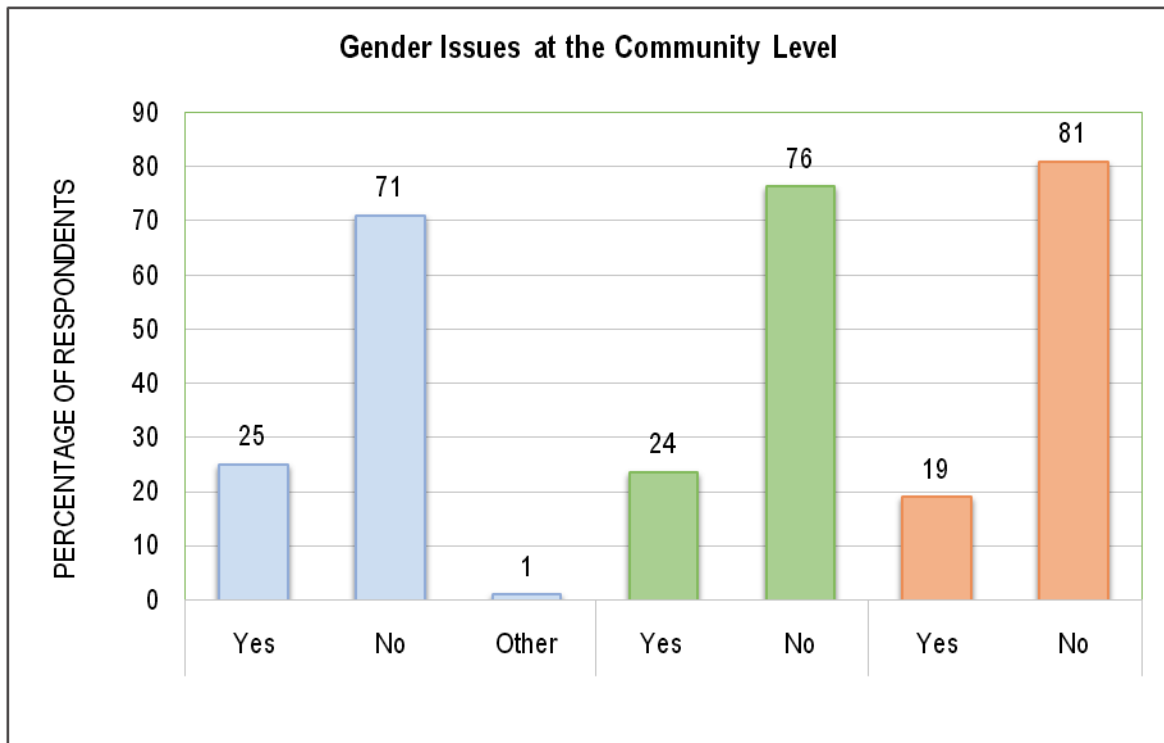
**Figure 35: Sources of Energy for Lighting and Cooking**

### 5.1.7 Community Well-being

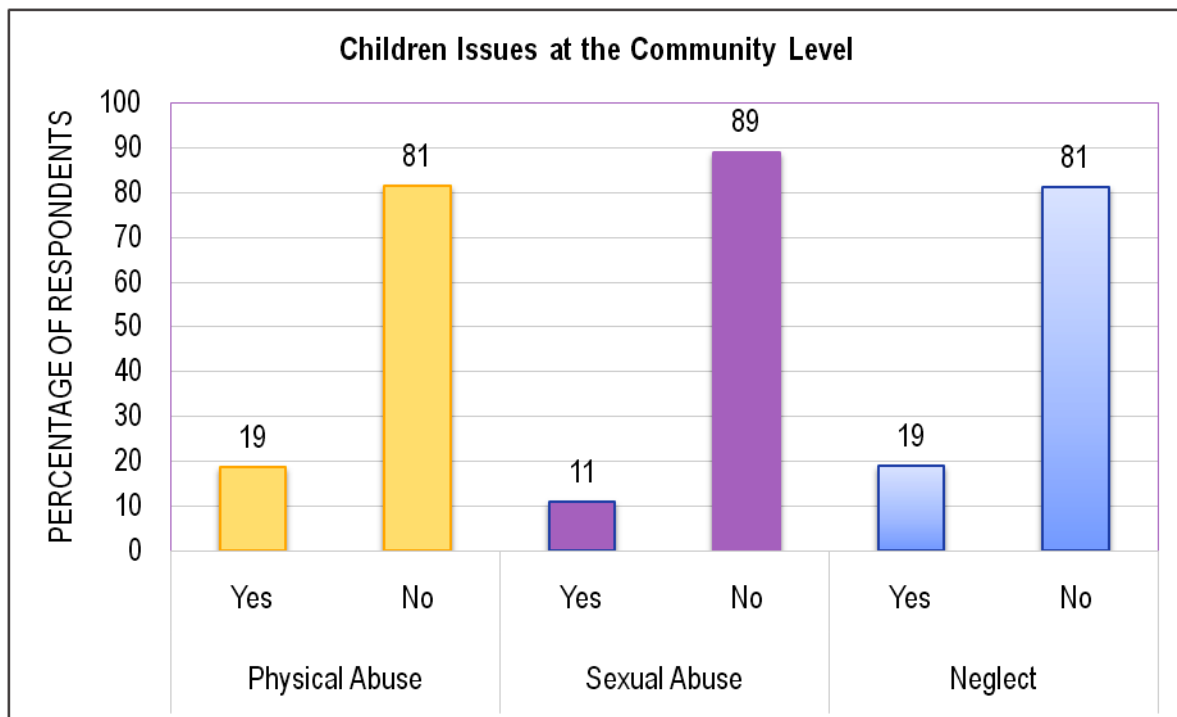
At the community level, persons identified crime (34%), poverty (28%) and lack of employment (33%) as the most prevalent social issues. Some level of discrimination (4%) has also been noted by the respondents. Issues of domestic violence were noted to occur in the area with 25% of the respondents highlighting it as a concern. There is also some level of sexual abuse and a high level of gender inequality occurring in the area as noted by 24% and 81% of the respondents, respectively (Figure 36).

In terms of issues affecting children, there are perceived incidences of physical abuse (19%), sexual abuse (11%) and neglect (19%) occurring in the area (Figure 37). Neglect is considered to be the most common form of child abuse and may lead to other physical, emotional and physiological problems if allowed to persist (National Society for the Prevention of Cruelty to Children 2017).

As it relates to the level of social cohesion, 37% believed that the project area had average cohesion, while 16% ranked it as good. A mere 1% thought that social cohesion was excellent while another 32% rated it as being either poor or very poor. Almost half of the respondents (49%) believed that there were no opportunities for local employment while a further 36% were unsure or unaware of any employment opportunities. For the respondents (15%) that thought that there were job opportunities, these were identified to be with shipping companies, construction companies, food courts, supermarkets and grocery stores, mechanic shops, taxi services, wash bays and tyre and welding shops. Opportunities within the labour industry were also cited as possible means of employment.



**Figure 36: Gender Issues – Domestic Violence, Sexual Abuse and Equality - at the Community Level**



**Figure 37: Issues – Physical Abuse, Sexual Abuse and Neglect - affecting Children at the Community Level**



### 5.1.8 Cultural Sites

As it relates to the cultural features of the project area, the residents primarily belonged to one of the three major religious groups in the country – Hinduism, Christianity and Islam – with Christianity accounting for 57% of the households’ surveyed (Figure 38). Several churches, temples and mosques were also noted within the project area. There are no declared cultural sites or monuments within the substations project site and along the proposed ROW.

