



Engineering, Procurement and Construction, of Eight (8) Utility Scale Ground-Mounted Solar PV Plants with Battery Energy Storage Systems in three (3) Lots

Annex C to the Tender Document: Environmental and Social Impact Assessments (including Environmental and Social Management Plans) and Environmental and Social Management Frameworks

| | |
|-------------------------------|---|
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| ICB No.: | GUYSOL-ICB-001-2022 |
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Abbreviations and Definitions

BESS - Battery Energy Storage Systems

CDC - Civil Defence Commission

DBIS - Demerara Berbice Interconnected Grid System

CESMP – Contractors’ Environmental and Social Management Plan

CDEMA – Caribbean Disaster Emergency Management Plan Agency

EPA – Environmental Protection Agency

EPC – Engineering, Procurement and Construction
ESA – Environmental and Social Analysis
ESMS – Environmental and Social Management System
ESMF – Environmental and Social Management Framework
ESIA – Environmental and Social Impact Assessment
ESMP – Environmental and Social Management Plan
EWS – Early Warning System
FWD – Flood Water Depth
FWSE – Flood Water Surface Elevation
GFDRR – Global Facility for Disaster Reduction and Recovery
GNBS – Guyana National Bureau of Standards
GRW – Grievance Redress Mechanism
GPL – Guyana Power and Light Incorporated
GUY SOL – Guyana Utility Scale Solar Photovoltaic Program
GWh – gigawatts hour
IDB – Inter-American Development Bank
IPCC – Intergovernmental Panel on Climate Change
MWh – megawatts hour
MWp – megawatt peak
REOC – Regional Emergency Operations Centre
RI – Recurrence Interval
ROW – right of way
WHO – World Health Organisation

1 INTRODUCTION

1.1 BACKGROUND

Electricity is an integral form of energy which fuels all sectors of an economy. It is considered a key indicator of significant economic growth and development in a country. As such, accurate forecasts of electricity demand inform investment decisions when it comes to power generation and supporting infrastructure with social and economic implications (GPL, 2023).

The Guyana Power and Light Incorporated (GPL)'s Electricity Demand Forecasting Framework 2022 estimated the electricity demand for the most populated regions in Guyana, that is, Demerara and Berbice, are currently being served by the Demerara-Berbice Interconnected Grid System (DBIS), the Essequibo Islands (Essequibo coast, Bartica, Leguan and Wakenaam) and newly added Linden. In this Forecast, the potential electricity demand is estimated to significantly increase in each county, more so, the DBIS (GPL, 2023).

In 2027, the peak power in the system is predicted at 409.1 MW with electricity demand reaching 2654.1 GWh, *Figure 1*. Specifically, the DBIS is expected to produce peak power at 354.3 MW with an electricity demand of 2,300.7 GWh. Essequibo is anticipated to peak at 37.1 MW with a demand of 232.8 GWh and Linden's electricity's demand is anticipated at 120.4 GWh with peak power at 18.4 MW (*Figure 1*).

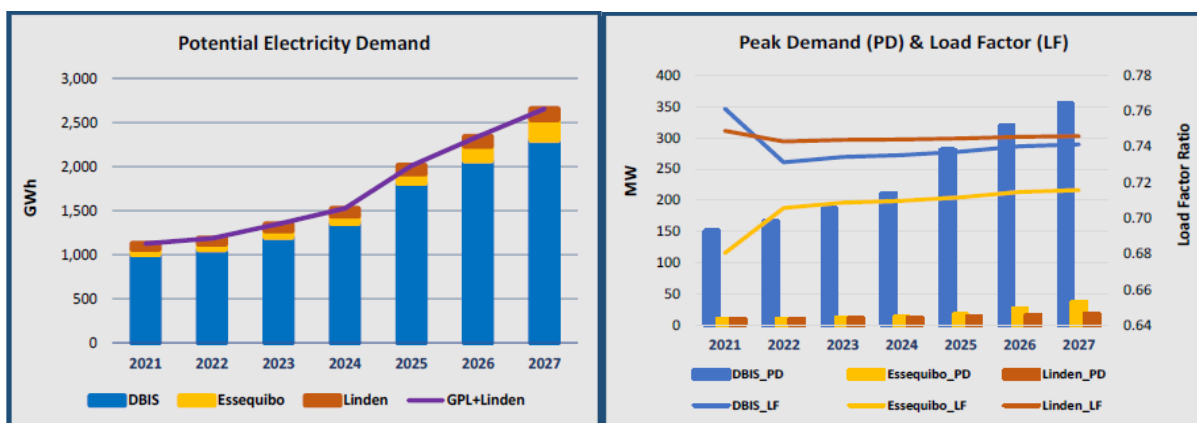


Figure 1: Electricity Demand Forecasts – Guyana

Source: GPL, 2023¹

To meet the energy demand and peak power forecasts, several options for natural and indigenous resources such as natural gas, hydropower and solar power have been presented. However, significant penetration from intermittent renewable energy resources requires a more technically robust power system which is another consideration in the Demand Forecasting Framework 2022. In consideration of this, the Government of Guyana committed 33 MWp of solar power through the Guyana Utility Scale Solar Photovoltaic Program (GUYSOL). Through the GPL, this program will deliver 10MWp of Solar PV capacity in Berbice, 8MWp of Solar PV capacity with 12 MWh Battery Energy Storage Systems (BESS) in Essequibo, and 15MWp of Solar PV capacity and 15 MWh BESS in Linden through non-reimbursable investment financing of up US\$83.3 million (GPL, 2023).