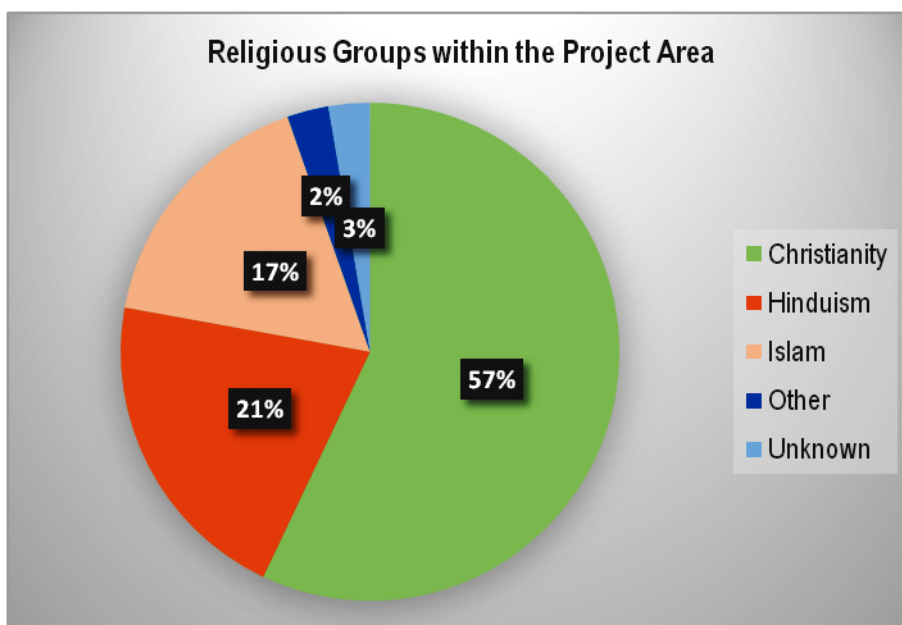


Figure 38: Religious Groups within the Project Area

## 5.2 Resettlement Plan

As stated earlier, the project will be implemented entirely within the capital city of Georgetown which has been established since 1781 on state lands. A population census was carried out to determine the exact number of persons that would be affected by land acquisition and any related impacts that can occur as a result of the project. This information provides the basis on which eligibility for compensation is determined. Based on the census and site visits, it is evident that there will be no physical displacement of occupants of the land where the substations will be expanded, no losses, and none of the units or persons would be affected by the project. As such, no resettlement plan is required under the project.

### 5.2.1 Livelihood Restoration Plan

Given that there is no resettlement and no economic activities or livelihood that will occur because of the project, the preparation of a livelihood restoration plan is not required. However, since lack of employment and poverty were cited as important social considerations for the residents of the area, the project can consider livelihood interventions, such as skills-based

training and the provision of short-term employment that could be of benefit to the residents in the area.

#### 5.2.2 Displacement of Physical Assets and Social Services

There are a number of physical and economical assets, and social services within the project area that are important for the well-being of the community. Currently there are both government and private schools; government health clinics/outposts/hospitals; financial institutions; markets; privately-owned shops and stores; places of worship; public spaces; one police station/outpost; one fire service station; and one post office in the project area. Additionally, several other developmental initiatives such as paved roads and telephone services have been completed in the area. Based on the surveys and site visits, it was determined that none of these facilities and services would be displaced or affected by the project, and as such there is no need for resettlement or compensation under the project.

## 6 ENVIRONMENTAL AND SOCIAL IMPACT ANALYSIS

The Interconnection Project (L5 Redundant Circuit and Conductor Upgrade Project) seeks to ensure that GPL meets its current and increasing demand for power, efficiently, while at the same time meet the urgent need to optimize generation and overall operating costs. It comprises the following main activities:

- Construction and commissioning of a single circuit overhead 69 kV Transmission Line between the Kingston and Sophia Substations;
- Extension of the Kingston and Sophia Substations to accommodate the new transmission line; and
- L5 Conductor Upgrade.

In this section, the Environmental and Social Impacts (ESI) of the proposed activities are identified and analyzed to inform adequate actions of control and measures of prevention of associated environmental and social risks.

While Transmission line projects are not considered as an air, water polluting and resource intensive sector, there can be considerable environmental impacts during the initial construction phase. The environmental and social impacts associated with the project are identified to ensure adequate measures are implemented for the project to be environmentally and socially viable and sustainable. The identification and analysis of the environmental and social impacts is based on available information concerning the major activities of the proposed project, identification of potential environmental and social aspects, and analysis of the significance of the environmental and social impacts.

Impacts will be assessed considering three factors: duration of the impact, its geographical extent and magnitude. Table 15 introduces the scales and definitions used for this project.

**Table 15: Impact Appraisal Criteria**

Criteria	Scale	Definition
Duration of effects	1. Short effects	Lasting less than a year
	2. Temporary effects	Lasting less than five years
	3. Long term	Lasting more than five years
Geographical spread	1. Local	Limited to the project site and immediate surroundings
	2. Medium	Up to 2km beyond the project site
	3. High	Up to 5km beyond the project spread
Magnitude	1. Low	Minimal and/or reversible changes to the baseline conditions in immediate surroundings

	2. Moderate	Evident changes to the baseline conditions in the surrounding area
	3. High	Significant changes to the baseline conditions

Based on these three factors the significance of an impact is determined as major; moderate; or minor as shown in the following table.

**Table 16: Impact Significance Criteria**

Spread	Duration	Magnitude	Rating	Significance
1	1	1	1	Insignificant
1	1	2	2	Minor
1	2	1	2	Minor
2	1	1	2	Minor
1	3	1	3	Minor
1	1	3	3	Moderate
3	1	1	3	Moderate
1	2	2	4	Moderate
2	1	2	4	Moderate
2	2	1	4	Moderate
1	2	3	6	Moderate
1	3	2	6	Moderate
2	1	3	6	Moderate
2	3	1	6	Moderate
3	1	2	6	Moderate
3	2	1	6	Moderate
2	2	2	8	Moderate
3	3	1	9	Moderate
3	1	3	9	Moderate
1	3	3	9	Major
2	2	3	12	Major
2	3	2	12	Major
3	2	2	12	Major
2	3	3	18	Major
3	2	3	18	Major
3	3	2	18	Major
3	3	3	27	Major

The following biophysical and socioeconomic aspects were considered for the impact analysis of the project sites.

**Table 17: Biophysical and Socio-economic aspects considered for impact analysis**

Biophysical	Socio-economic
Air Quality	Displacement
Noise	Employment
Soil	Livelihood
Land Use	Cultural resources
Landscape and Visual Amenities	Infrastructure
Solid Waste	Health and Safety
Water resources	
Natural Habitat	

**Table 18: Environmental and Social Impact analysis**

	CONSTRUCTION PHASE	OPERATION PHASE
Air quality	<p><u>Dust generation</u>: fugitive dust emissions during construction are expected. These are anticipated to be brief, frequent, and localized due to preparation of the site and use of heavy machinery (clearing, levelling, excavation, grading). Effects can be minimized with adequate mitigation measures. The impact is considered minor.</p> <p><u>Exhaust emissions</u>: expected to be brief and localized due to the operation of heavy machinery, transportation trucks, generators, compressors and other construction equipment. The impact is considered minor.</p>	
Noise	<p><u>Noise levels</u>: during construction noise levels will be above ambient due to construction equipment operation and increased vehicular traffic. The effects will be temporal and localized in the construction area. Mitigation measures can be put in place to reduce some of the effects. The impact is considered minor.</p>	<p><u>Noise levels</u>: Operation of the substations and maintenance activities at substations and the transmission line will generate levels of noise slightly beyond ambient conditions. The effects will be temporary and localized. The impact is considered minor.</p>
Soil	<p><u>Erosion and compaction</u>: Proposed right-of-way (REO) for the parallel transmission line is located along road reserves between Kingston and Sophia. The soil in the areas can be described as disturbed. The effect of the construction of the parallel transmission line on the soil is not expected to affect significantly the status of the environment. Nonetheless, mitigation measures can be put in place to minimize cumulative impacts on soil erosion. The impact is considered minor.</p>	<p><u>Erosion</u>: Operation and maintenance activities may involve the removal of vegetative cover at the ROW. The effects will be localized. Adequate measures will be implemented to minimize or reinstate when possible the vegetative cover. The impact is considered minor.</p> <p><u>Soil contamination</u>: Brief and localized soil contamination due to spills during operation and maintenance activities. Effects can be avoided with adequate mitigation measures. The impact is considered</p>

	CONSTRUCTION PHASE	OPERATION PHASE
	<p>The extension of the substations at Kingston and Sophia will be done at the same sites. Both sites already accommodate GPL infrastructure and is considered a disturbed area. Mitigation measures will be put in place to minimize cumulative impacts on soil erosion. The impact is considered minor.</p> <p><u>Soil contamination:</u> Brief and localized soil contamination due to spills during operation of construction equipment. Effects can be avoided with adequate mitigation measures. The impact is considered minor.</p>	minor.
Land use	<p><u>Land use:</u> current land use of the ROW is road reserves commonly used for installation of infrastructure networks such as the one for the proposed project. The extension of substations will be done at GPL sites at Kingston and Sophia. Therefore, there is no expected modification of the Land use of the proposed project site. The impact is considered insignificant.</p>	
Landscape and Visual amenities	<p><u>Landscape and visual amenities:</u> The proposed ROW is already used to host infrastructure related to the electricity and communications sectors. Therefore, the new transmission line will not significantly affect the current landscape of the area. Similarly, the expansion of Kingston and Sophia substations will not disturb in a significant manner the current landscape of the area. There are no tourist or recreational attractions in the propose ROW or sites that would be affected by the project. Therefore, impacts to the landscape are considered insignificant.</p>	
Solid waste	<p><u>Solid waste generation:</u> construction waste and</p>	<p><u>Solid waste generation:</u> solid waste will be generated</p>



	CONSTRUCTION PHASE	OPERATION PHASE
	domestic waste generation are expected in the project sites. Minor amounts of hazardous waste and materials are also expected to be generated. Adequate solid waste management will take place always. Mitigation measures to minimize any impacts to surface water, soil and roads will be implemented. The effects will be temporary and localized. The impact is considered minor.	from operation and maintenance of the transmission line. The effects will be brief and localized. Minor amounts of hazardous waste and materials are also expected to be generated. Adequate solid waste management practices will be implemented. The impact is considered minor.
Water resources	<u>Increased run-off</u> : Due to the removal of vegetation and soil compaction there may be an increased run-off to nearby waterbodies and drainage channels, which can have a direct effect on the concentration of suspended solids, sediments accumulation, and reduction of the drainage capacity. The effects are temporary and spread throughout the ROW in the case of the new transmission line. The effects are temporary and localized in the case of the STATCOM installation. Adequate mitigation measures are required to minimize the effects. The impact is considerate moderate.	
Natural habitat	<p><u>Loss of natural habitat (biodiversity)</u>: The proposed ROW and project site are considered disturbed locations. Project sites and proposed ROW are clear of any major vegetation and there is no presence of critical or sensitive species of flora or fauna.. Loss of natural habitat (biodiversity) is not a concern for this project.</p> <p><u>Mangroves</u>: There exist few behind GPL's Kingston facility (see Figures 19 and 20). These mangroves are not expected to be disturbed because of construction activities on the site.</p> <p><u>Increased bird mortality</u>: Electrocution and collision of</p>	

	CONSTRUCTION PHASE	OPERATION PHASE
	birds may increase due to the presence of a new transmission line. However, the path of the ROW is in already disturbed areas. Other energy and communication lines are nearby the ROW and its path will not interfere with any sensitive habitats. There are no reports of presence of threatened species in the city. Mitigation measures will also be put in place to minimize this effect. The impact is considered minor.	
Displacement	<u>Displacement:</u> Based on the census conducted under this study to determine the number of persons affected by land acquisition, it is evident that there will be no physical displacement of occupants of the land where the substations will be expanded, no losses, and none of the units or persons would be affected by the project. As such, no resettlement plan is required under the project.	
Employment	<u>Employment:</u> Employment opportunities for local skill and non-skilled labour is an expected positive impact of the project. The effects are temporary and localized. The impact is considered minor.	
Livelihood	<u>Livelihood:</u> Based on the census and site visits conducted under this study to determine the socio-economic activities affected by land acquisition, it is evident that there will be no physical displacement of activities in the ROW and the land where the substations will be expanded, no losses, and none of the units or persons would be affected by the project. The impact is considered insignificant. The ROW is located entirely in vacant Government reserves thus there are no businesses that will be directly affected or relocated	<u>Services:</u> Due to the expected increase in the reliability of the energy supply it is expected that this will positively affect other sectors such as Education, Public Health and Water and Sanitation since the provision of their services will be able to increase in quality as it is somewhat dependent on electricity provision.

	CONSTRUCTION PHASE	OPERATION PHASE
	<p>due to the installation of TL.</p> <p><u>Housing</u>: property value may decline due to presence of transmission line.</p>	
Cultural resources	<p><u>Damage to cultural sites</u>: there are no cultural sites or monuments along the proposed ROW or nearby the Sophia and Kingston GPL sites. Therefore, impacts on cultural resources are not a concern for the proposed project.</p>	
Infrastructure	<p><u>Disruption of services</u>: It is expected</p> <p><u>Traffic congestion</u>: During the construction phase of the transmission line, there will be the need to temporary close roads or reduce the traffic to one way direction. While the effect is temporary, its spread and magnitude can be high given the common narrow roads in the city of Georgetown and the ROW closeness to main roads. The impact is considered major.</p>	<p><u>Reliability of energy supply</u>: GPL will be able to provide more reliable power supply to customers. Maintenance activities will be able to be carried out as required given the redundancy of the system. There will be less system shutdowns because of lack of maintenance. The effect is considered long-term, with large spread and high significance to the community. The impact is considered major.</p> <p><u>Traffic congestion</u>: Temporary road closure may be required to perform maintenance activities. While the effect is brief, its spread and magnitude can be high given the common narrow roads in the city of Georgetown and the ROW closeness to main roads. The impact is considered moderate.</p>
Health and Safety	<p><u>Occupational hazards</u>: Occupational hazards during construction are expected. Adequate mitigation measures will be put in place to reduce accident occurrence. The impact is considered moderate.</p> <p><u>Public Safety</u>: during the construction phase and considering the ROW and the volume of vehicular traffic along the area, public safety should be of</p>	<p><u>Occupational hazards</u>: Occupational hazards during operation and maintenance activities are expected. Adequate mitigation measures will be put in place to reduce accident occurrence. The impact is considered moderate.</p> <p><u>Public Safety</u>: Occurrence of accidents are possible during maintenance activities. Adequate mitigation</p>

	<b>CONSTRUCTION PHASE</b>	<b>OPERATION PHASE</b>
	<p>outmost importance. Adequate mitigation measures will be identified to minimize the occurrence of traffic and pedestrian accidents. The impact is considerate moderate.</p>	<p>measures will be identified to minimize the occurrence of traffic and pedestrian accidents. The impact is considerate moderate.</p>

## **7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**

The Environmental and Social Management Plan (ESMP) is an important tool to monitor the effectiveness of the identified mitigation measures and project commitments with regards environmental and social aspects to ensure sustainability of the project. The ESMP may be used to comply with requirements set in the Environmental Permit issued by the Environmental Protection Agency in Guyana (EPA).