¹GPL. (2023). Development and Expansion Programme. Georgetown: Guyana Power and Light Inc.

The general objective of GUY SOL is to support the diversification of Guyana's energy matrix toward using climate resilient renewable energy sources in the electricity generation matrix (IDB, 2022). The specific objectives of the program are:

- Avoid CO² emissions with the development of solar PV generation plants.
- Lower the cost of electricity generation while supporting the country's transition towards renewable energy sources of generation.
- Improve the operation and management of the isolated systems of Essequibo and Linden and develop local skills for services related to solar PV generation systems (IDB, 2022).

The Program consists of two main components:

➤ **Component 1:** Solar PV Solutions in the Energy Matrix

This component will cover the investment in the 33 MWp solar PV developments and associated energy storage systems.

➤ **Component 2:** Operation efficiency and reliability of the systems

Eight farms were proposed under Component 1. Three sites (Prospect, Hampshire and Trafalgar) are vacant agricultural fields in Berbice owned by the Government, to avoid land conflicts. Two of the three sites designated in Linden, that is, Dacoura and Retrieve are former mining sites with Block 37 described as a vegetated area. In Essequibo, Onderneeming, another vegetated area was the only feasible technical option for the respective area, and another site was identified in Charity. The total 33MWp solar PV in the three different grids are as follows:

- 15MWp of Solar PV with a minimum of 22MWh (11MW, 2h) of battery storage for the Linden Isolated System
- 8MWp of Solar PV with a minimum of 12MWh (6MW, 2h) of battery storage for the Essequibo Coast Isolated System
- 10MWp of Solar PV for the Demerara-Berbice Interconnected System, specifically in Berbice

These farms will provide a cost-effective first step to transition to a cheaper, greener form of generation that is consistent with the GPL's Demand Forecasting Framework 2022. Furthermore, this development will act as a catalyst to further renewable energy investments, increase the percentage of electricity generated by a renewable source penetration, lower carbon emissions, improve grid stability and reduction in Government subsidies for utilities.

1.2 JUSTIFICATION

In compliance with the Guyana National Environmental Legislation, GPL Environmental and Social Protection Policies and the Inter-American Development Bank (IDB)'s Environment and Safeguards Compliance Guidelines, several assessments are required to address the environmental and social issues related to any proposed project. As such, two Environmental and Social Assessments were conducted in the planning stages including:

- An Environmental and Social Analysis (ESA) report of the Program, inclusive of a Consultation Plan and Consultation Report.

- An Environmental and Social Management Plan (ESMP) of the Program that ensured the environmental and social sustainability of the infrastructures and the activities to be financed by the operation and its associated facilities.

In December 2021, the Environmental Engineering Solutions Incorporated (EES) was consulted to complete the required reports. This representative sample of the program consisted of three (3) out of the eight (8) project sites, namely:

- Block 37, Linden-Soesdyke Highway, Region 10
- Retrieve, Linden, Region 10
- Prospect, East Canje Berbice, Region 6

Following this, in July 2022, the second ESA and ESMP were conducted for the remaining five (5) project sites, particularly:

- Onderneeming, on the Left Bank of the Essequibo River; Region 2
- Charity, on the Right Bank of the Demerara River, Region 2
- Dacoura, on the Left Bank of the Demerara River, Region 10
- Hampshire, East Coast Berbice, Region 6
- Trafalgar, West Coast Berbice, Region 5

An Environmental and Social Management Framework (ESMF) was also completed under the program. The ESAs found that potential impacts are less than significant, site specific, mostly reversible and that a range of potential measures for mitigation can be readily designed in most cases.

The implementation of a “Category B”² project as stipulated by the IDB’s Environmental and Social Safeguards outlines that the contractor must develop a specific ESMP at the construction level, including the social and environmental management measures to be implemented, along with a clear definition of responsibilities and the necessary resources that must be allocated for this purpose. These guidelines in the Contractors’ Environmental and Social Management Plan (CESMP) are developed during the project’s environmental and social assessment process and are included in the bidding documents for both construction and supervision of works.

1.3 PURPOSE AND SCOPE

In December 2022, GPL published a Request for Bids (RFB) through International Competitive Biddings (ICB) for the Engineering, Procurement and Construction (EPC) of Eight (8) Utility Scale Ground-Mounted Solar PV Plants with Battery Energy Storage Systems – Three (3) Lots. To successfully meet the requirements, a Joint Venture between SUMEC Complete Equipment & Engineering Co. Ltd and XJ Group Corporation, or JV of SUMEC-XJ Group was formed and a Bid was submitted. In May 2024, JV of SUMEC-XJ Group was successfully awarded the EPC Contract for five (5) of eight (8) Utility Scale Ground-Mounted Solar PV Plants (18MWp) with Battery Energy Storage Systems (total 12MWh) - two (2) Lots. Therefore, this CESMP governs the Berbice Lots (Trafalgar, Hampshire and Prospect) and Essequibo (Onderneeming and Charity). The Plan includes the following aspects:

² Category B operations are those that may generate moderate, but localized and short-term negative environmental and social impacts, for which effective mitigation measures are available.

- Legal framework, procedures and standards applicable at the national, international and financial institution levels
- Organizational structure and organization chart to manage the environmental and social aspects of the project
- Types of management and mitigation measures to be implemented during the project
- Allocation of human and financial resources for the socio-environmental management of the project
- Provisions for compliance, monitoring and reporting of socio-environmental management results, such as the results of field inspections, audits, routine monitoring and supervision visits
- Emergency response planning, including incident and accident reporting
- Supervision, monitoring and reporting: Ensuring socio-environmental compliance

A CESMP should be open to regular review and update due to changes in environmental and social conditions as the project progresses. All contractors / sub-contractors are responsible for the implementation of the CESMP, and the general principles presented within the scope of the CESMP, as well as for the implementation of more detailed plans and procedures. This Plan sets out the approach planned by the Contractor to prevent or reduce any identified environmental and social impacts. Environmental and social management plans within the CESMP, covering the construction and commissioning phases, have been prepared to be updated in line with the changing conditions as the Project progresses and the outputs regarding the stakeholder engagement process. In the operational phase of the Project, if the conditions determined in the ESIA process differ, the risks and impacts arising from the Project will be re-evaluated to adapt to the new conditions.

1.3.1 Structure

Subjects covered within the scope of this CESMP are presented under the following chapters:

- Description of the Proposed Activity – This provides an overview of the works proposed for each site including the total MWp and crucial transmission groundwork. It provides detailed description of each site location, land use types and access.
- Scope of works – This specifies the total lot, acreage and area of disturbance within each site. Additionally, it describes all equipment and related/ancillary equipment comprising BESS systems. It also describes the main activities under the phases of development (construction, commissioning, operations and maintenance).
- Considerations of Alternative Options – This provides potential alternative options that may be considered under the Project.
- Description of the Environment – This provides a baseline of the physical environment (soils, climate, hydrology, geology) of each site referencing the ESA and ESMP. Other aspects of the physical environment examined water table, air quality and noise quality prior to commencement of works. An overview of the biological and social environments was also incorporated.

- Summary of impacts associated with the Project – This chapter looked at the potential environmental and social impacts of the proposed works for each site to inform adequate actions of control and identify feasible and cost-effective measures that may reduce potentially significant adverse environmental impacts to acceptable levels. It also includes a proposed monitoring programme to be implemented at each solar PV farm. Social and community engagement aspects include a consultation plan to ensure ongoing consultations are held and stakeholders are involved in discussing how they are affected and the range of measures for reducing identified impacts including a Grievance Redress Mechanism.
- Documentation of Information and Report Management – This section explains the implementation arrangements, schedule and costs including the documentation of information and record management along with mitigation costs. A Labour Assessment and Emergency Response Plan are also included in this section.

Integration of the CESMP

It is the responsibility of the Contractor and Executing Agency to ensure that the CESMP is fully integrated into project preparation and planning.

Disclosure

This CESMP may be publicly disclosed and easily accessible to interested stakeholders. As it is dynamic, it is subject to reviews, updates and approvals as necessary throughout the implementation of the Project.

2 DESCRIPTION OF THE PROPOSED ACTIVITY

2.1.1 BERBICE

A total of 10MWp of Solar PV for the Demerara-Berbice Interconnected System, specifically 4MWp is proposed for Trafalgar on the West Coast of Berbice (Fig. 2), 3MWp at Hampshire (Fig. 3) in Corentyne and 3MWp at Prospect on the East Coast of Berbice (Fig. 4). The Trafalgar solar PV farm is proposed to interconnect to the Onverwagt 69kV busbar via a 2km 69kV Line. The Hampshire solar PV farm will interconnect to the Canefield F3 13.8kV load feeder via a short 13.8kV line (under 1km). As a part of new interconnection transmission line for Prospect Solar Farm, the approximate length is 531 meters.

All new interconnection transmission lines from the Solar PV Farms are expected to lay down between the existing right of way (ROW) from existing transmission lines. This approach will minimize environmental impacts as the proposed ROW for the installation of the transmission line currently holds infrastructure related to the electricity and communications sectors.