In this section the proposed ESMP is presented to be used throughout the life of the proposed project. The ESMP will aid the management of environmental and social factors associated with the proposed project and will provide recommendations to help prevent, minimize or avoid the potential negative impacts that may occur in the construction and operation of the proposed facilities.

The objective of the ESMP is to (i) clearly outline the proposed mitigation measures to avoid, reduce, or minimize the effects of project impacts; and (ii) monitor project compliance with legal requirements.

The following tables describe the mitigation measures recommended for the adverse impacts that were identified, it also identified the monitoring indicators for the proposed action, and the parties involved in the implementation and monitoring of the ESMP implementation. The ESMP includes mitigation measures for the construction, operation and decommissioning phases.

**Table 19: Environmental and Social Management Plan – Construction Phase**

<b>Environmental and Social Management Plan Construction Phase</b>					
	<b>Issue/ Impact</b>	<b>Mitigation Measures</b>	<b>Monitoring Indicators</b>	<b>Responsibility for Implementation</b>	<b>Responsibility for Monitoring</b>
<b>Air Quality and noise</b>	<b>Dust generation</b>	<ul style="list-style-type: none"> <li>▪ Covering of stockpiles to minimize dust generation.</li> <li>▪ Suppress dust from construction, stock piles and increased vehicular traffic by sprinkling water.</li> <li>▪ Consider wind direction when stockpiling construction materials. Orientation shall avoid downwind residences or sensitive locations.</li> <li>▪ Covering of trucks to avoid spillage.</li> <li>▪ Speed control.</li> </ul>	<ul style="list-style-type: none"> <li>▪ PM monitoring.</li> <li>▪ Dust generation observation.</li> <li>▪ Complaints register.</li> </ul>	All contractors on site.	Site Supervisor.
	<b>Exhaust emissions</b>	<ul style="list-style-type: none"> <li>▪ Regular maintenance of vehicles and on-site construction equipment</li> </ul>	<ul style="list-style-type: none"> <li>▪ Equipment maintenance records according to schedule.</li> <li>▪ Vehicle fitness certificates.</li> </ul>	All contractors on site.	Site Supervisor.
	<b>Noise levels</b>	<ul style="list-style-type: none"> <li>▪ Use of padding/noise isolators or enclosure for construction noise generating machines.</li> <li>▪ Fixed noise sources or activities to be carried out away from site boundaries,</li> </ul>	<ul style="list-style-type: none"> <li>▪ Monitoring of dB.</li> <li>▪ Complaints register.</li> <li>▪ Equipment maintenance records according</li> </ul>	All contractors on site.	Site Supervisor.

Environmental and Social Management Plan Construction Phase					
	Issue/ Impact	Mitigation Measures	Monitoring Indicators	Responsibility for Implementation	Responsibility for Monitoring
		<p>particularly boundaries close to sensitive environments.</p> <ul style="list-style-type: none"> <li>Adequate maintenance of construction vehicles and machinery.</li> <li>Use of ear plugs or ear muffs for specific activities by workers.</li> </ul> <p>Stakeholders consultation (immediate surroundings of site) to plan activities accordingly.</p>	<p>to schedule.</p> <ul style="list-style-type: none"> <li>Workers compliance to H&amp;S procedures.</li> </ul> <p>Consultation records.</p>		
<b>Soil</b>	<b>Erosion and compaction</b>	<ul style="list-style-type: none"> <li>Adequate drainage will be developed for the site.</li> <li>Implement revegetation in critical areas.</li> </ul>	<ul style="list-style-type: none"> <li>ESMP Compliance records.</li> </ul>	All contractors on site.	Site Supervisor.
	<b>Soil contamination</b>	<ul style="list-style-type: none"> <li>Adequate disposal of waste materials.</li> <li>Provision of bunded areas for storage of oil/fuel with 115% capacity of the stored material.</li> <li>Provision of spill kits at relevant locations.</li> <li>Construction vehicles and machinery will be serviced regularly and off-site or at impervious surfaces to avoid soil contamination.</li> </ul>	<ul style="list-style-type: none"> <li>Complaints register.</li> <li>ESMP Compliance records.</li> <li>No. of incidents (spills).</li> </ul>	All contractors on site.	Site Supervisor.
<b>Solid Waste</b>	<b>Solid waste</b>	<ul style="list-style-type: none"> <li>All waste generated on site will</li> </ul>	<ul style="list-style-type: none"> <li>ESMP Compliance</li> </ul>	All contractors	Site



Environmental and Social Management Plan Construction Phase					
	Issue/ Impact	Mitigation Measures	Monitoring Indicators	Responsibility for Implementation	Responsibility for Monitoring
	<b>generation</b>	<p>be collected by an EPA approved contractor. Waste will be disposed off at the Haag's Bosch Sanitary Landfill.</p> <ul style="list-style-type: none"> <li>▪ Landfill authorities will be consulted to ensure adequate coordination for the reception of construction waste.</li> <li>▪ The site will be provided with an adequate number of bins for the disposal of domestic waste.</li> <li>▪ Hazardous waste management plan will be developed by contractor. Hazardous waste such as spent oil, oily rags, etc. will be stored on site and disposed of according to an approved plan and in line with EPA recommendations.</li> <li>▪ Burning of waste on-site will be prohibited.</li> </ul>	<p>records.</p> <ul style="list-style-type: none"> <li>▪ Consultation records with solid waste management authorities.</li> <li>▪ Compliance with Hazardous waste management plan.</li> <li>▪ Complaints records.</li> <li>▪ Valid contract with solid waste collection contractor.</li> </ul>	on site.	Supervisor.
<b>Water Resources</b>	<b>Pollution of water bodies</b>	<ul style="list-style-type: none"> <li>▪ Adequate drainage will be designed for the site to minimize run-off.</li> <li>▪ Drainage system will be monitored and frequently maintained.</li> </ul>	<ul style="list-style-type: none"> <li>▪ ESMP compliance records.</li> <li>▪ Existence of temporary sanitary facilities.</li> <li>▪ Valid contract with</li> </ul>	All contractors on site.	Site Supervisor.