2.1.2 Hampshire

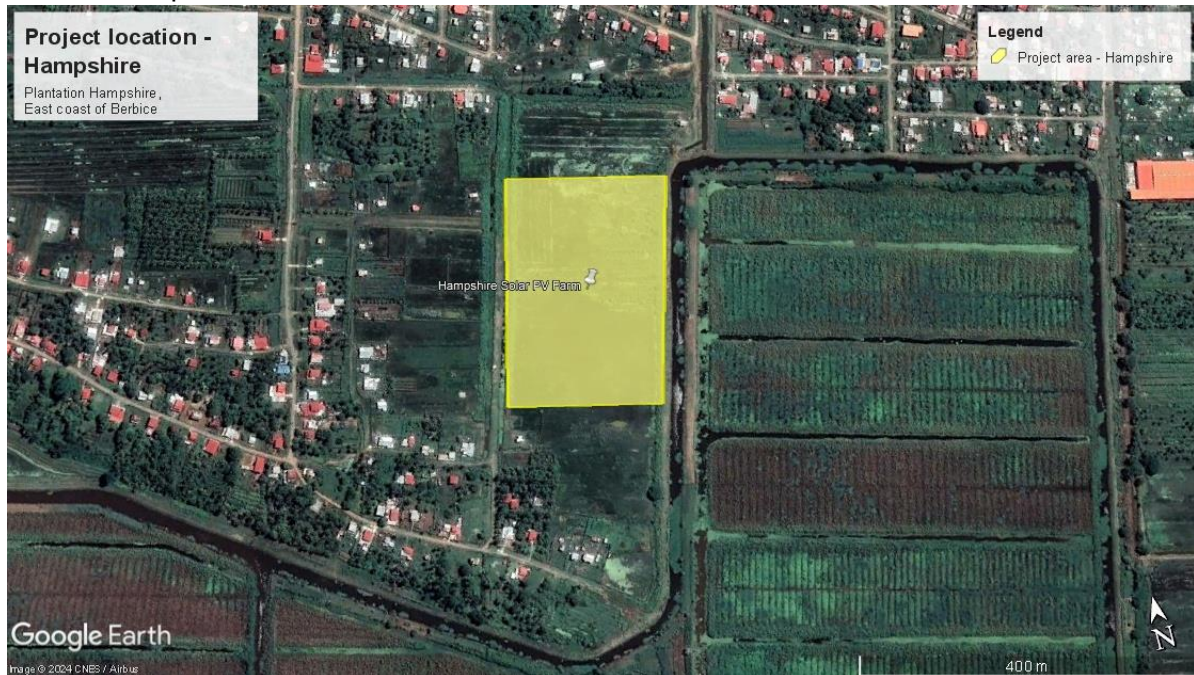


Figure 2: Project Site – Hampshire (Berbice)

The Hampshire site ($6^{\circ}15'10.5''N$ $57^{\circ}21'49.9''W$, 14.427 acres), otherwise known as Tract “GPL 1” being a portion of Lot 260 Block 7, Government Land is situated at Plantation Hampshire on the east coast of Berbice in the county of Berbice, Guyana (Fig. 2). It has been regarded as swamp lands with low bush and is located along an Unnamed Main Access Road, off the Berbice Highway in the locale of “Hampshire” in Hampshire, Berbice, Guyana. The site is located approximately 1.0 km along the unnamed main access road which is directly off the Berbice Highway and approximately 112km from Georgetown.

The site can be accessed by the Corentyne Public Road via a junction. There is an established (asphalted and dirt) road. Direct access is through a bridge that was built at the south-eastern section of the site, adjacent to the unnamed main access road. The site can be described as an open sparsely grassed lot with several areas that are waterlogged. In the recent past, the area may have been used for the cultivation of crops.