Environmental and Social Management Plan Construction Phase					
	Issue/ Impact	Mitigation Measures	Monitoring Indicators	Responsibility for Implementation	Responsibility for Monitoring
		<ul style="list-style-type: none"> <li>Adequate temporary sanitary facilities will be provided for workers on-site.</li> <li>Frequent collection of waste generated by sanitary facilities will be done by an EPA approved contractor.</li> <li>Use soil retention methods when ROW is located parallel to drainage canals.</li> <li>Construction materials will be located at least 5m away from water ways and canals whenever possible. Alternatively, construction materials should be contained to avoid spillage into waterways and canals.</li> </ul>	waste collection contractor.		
Loss of Natural Habitat	Bird mortality	<ul style="list-style-type: none"> <li>Installation of perch deterrents.</li> </ul>	<ul style="list-style-type: none"> <li>No. of death birds per month</li> </ul>	All contractors on site.	Site Supervisor.
	Mangroves	<ul style="list-style-type: none"> <li>While Mangroves are not expected to be disturbed due to construction activities, they should be protected. Workers will be prohibited from intruding the mangrove area, dumping of solid waste or other disturbance to the zone. Access</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>		

Environmental and Social Management Plan Construction Phase					
	Issue/ Impact	Mitigation Measures	Monitoring Indicators	Responsibility for Implementation	Responsibility for Monitoring
		should be restricted and any disturbance penalized.			
Infrastructure	Disruption of services	<ul style="list-style-type: none"> <li>Construction activities should be plan in a way to minimize service interruptions.</li> <li>Whenever service interruption is unavoidable, timely advisory should be issue to the affected areas through relevant communication means.</li> <li>Unavoidable disruption of services should be planned in consultation with relevant stakeholders to minimize negative effects on economic activities.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>		
	Traffic Congestion	<ul style="list-style-type: none"> <li>Working hours should consider sensitive activities conducted in nearby locations.</li> <li>Movement of construction vehicles or heavy machinery should be avoided during rush hours.</li> <li>Night work should be considered when possible once is decide in consultation with relevant stakeholders.</li> <li>Timely public advisory with</li> </ul>	<ul style="list-style-type: none"> <li>Stakeholders' consultation.</li> <li>Complaints register.</li> <li>ESMP compliance records.</li> </ul>	All contractors on site.	Site Supervisor.

Environmental and Social Management Plan Construction Phase					
	Issue/ Impact	Mitigation Measures	Monitoring Indicators	Responsibility for Implementation	Responsibility for Monitoring
		regards road closures. <ul style="list-style-type: none"> <li>▪ Identification of alternative routes to divert traffic.</li> <li>▪ Adequate signage informing road closures and alternative routes.</li> </ul>			
<b>Health and Safety</b>	<b>Occupational Hazards and Public Safety</b>	<ul style="list-style-type: none"> <li>▪ Health and Safety plan will be implemented by contractor on site.</li> <li>▪ Workers awareness sessions on health and safety issues will be carried out regularly.</li> <li>▪ All persons on site will use personal protective equipment (PPE).</li> <li>▪ Site emergency response plans will be developed. Including Fire Safety Plan.</li> <li>▪ Adequate fire-fighting equipment will be provided on site.</li> <li>▪ Adequate signage on site and in surrounding areas should be visible and properly maintained.</li> <li>▪ Traffic control and speed limits will be observed.</li> <li>▪ Working hours will be limited</li> </ul>	<ul style="list-style-type: none"> <li>▪ H&amp;S Plan compliance records.</li> <li>▪ H&amp;S awareness sessions attendance records.</li> <li>▪ Site emergency response and Fire Safety plans developed and implemented.</li> <li>▪ ESMP compliance records.</li> <li>▪ Visible traffic and speed signage.</li> <li>▪ No. of accidents.</li> </ul>	All contractors on site.	Site Supervisor.

Environmental and Social Management Plan Construction Phase					
	Issue/ Impact	Mitigation Measures	Monitoring Indicators	Responsibility for Implementation	Responsibility for Monitoring
		<p>to day-light, unless otherwise agreed with relevant stakeholders.</p> <ul style="list-style-type: none"> <li>Occupational hazards should be marked on site and staff trained on hazard recognition.</li> <li>Cleanliness of the site will be maintained at all times.</li> </ul>			

Table 20: Environmental and Social Management Plan – Operation Phase

Environmental and Social Management Plan Operation Phase					
	Issue/ Impact	Mitigation Measures	Monitoring Indicators	Responsibility for Implementation	Responsibility for Monitoring
Noise	Noise levels	<ul style="list-style-type: none"> <li>Use of padding/noise isolators for equipment.</li> <li>Adequate maintenance of equipment.</li> <li>Use of ear plugs or ear muffs for specific activities by workers.</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of dB.</li> <li>Complaints register.</li> <li>Equipment maintenance records according to schedule.</li> <li>Workers compliance to H&amp;S procedures.</li> </ul>	GPL staff.	EHS Officer.
Soil	Erosion and compaction	<ul style="list-style-type: none"> <li>Implement revegetation in critical areas.</li> </ul>	<ul style="list-style-type: none"> <li>ESMP Compliance records.</li> </ul>	GPL staff.	EHS Officer.

	<b>Soil contamination</b>	<ul style="list-style-type: none"> <li>▪ Adequate disposal of waste materials.</li> <li>▪ Provision of bunded areas for storage of oil/fuel with 115% capacity of the stored material.</li> <li>▪ Provision of spill kits at relevant locations.</li> <li>▪ Vehicles and machinery will be serviced regularly and off-site or at impervious surfaces to avoid soil contamination.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Complaints register.</li> <li>▪ ESMP Compliance records.</li> <li>▪ No. of incidents (spills).</li> </ul>	GPL staff.	EHS Officer.
<b>Solid Waste</b>	<b>Solid waste generation</b>	<ul style="list-style-type: none"> <li>▪ All waste generated on site will be collected by an EPA approved contractor. Waste will be disposed of at the Haag's Bosch Sanitary Landfill.</li> <li>▪ The site will be provided with an adequate number of bins for the disposal of domestic waste.</li> <li>▪ Hazardous waste such as spent oil, oily rags, etc. will be stored on site and disposed of according to an approved plan and in line with EPA recommendations.</li> <li>▪ Burning of waste on-site will be prohibited.</li> <li>▪ Disposal of electric equipment will be done in line with international standard and good practice</li> </ul>	<ul style="list-style-type: none"> <li>▪ ESMP Compliance records.</li> <li>▪ Compliance with Hazardous waste management plan.</li> <li>▪ Complaints records.</li> <li>▪ Valid contract with solid waste collection contractor.</li> <li>▪ Compliant disposal of used electrical equipment</li> </ul>	GPL staff.	EHS Officer.
<b>Water Resources</b>	<b>Pollution of water bodies</b>	<ul style="list-style-type: none"> <li>▪ Drainage system will be monitored and frequently maintained.</li> <li>▪ Frequent collection of waste generated by sanitary facilities will</li> </ul>	<ul style="list-style-type: none"> <li>▪ ESMP compliance records.</li> <li>▪ Valid contract with waste collection</li> </ul>	GPL staff.	EHS Officer.

		be done by an EPA approved contractor.	contractor.		
<b>Loss of Natural Habitat</b>	<b>Bird mortality</b>	<ul style="list-style-type: none"> <li>Installation of perch deterrents.</li> </ul>	<ul style="list-style-type: none"> <li>No. of death birds per month</li> </ul>	GPL staff	EHS Officer.
<b>Health and Safety</b>	<b>Occupational Hazards and Public Safety</b>	<ul style="list-style-type: none"> <li>Health and Safety plan will be adhered to by GPL staff.</li> <li>Workers awareness sessions on health and safety issues will be carried out regularly.</li> <li>All persons on site conducting maintenance will use personal protective equipment (PPE).</li> <li>Site emergency response plans will be developed. Including Fire Safety Plan.</li> <li>Adequate fire-fighting equipment will be provided on site.</li> <li>Adequate signage on site and in surrounding areas should be visible and properly maintained.</li> <li>Traffic control and speed limits will be observed.</li> <li>Occupational hazards should be marked on site and staff trained on hazard recognition.</li> <li>Cleanliness of the site will be maintained at all times.</li> </ul>	<ul style="list-style-type: none"> <li>H&amp;S Plan compliance records.</li> <li>H&amp;S awareness sessions attendance records.</li> <li>Site emergency response and Fire Safety plans developed and implemented.</li> <li>ESMP compliance records.</li> <li>Visible traffic and speed signage.</li> <li>No. of accidents.</li> </ul>	GPL staff.	EHS Officer.
	<b>Community Health and Safety</b>	<ul style="list-style-type: none"> <li>Specific provisions (i.e. fences, gates, etc.) will be implemented to reduce possible community health and safety issues during</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>		



## 8 MONITORING REQUIREMENTS

### 8.1 Environmental Requirements

Environmental monitoring is a process needed to measure the accuracy of predicted impacts of the project as well as measuring the efficacy of recommended mitigation measures. It serves as an early-warning tool to take actions for any residual/new impacts and improvement of mitigation measures. For the proposed project, the focus of the environmental monitoring shall be on ambient air quality and noise level management as there would be no effluent discharge from the facility.