2.1.3 Trafalgar

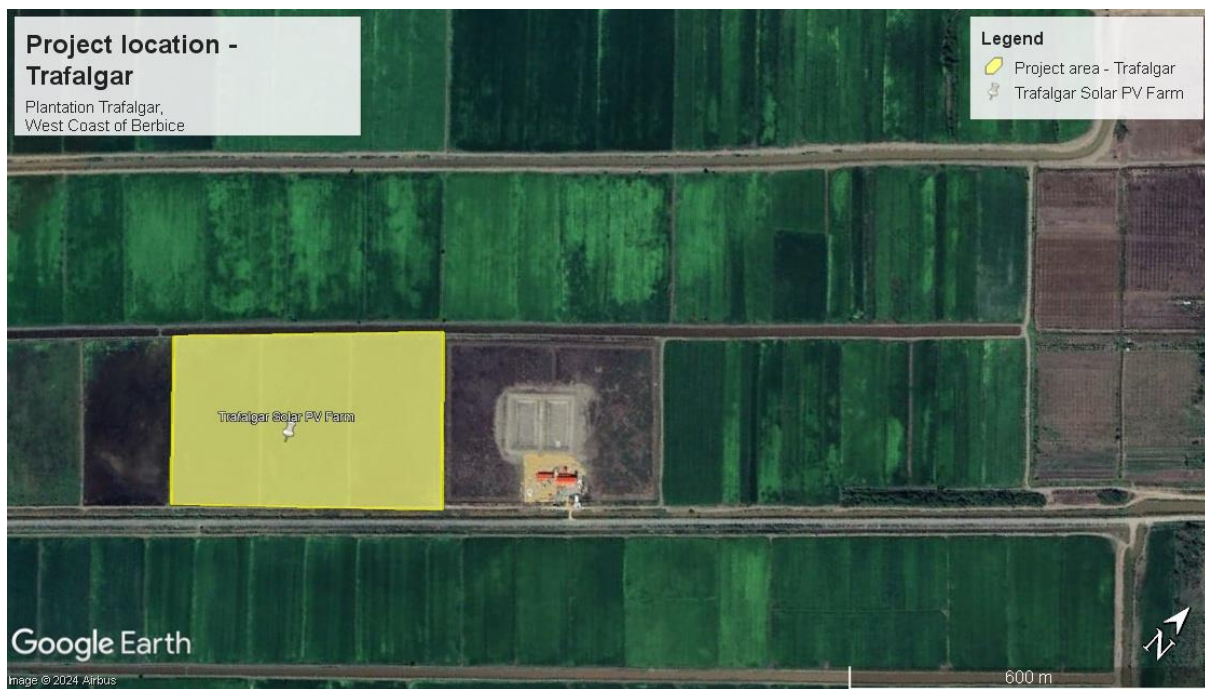


Figure 3: Project Site – Trafalgar (Berbice)

Site Trafalgar (6°24'37.5"N 57°38'31.8"W, 26.45 acres) otherwise known as Tract “Y” comprises three plots of state lands and is situated in rear of the east one-third of Plantation Trafalgar on the west coast of Berbice, in the county of Berbice, Guyana and is regarded as vacant (Fig. 3). The site for the solar PV farm is located along the Mahaica-Mahaicony Abary (MMA) main access road, off the Berbice Highway in the locale of “No. 27” in Trafalgar, Berbice. The site is located approximately 2.5 km along the MMA access road which is directly off the Berbice Highway and approximately 73.5km from Georgetown along the Berbice Highway. It can be described as an open sparsely grassed lot with several areas that are waterlogged. In the recent past, the site was used for the cultivation of crops like rice. An existing culvert crossing to the south-eastern section of the site, off the MMA asphalted main access road provides access to the site.

2.1.4 Prospect



Figure 4: Project site – Prospect (Berbice)

The Prospect site ($6^{\circ}15'09.3''N$ $57^{\circ}29'24.8''W$, 56.528 acres), also called Tract “XXX” being a vacant portion of Plantation Prospect is situated on the Corentyne Coast in the county of Berbice, Guyana (Fig. 4). It is located along Canje Road, off the Berbice Highway in the locale of the Canefield Settlement in Prospect, Berbice. Further, it is situated approximately 1.0 km along the Cumberland Primary School Street which is directly off the Berbice Highway-Palmyra Access Road and approximately 107km from Georgetown along the Berbice Highway.

Direct access to the site is through the current roads which are underdeveloped.

2.2 ESSEQUIBO

This Lot comprises a total of 8MWp of Solar PV with a minimum of 12MWh (6MW, 2h) of Battery Storage for the Essequibo Coast Isolated System specifically 5MWp at Onderneeming (Fig. 5) and 3MWp in Charity (Fig. 5) including a total of 6MW, 2hr (minimum) BESS split into 3.75MW at Onderneeming and 2.25MW at Charity for stability support on the grid. The Onderneeming solar PV farm interconnects to the South 13.8kV Load Feeder via a short 13.8kV Line (under 1km). The Charity solar PV farm will interconnect to the north 13.8kV feeder via a 2km 13.8kV line.

2.2.1 Onderneeming

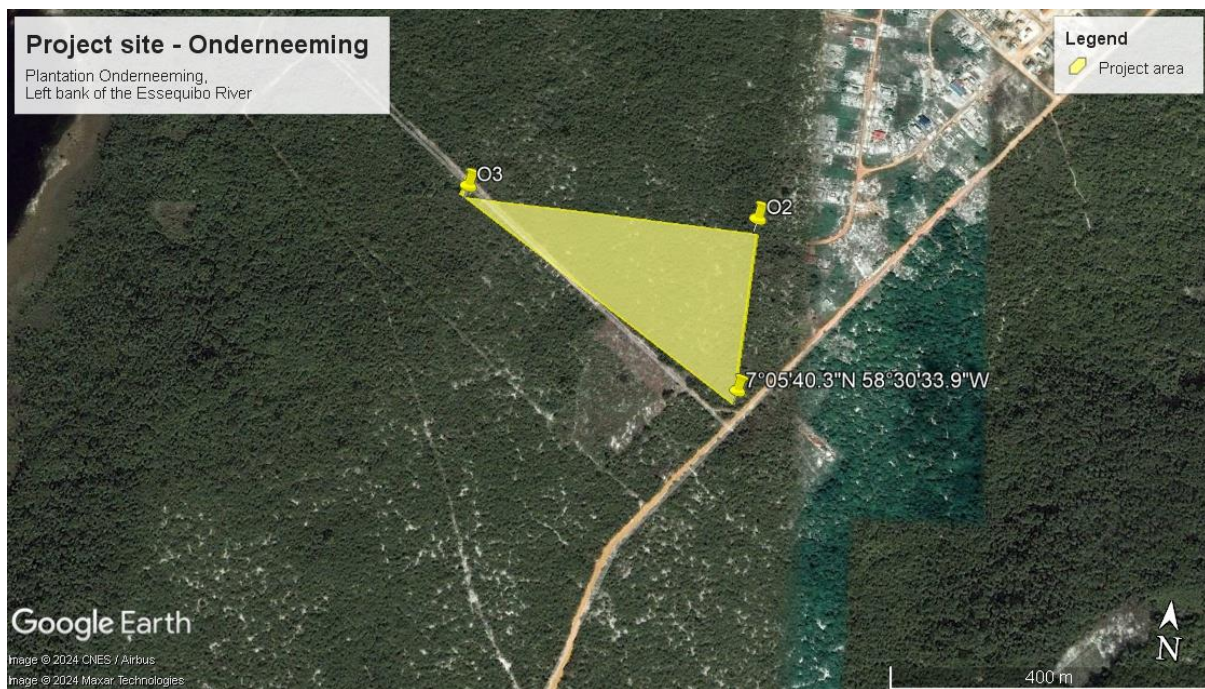


Figure 5: Project site - Onderneeming (Essequibo)

The Onderneeming site (7°05'40.3"N 58°30'33.9"W, 13.60 acres) also known as Tract “GPL 1” is a portion of state land, in the rear of Plantation Onderneeming on the left bank of the Essequibo River in the County of Essequibo, Guyana (Fig. 5). As it stands, it is classified “bush”.

Access to the community of Onderneeming and site are through the same sand pit road that connects to the public road. There are no plans for further site expansion currently as there is an established road for access.

2.2.2 Charity



Figure 6: Project site - Charity (Essequibo)

The Charity solar PV site (7°24'31.61"N 58°34'52.39"W, 20 acres) is regarded a portion of government land in rear of Try Best, Burnt Bush, Buxton, Grant St. Joseph, Charity and Unity or Land Registration Block Number VII in the right bank Pomeroun River, in the county of Essequibo. It is classified as vacant. The main road is approximately 1.28km from the southeastern boundary, with the town centre southwest of the project site at 1.62km.

The site can be accessed from the Essequibo Coast Public Road at a junction. There is an established asphalted road. A new access road, inclusive of a bridge are required in the project works. The road to be constructed is approximately 1,200m, while the trench to be bridged is approximately 5m.

2.3 SCOPE OF WORKS

All specifications contained within the Standard Bidding Document for the Engineering, Procurement and Construction of the Utility Scale Ground-Mounted Solar PV Plants with Battery Energy Storage Systems were guided by the IDB's guidelines for Design, Supply and Installation Services of Plant and Procurement of Goods and works Policies, however since the Contractor was awarded five of the eight Utility Scale Ground-Mounted Solar PV Plants with Battery Energy Storage Systems (Table 1), only these Lots were discussed in this CESMP.

Table 1: Lot, acreage and area of disturbance

| Lots | Location | Acreage (acres) | Average area of disturbance (m) |
|------|--|-----------------|---------------------------------|
| 1 | Berbice - Trafalgar on the West Coast of Berbice 30 4MWp | 30 | 49232 m ² |

| | | | |
|-------|---|-------------|-------------------------------------|
| | Berbice - Prospect on the East Coast of Berbice | 56.5 | 50856 m ² |
| | Berbice - Hampshire in Corentyne, Berbice | 14.4 | 38811 m ² |
| 3 | Essequibo Coast – Onderneeming | 13.6 | 56010 m ² |
| | Essequibo Coast – Charity | 20 | 37018 m ² |
| Total | | 134.6 acres | 231927 m ² (57.31 acres) |

Specifically, the Project scope includes the following facilities:

All equipment (including PV modules, mounting structures, inverters, charge controller, battery, battery container, wiring, software, meters & instructions, safety disconnects (AC and DC circuit breakers), grounding equipment, surge protection, lighting protection and related/ancillary equipment) to comprise PV + BESS systems with an aggregate capacity of 18MWp Solar PV + 12 MWh BESS minimum. The key technical components of the five (5) solar PV farms include:

1. Solar panels (Photovoltaic Modules)

- *Type:* mono, n-type Double Glass Bifacial Modules
- *Weight:* 33.1 kg
- *Warranty:* 12-year limited product warranty and 25-year limited power guarantee
- *Number of panels:* 29568 panels
- *Efficiency:* 22.6 %
- *Specification:* 238±2mmX1134±2mmX30±1
- *No of cells:* 132 (6x22)

See Annex I: Technical Specifications of Solar PV Module for detailed specifications.