The baseline for the environmental monitoring shall be the database contained in chapters 4.3 and 4.4 of this report while standards shall be in accordance the EPA Permit issued for the construction and operation of the facilities. The environmental monitoring schedule and requirements for the proposed project is presented in the following table.

**Table 21: Environmental Monitoring Schedule**

<b>Environmental Attribute</b>	<b>Schedule</b>	<b>Parameters</b>	<b>Location</b>	<b>Frequency</b>	<b>Method</b>
Air Quality	Construction and operation phase	TSP	Middle of site and the four boundaries of the sites and along the ROW.	Monthly for the construction phase.	Portable air monitoring equipment.
Noise	Construction and operation phase	Noise levels	Middle of site and the four boundaries of the sites and along the ROW,	Monthly for the construction phase.	Portable sound level equipment.

### 8.2 Monitoring of ESMP indicators

Other aspects of the ESPM should also be monitored regularly to inform the effectiveness of the mitigation measures or the need for improvement of such. The ESMP monitoring report should be included in the Progress Report of the contractor and/or the Supervision report and should report on the proposed indicators included in the ESMP.

## **9 EMERGENCY RESPONSE PLAN**

The Emergency Response Plan has been prepared to provide employees at GPL Kingston and Sophia substations with the necessary information to respond to potential emergency situations in an expedient and safe manner to prevent harm/impairment to employees, local residents, or the natural environment. This plan provides response procedures to incidents that may be encountered during operations at the GPL substations in Sophia and Kingston. The procedures were developed to ensure that personal safety is not compromised, responsibilities are assigned, the emergency is mitigated, the public and environment are protected, and that follow-up monitoring and reporting are performed when incidents occur at the GPL sites. Incident response contacts and telephone numbers, both on-site and off-site are presented at the beginning of this plan to facilitate a rapid response to incidents. Detailed incident response procedures are presented and emergency contact information will be updated as needed on all copies of this plan and at all posted locations to ensure rapid response to incidents. Posted locations of plans will include:

- Main Office
- Maintenance Department
- Security Department
- Workers Quarters/Change Room

The Emergency Response and Incident Management Plan will define the methods of intervention and required resources to be implemented by GPL in the event of an accident to protect staff and property and to prevent harmful effects on the local population and the environment. As part of the plan, GPL will facilitate the alert of rescue services and inform the competent relevant authorities. As such, the detailed Emergency Response Plan includes:

- Emergency Contact Details;
- Emergency Procedures;
- Description of an Emergency;
- Authority of Control;
- Scenario Description and Response;
- Materials Inventory; and
- Incident Reporting Formats

### **9.1 Emergency Response Principles**

The emergency response procedures involve the following priorities for action:

- Protection of human health and safety;
- Contain the threat/hazard;
- Neutralize and render safe any noxious or hazardous materials; and
- Commence clean-up activities and site remediation efforts.

Emergency response procedures manage events that are not anticipated, almost totally unlikely to occur or reasonably anticipated. It is therefore imperative to plan for worst case scenarios or adopt general procedures. It is also important to recognize that although highly unlikely, an emergency can have serious impacts wellbeyond the individual or the operation involved.

## **9.2 Identification of an Environmental Emergency**

According to the UNEP's Governing Council, an environmental emergency is defined as, "sudden-onset disasters or accidents resulting from natural, technological or human-induced factors, or a combination of these, that causes or threatens to cause severe environmental damage as well as loss of human lives and property." (UNEP 2002). Therefore, in event of occurrence this would call for immediate action. Some examples of events that would require the initiation of an emergency response procedure and reporting at GPL include:

1. A fire.
2. Electrocution.
3. A fuel spill or releases of hazardous chemicals or wastes to the groundwater or surface water;
4. Transmission Lines structural damages;
5. Medical emergencies; and
6. Minor and major accidents.

## **9.3 Authority of Control**

The Manager of the substation has the overall authority to take control of any incident within any department of the operation, and they can also, depending on the severity of the situation will decide to cease all or any part of the operation following an incident. The Manager will also decide on the category and level of response required for a particular emergency incident.

## **9.4 Minor or Major Incident/Accident**

Prompt and effective communication after the occurrence of an accident or emergency to personnel within the operation is vital to reduce the amount loss/damage that is observed as a result. Additionally, prompt notification of an emergency will allow for adequate time for the Manager to execute corrective systems, mitigate the hazard or, in extreme cases, evacuate the premises. In the event of a major incident/accident, the Manager of the GPL site will be immediately informed. In case of an injury, the Manager will ensure first aid treatment is applied. In the case of a bone fracture or if the employee or person is in an unconscious state the Georgetown Public Hospital will be alerted and the Manager will arrange transportation to the Hospital, which is some less than 2 km distance from the Kingston substation and less than 5 km from the Sophia substation.

In the event of a minor accident or emergency, the Manager will be notified verbally. Manager will be notified for emergencies pertaining to personnel related accidents/emergencies, the Operations Department will be consulted for equipment or machinery malfunctions and the Manager will be contacted for emergencies threatening environmental systems. The project site will have a clearly displayed directory located in a location which contains the contact details for the Manager and Operation Department. Therefore, they can be alerted via telephone if an emergency occurs. The relevant personnel, when notified, would take responsibility for on-site response to the event utilizing available tools, equipment and/or mechanisms. Importantly, each emergency which occurs at the GPL sites will be documented in an Accident and Emergency Record Book, which would be useful in monitoring as well as emergency systems enhancement. Bells, whistles or blow horns will be used for emergency communication, the employees should also be made aware of this.

### **9.5 Internal and External Emergency Contact Details**

GPL in an effort to ensure a safe work environment for all employees and visitors of the substations will disseminate and post on the Notice Boards at the Security entrance of the Mill, the list of External Emergency Contacts alongside the Internal Company emergency contact list. In the event of a serious emergency at the operation, key officials of GPL, who may not necessarily be based at the site, must be contacted and duly informed of the situation. The external emergency contact list will consist of a list of emergency contact numbers for the relevant external agencies. These agencies are to be contacted in the event of an emergency when the said emergency has gone beyond the control of the Managerial staff. Henceforth, in an event when an emergency has gone beyond the control of internal company emergency response actions; or requires further attention. The Manager will contact the following relevant key agencies and institutions whose mandates are relevant to the operations at the GPL's substations and that may need to be contacted in the event of an emergency. These institutions and their respective contact details are listed below:

<b>Organization</b>	<b>Telephone Number</b>
GPL Main Office	(592) 231-4144
Georgetown Public Hospital	(592) 227-8204
Emergency Fire Station	912
Environmental Protection Agency	(592) 225-5467-69, 225-5471-72, 225-6044/48, 225-0506
Guyana Police Force G/town	(592) 227-2128
Air Services Ltd	(592) 222-4368

## 9.6 Emergency Equipment

GPL will have several key equipment on site that will be utilised in the event of an emergency, these equipment are fire extinguishers, spill kits and first aid kits.

### Fire Extinguishers and Sand Buckets

GPL Inc. will ensure that the Kingston and Sophia substations will be equipped with functional fire extinguishers. These extinguishers will be located at strategic points within the following departments and will be clearly labelled for easy identification: i.e. Electrical, Maintenance, Mechanical, Office, the Security and the Kitchen. These strategic points will be clearly marked and accessible to employees who will have knowledge of their position. Fire extinguishers will be inspected monthly by the Manager of the site. Moreover, the extinguishers will undergo an official inspection by an officer of the Guyana Fire Service (GFS), on a bi-annual (six months) basis to ensure that they are functioning effectively and are in accordance with recommendations of the GFS with regards to the maintenance of fire extinguishers. Additionally, all employees of GPL are required to undergo basic training in the utilisation of a fire extinguisher. Further, sand buckets will be located at strategic locations throughout the site. These will be used to supplement the extinguishing actions in the event of a fire, especially if a fire extinguisher is not immediately available at the point. Moreover, in the event of a fire, employees will initiate the following procedure as a result of fire drills:

- Sound alarm to immediately notify all employees to evacuate building or area and organize first aid equipment.
- Contact the site Managers.
- Address the fire hazard with provided fire fighting equipment if practicable to do so, without taking personal risks.
- If not practicable alert the Fire Station and evacuate the premises.
- Make entry into the Accident and Emergency Record book.

### Spill Kits

Fuel secondary containment bonds that will have 115% containment capacity in event of a spill. GPL has recognised that spills - relating to fuel, oil and other lubricants - may emanate from the operation. If this occurs it can pose a great threat and cause adverse impacts, especially since the Complex is in such close proximity to watercourses. In this regard, the company will acquire spill kits to be used for remedial actions against any spills occurring onsite.

Clearly labelled kits will be strategically placed in the fuel tank refuelling points and the Mechanical Department each where oil, fuel, or any other lubricants are utilised. Key personnel whose duties include constant contact with these materials (such as drivers etc.) will be identified and trained in the use of these kits. In the unlikely event of a spill beyond or outside the containment area the following action will be taken:

- Provide specific training guidelines and procedures for personnel to ensure a safe and effective response to potential spill events.
- Provide training guidelines for recovery and disposal of all materials contaminated in the event of a spill.
- Alert the Mill Managers.
- If practical employees should utilise Spill Kits to address the spill.
- Treat spill with absorbent materials such as sand or paddy husk and if possibly create a bund to prevent the spread of the spill and contaminating the waterways and soil.
- Make entry into the Accident and Emergency Record book.
- Inform EPA.

### First Aid Kits

By definition First Aid is the immediate and temporary care/help given to the victim of an accident and sudden illness until professional medical treatment and help can be obtained. First aid response is important in an emergency because quick first aid response:

- Could mean the difference between life and death.
- Can reduce the severity of a particular injury obtained/or illness.

The Kingston and Sophia substations will have equipment which can sometimes be dangerous and cause harm, especially if carelessness and/or negligence on the part of employees occur. As such, the sites will have numerous well-stocked First Aid Kits on site within the departments. The company will ensure that each kit is clearly labelled and easily identifiable. There should also be instruction guidelines on the utilisation of the kit's contents. GPL Management will be responsible for the establishment, maintenance, and to visibly post all information regarding adequate first aid supplies, providers, equipment and location in the event of an onsite injury.

The Company will take all necessary precautions to designate first aid attendants or Medics. The name and contact number of the trained first aid attendants will be posted alongside the first aid kits sufficient for the number of employees within the operation. The first aid kits will be regularly inspected and replenished as need requires by Managers and Supervisors. Records will be kept by Managers and Supervisor on what has been used from the first aid kit at each point location, by whom, and the reason for its use. This will be done in order to keep an inventory record of the first aid supplies.

It is the responsibility of all managers, supervisors and staff to be familiar with the contents of the first aid kit and have basic first aid knowledge to assess an injured person and provide any immediate medical assistance; such as CPR (if qualified), maintain open airways if breathing is an issue, prevent heavy blood loss; while awaiting a trained first aid attendant. Hence, in the event of an accident or emergency, staff must immediately alert and summon the first aid attendant or Medic and provide as much information as possible. The injured

party must not be moved unless it is of necessity to protect their lives or to prevent further injury from occurring.

First aid attendants or Medics will be qualified health care professionals trained in first aid for:

- Respiratory arrest, cardiac arrest (CPR), haemorrhage, lacerations/abrasions,
- Amputations, musculoskeletal injuries, shock, eye injuries, burns,
- Loss of consciousness, extreme temperature exposure (hypothermia/hyperthermia),
- Paralysis, poisoning, loss of mental functioning, and drug overdose.
- Application of dressings and slings.
- Treatment of strains, sprains, fractures, bites, stings, contact with poisonous plants/animals/ material.
- Immobilization, handling and transporting injured persons.
- First Aid Content

The acceptable quantity of first aid kits/materials to number of workers will be determined by the Environmental/Occupational Safety and Health Department. The Environmental Department will also be responsible through the first aid attendants/supervisors to maintain the contents of each first aid kit/materials. The first aid kit and materials should be stored in a dust/water proof appropriate container. Each first aid kit shall contain but not limited to the following items:

- |   |   |
|---|---|
| • Gauze pads                                    | • Tweezers  |
| • Large gauze pads (at least 8" x 10")          | • Adhesive tapes  |
| • Box adhesive bandages (Band-Aids)             | • Latex gloves  |
| • Package gauze roller bandage at least 2" wide | • Resuscitation equipment such as resuscitation bag, airway, or protective facemask |
| • Triangular bandages                           | • Elastic wraps   |
| • Rubbing alcohol / alcohol wipes               | • Splint  |
| • Scissors                                      | • Directions for requesting emergency assistance                                    |
| • Burn cream                                    | • Snake bite kit  |
| • Ammonia inhalants                             | • Cold packs  |
| • Butterfly closures                            | • Eye wash kit  |
| • Hand mirror                                   | • Cotton balls  |
| • Limacol                                       | • Anti-diarrhoeal Medicine  |
| • Ibuprofen, Panadol (Pain tablets)             | • Hand Sanitizer  |
| • Antiseptic Cream                              | • Antibiotic Ointment   |

Additional first aid materials needed but not limited to the following are:

- Two (2) clean acceptable Blankets
- Rigid stretcher



## **9.7 Training**

GPL has recognised the great need for personnel employed at the substations to be knowledgeable and adequately prepared to respond to incidents that may have adverse impacts on human health and safety, infrastructure, equipment, environmental resources, or a combination of these. As such, the company will ensure that staff is provided with a Manual that will provide guidance and direction for the implementation and operation of the Complex to all personnel. Regular drills and exercises to test the response procedures to emergencies, and to enhance the preparedness and capacity of workers to effectively respond to the above mentioned situations if/when they do occur will be organized.

## **9.8 Emergency Evacuation Routes**

Evacuation route maps will be posted in each Department. The following information will be marked on evacuation maps:

- Emergency exits
- Primary and secondary evacuation routes
- Locations of fire extinguishers
- Fire alarm pull stations' location
- Assembly points
- Site personnel should know at least two evacuation routes.