2. Mounting structures

- *Fixed tilt:* Rigid structures that hold panels at a fixed angle
- *Tracking systems:* Single-axis or dual axis trackers that adjust the panel orientation to follow the sun, increasing efficiency
- *Material:* Galvanized steel or aluminium

3. Inverters

- *Central Inverters:* Convert DC power from many panels to AC power. Suitable for larger installations.

4. Electrical Wiring and Combiner Boxes

- *DC Cables:* Connect solar panels to inverters.
- *AC Cables:* Carry the converted AC power from inverters to the grid connection point.

5. Transformers

- *Step-Up Transformers:* Increase the voltage of the generated power to match the grid requirements

6. Battery Energy Storage System

- *Type:* Lithium-ion batteries are the most common due to their high energy density and efficiency.
- *Components:*

- a. Battery Racks: Contain the individual battery cells.
- b. Battery Management System (BMS): Monitors and controls battery performance and safety.
- c. Inverters/Converters: Bidirectional inverters to manage charging and discharging of the batteries.

7. Monitoring and Control Systems

- *SCADA (Supervisory Control and Data Acquisition)*: Systems that monitor, control, and collect data from the PV farm to optimize performance and quickly address issues.
- *Data Loggers*: Record performance metrics for analysis.

8. Grid Connection

- *Interconnection Equipment*: Switchgear, protection devices, and metering equipment to safely connect the PV farm to the grid.
- *Power Meters*: Measure the electricity generated and fed into the grid.

9. Protection and Safety Equipment

- *Surge Protection Devices (SPD)*: Protect against voltage spikes
- *Grounding Systems*: Ensure safety by grounding electrical components.
- *Fire Safety Systems*: Include fire suppression equipment and protocols.

10. Infrastructure

- *Access Roads*: For maintenance and operational vehicles.
- *Fencing and Security Systems*: Protect the site from unauthorized access.

2.3.1 Main activities under the phases of development

All activities under the construction phase are managed by the Contractor. Upon commissioning of the five solar PV farms, all activities onward fall under the oversight of the Project Owner. The construction phase is expected to last 12-18 months with an average of 20-30 mix of nationalities including Chinese and Guyanese personnel per site daily. The total life of the project is estimated at 25 years with 1-year guarantee period which allows the Contractor to address potential issues, if any. Operating hours during construction are scheduled for 07:00 - 17:30 hrs. Geotechnical Surveys were conducted to assess potential subsurface issues such as the presence of groundwater, rock layers, or soil contaminants as well as to ensure the stability, durability and efficiency of the solar PV system. It was revealed that the nature of the soils within the project sites (See *Description of the Environment*), subsurface developments are necessary at all sites to support the structures and infrastructure needed for solar installation by means of pile foundations and concrete pads as recommended.

Due to the location of the Onderneeming project site, vegetation removal is required with an estimated fourteen (14) acres (GPL, 2022). All activities undertaken by the Contractor make certain that the natural landscape is maintained through minimal alterations and interaction so that there is little to no change to the surrounding environment.

Construction Phase

A. Site Preparation

- i. Land Clearing and Grading: Clear vegetation, level the site, and prepare the land for construction.
- ii. Access Roads: Build access roads as needed to facilitate transportation of materials and equipment.

B. Civil Works/Subsurface Developments

- i. Foundations: Construct piled foundations for and equipment enclosures.
- ii. Pile Foundations: Install pile foundations to support the mounting structures for solar panels. This involves driving steel or concrete piles into the ground to a suitable depth, ensuring stability and resistance to environmental factors.
- iii. Concrete Pads: Pour concrete pads for supporting heavy equipment such as inverters, transformers, and battery energy storage systems.
 - i. Trenching: Dig trenches for underground cabling and conduits.
 - ii. Fencing: Install security fencing around the site perimeter.
- C. Installation
 - i. Mounting Structures: Install mounting systems for solar panels.
 - ii. Solar Panels: Install solar panels on mounting structures, ensuring proper alignment and orientation.
 - iii. Inverters: Install inverters at designated locations and connect to the PV arrays.
 - iv. Cabling: Lay DC cabling from solar panels to inverters, and AC cabling from inverters to transformers.
 - v. Transformers: Install and connect step-up transformers to the grid connection point.
- D. BESS Installation:
 - i. Battery Racks: Assemble and install battery racks.
 - ii. Inverters/Converters: Install bidirectional inverters for the BESS.
 - iii. BMS: Set up the battery management system (BMS).
- E. Electrical Works
 - i. Grid Connection: Connect the solar PV system and BESS to the grid, ensuring compliance with utility requirements.
 - ii. Switchgear: Install and configure high-voltage switchgear for grid interfacing and protection.