## **9.9 Incident Reporting Document Formats**

After every incident/accident a report will be required. The Manager of the site will have direct responsibility for the preparation of such a report. The following formats will be applied for various incidents:

## **EMERGENCY PERSONNEL NAMES AND PHONE NUMBERS**

DESIGNATED RESPONSIBLE OFFICIAL (Highest Ranking Manager at

\_\_\_\_\_ site, such as \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_):

Name:

Phone: (\_\_\_\_\_)

EMERGENCY COORDINATOR:

Name:

Phone: (\_\_\_\_\_)

AREA/FLOOR/ROOM MONITORS (If applicable):

Area/Floor:

Name:

Phone: (\_\_\_\_\_)

Area/Floor:

Name:

Phone: (\_\_\_\_\_)

ASSISTANTS TO PHYSICALLY CHALLENGED (If applicable):

Name:

Phone: (\_\_\_\_\_)

Name:

Phone: (\_\_\_\_\_)

Date \_\_\_\_/\_\_\_\_/\_\_\_\_

## **MEDICAL EMERGENCY**

Call medical emergency phone number (check applicable):

- ☐ Paramedics
- ☐ Ambulance
- ☐ Fire Department
- ☐ Other

Provide the following information:

- a) Nature of medical emergency,
  - b) Location of the emergency (building, room number), and
- 
- Do not move victim unless absolutely necessary.
  - Call the following personnel trained in CPR and First Aid to provide the required assistance prior to the arrival of the professional medical help:

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

If personnel trained in First Aid are not available, as a minimum, attempt to provide the following assistance:

1. Stop the bleeding with firm pressure on the wounds (note: avoid contact with blood or other bodily fluids).
2. Clear the air passages using the Heimlich maneuver in case of choking.

In case of rendering assistance to personnel exposed to hazardous materials, wear the appropriate personal protective equipment. Attempt first aid ONLY if trained and qualified.

Date \_\_\_\_/\_\_\_\_/\_\_\_\_

## **FIRE EMERGENCY**

When fire is discovered:

- Activate the nearest fire alarm (if installed)
- Notify the local Fire Department by calling 912.
- If the fire alarm is not available, notify the Managers/Supervisors about the fire emergency.

Fight the fire ONLY if:

- The Fire Department has been notified.
- The fire is small and is not spreading to other areas.
- Escaping the area is possible by backing up to the nearest exit.
- The fire extinguisher is in working condition and personnel are trained to use it.

Upon being notified about the fire emergency, occupants must:

- Leave the building using the designated escape routes.
- Assemble in the designated area (specify location)
- Remain outside until the competent authority (Managers) announces that it is safe to re-enter.

Managers or Supervisors must (underline one):

- Disconnect utilities and equipment unless doing so jeopardizes his/her safety.
- Coordinate an orderly evacuation of personnel.
- Perform an accurate head count of personnel reported to the designated area.
- Determine a rescue method to locate missing personnel.
- Provide the Fire Department personnel with the necessary information about the facility.

Area/Floor Monitors must:

- Ensure that all employees have evacuated the area/floor.
- Report any problems to the Managers or Supervisors at the assembly area
- Assistants to Physically Challenged: Assist all physically challenged employees in emergency evacuation.

Date \_\_\_\_/\_\_\_\_/\_\_\_\_

## **CHEMICAL SPILL**

The following are the locations of:

Spill Containment and Security Equipment: \_\_\_\_\_

Personal Protective Equipment (PPE): \_\_\_\_\_

When a Large Chemical Spill has occurred:

- Immediately notify the Managers or Supervisors.
- Contain the spill with available equipment (e.g., pads, booms, absorbent powder, etc.).
- Secure the area and alert other site personnel.
- Do not attempt to clean the spill unless trained to do so.
- Attend to injured personnel and call the medical emergency number, if required.
- Call a local spill cleanup company or the Fire Department (if arrangement has been made) to perform a large chemical spill cleanup.

Name of Spill Cleanup Company: \_\_\_\_\_

Phone Number: \_\_\_\_\_

- Evacuate building/area as necessary

When a Small Chemical Spill has occurred:

- Notify the Managers and/or supervisors.
- If toxic fumes are present, secure the area (with caution tapes or cones) to prevent other personnel from entering.
- Small spills must be handled in a safe manner, while wearing the proper PPE.
- Review the general spill cleanup procedures.

Date \_\_\_\_/\_\_\_\_/\_\_\_\_

## 10 CONSULTATION PLAN

The proposed project requires that stakeholders who may be affected by a project must be consulted. Stakeholders include people who may not be directly affected, and other groups who may possess information and resources that can benefit the project. This may include other government agencies, individuals and groups with particular expertise such as independent experts, and people who have an interest in a project and who may influence its outcomes. The present consultation plan considers:

1. Identification of stakeholders
2. Identification of impact or benefits, interests, positive or negative; and
3. Methodology to engage with each of the different groups.

### **1. Identification of Stakeholders**

*Beneficiaries:* The entire area served by GPL substations in Kingston and Sophia is expected to positively benefit from the intervention through a stable, more reliable electricity service. This includes private sector, and service providers.

- GPL customers in Georgetown,
- Private Sector in Georgetown (customers),
- Local labor, and
- Services providers (Hospitals, Schools and Water Utility).

*Persons adversely affected:* Most negative impacts identified are minor and moderate and more likely to be experience due to the proximity of the project site to residences or businesses.

- Drivers in Georgetown;
- Residents along the ROW; and
- Private sector/business operating in the ROW.

*Implementing agency staff and their consultants:*

- GPL staff;
- Contractor's on site; and
- Supervision firm.

*Government policymakers and local authorities:* Coordination to ensure compliance to local laws or support for the implementation of mitigation measures will be required with the following Agencies and Ministries.

- Ministry of Public infrastructure;
- Ministry of Presidency;
- Environmental Protection Agency;
- Guyana Lands and Surveys Commission;
- Georgetown City Council;
- Ministry of Communities;
- Guyana Energy Agency;
- Guyana Police Force; and

- Ministry of finance.

*Academia and research organizations:*

- University of Guyana.

*Financing institutions:*

- Inter-American Development Bank.

## **2. Identification of impact or benefits.**

The identification of adverse and positive impact is discussed in detail on Chapter 6 of the Environmental Impact Assessment Report. For the Consultation Plan the adverse and positive impacts are mentioned and a relation is established between impacts and stakeholders.

- Adverse Impacts:
  - Dust generation;
  - Exhaust emissions;
  - Noise Levels;
  - Solid waste generation;
  - Pollution of water bodies;
  - Disruption of services;
  - Traffic Congestion; and
  - Health and Safety.
- Positive Impacts:
  - Local employment;
  - Reliability of energy supply; and
  - Improved access to services.
- Stakeholders impacted by Adverse Impacts:
  - Residents along the ROW;
  - Businesses along the ROW; and
  - Drivers in Georgetown.
- Stakeholders benefitting from Positive Impacts:
  - GPL customers in Georgetown;
  - Private Sector in Georgetown;
  - Local labour; and
  - Services providers (water utility, hospitals).

### **3. Methodology to engage with each of the different groups.**

The recommended methods of stakeholder engagement for the proposed project are the following:

- Public hearings or meetings for adversely affected and beneficiaries.
- Workshops to GPL staff to inform the project and needed maintenance and operation requirements.
- Consultations with key informants to engage local authorities and relevant agencies involved during the construction and operation of the project, including the financial donor.
- Discussions as part of conducting surveys or census studies with beneficiaries and adversely affected persons.
- Consultations with beneficiaries and adversely affected persons using electronic media.
- Awareness campaigns and outreach to beneficiaries and adversely affected persons.



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