Commissioning Phase

- A. Testing and Commissioning
 - i. System Testing: Conduct comprehensive testing of all components including solar panels, inverters, transformers, and BESS.
 - ii. Performance Verification: Verify system performance against design specifications and grid requirements.
 - iii. Safety Checks: Perform safety checks to ensure all installations meet regulatory standards and best practices.
 - iv. Grid Synchronization: Coordinate with the utility company to synchronize the system with the grid.
- B. Handover
 - i. Documentation: Compile and hand over all project documentation, including design plans, test results, and operational manuals.
 - ii. Training: Provide training to local operators on system operation and maintenance.

Operation and Maintenance Phase

Upon commissioning of the five solar PV Farms, all activities within this phase falls under the supervision of GPL.

- A. Monitoring

- i. SCADA Systems: Implement Supervisory Control and Data Acquisition systems for real-time monitoring and control.
- ii. Data Analytics: Use data analytics to monitor performance, identify issues, and optimize operations.
- B. Maintenance
 - i. Regular Inspections: Conduct regular inspections and maintenance of solar panels, inverters, transformers, and BESS.
 - ii. Cleaning: Perform periodic cleaning of solar panels to maintain optimal performance.
 - iii. Repairs: Address any faults or failures promptly to minimize downtime.
- C. Performance Optimization
 - i. Data Review: Regularly review performance data to identify trends and opportunities for efficiency improvements.
 - ii. Upgrades: Implement upgrades as needed to enhance system performance and extend the lifespan of the components.

Solid Waste Management

During the construction phase, several waste streams will be generated including:

- Municipal solid waste will be collected in waste receptacles and disposed of by local sanitation services on stipulated days.
- Construction wastes including soil and excavation waste, packaging materials, metal and scrap, concrete and masonry waste, electrical waste, plastic, wood wastes will be collected in large waste receptacles, reused where needed and discarded by means of local sanitation facilities.
- Hazardous wastes like batteries, solvents, lubricants and other chemical products, though minimal will be segregated for subsequent removal from site by the Contractor and treated/or disposed as stipulated by the Environmental Protection Agency.

Water Supply Source

Water will be supplied to each site by water trucks and bottled water procured by the Contractor. Rainwater harvesting methods are also proposed for implementation on site. The estimated total daily consumption for 1 person is 100L which includes drinking water, sanitation, cooking and cleaning. On average, a person might use approximately 80-100L of water per day for personal and sanitation needs. The construction phase is expected to last 12-18 months or 365-547 days, therefore an estimate was calculated at the maximum time, i.e.:

- **Total daily consumption:** 100 L/person×30 people=3000 L/day
- **Average total consumption:** 3000 L/day×547 days/year=1,641,000 L

The average water consumption for a solar PV site with 30 working people for 547 days or 18 months (maximum) in the duration of the construction phase is 1,641,000 L.

Additional water usage under the Operational and Maintenance Phase

Cleaning solar PV panels is necessary to maintain their efficiency. The frequency and water usage depend on the location (dust levels, rainfall, etc.). Based on the technical and maintenance specifications provided in the Manual, cleaning is recommended as:

- **Cleaning frequency:** 1 time per year

A buildup of dust or dirt on the module front face will result in a decreased energy output. Clean the module preferably once per annum, more frequently in dusty conditions. The estimated water consumption per farm is calculated as follows:

- **Water usage per cleaning:** 2,000 L (This can vary widely based on system size, cleaning methods, climatic conditions so adjust accordingly).
- **Annual cleaning water usage:** 1 cleaning/year×2000 L/cleaning ×5 =10,000 L
- **Total annual cleaning water usage:** 2000 L/cleaning/farm =2000

The average annual water consumption usage for cleaning, is approximately **litres per year**.

Fuel Storage Capacity and Quantity

The project will not utilise fuel storage tanks above or underground. Procurement of fuel and/or refuelling of heavy machines will be conducted at local fuel stations as needed.

Future Developments

In their Development and Expansion Plan 2023, the GPL estimates that the potential electricity demand will significantly increase in each county in the future. However, no further development is anticipated upon completion of works specifically regarding amenities, buildings, access ways, stockpile areas, dredge areas, waste product disposal and treatment areas, all dams and water storage areas, storage areas including fuel storage and waste oil and landscaped areas. Furthermore, upon completion of works and clearance that the Project has met the intended requirements, the solar PV Farms will be handed over the Project Developer, i.e. GPL who becomes responsible for plans for expansion, maintenance, upgrades, etc.

2.3.2 CONSIDERATION OF ALTERNATIVE OPTIONS

Alternative options are presented to mitigate any potential losses and repurpose resources effectively. Good alternatives also allow the team to meet the objectives of the project with fewer risks. Some potential alternatives that the Contractor may consider under the Project include:

- 1) Repurpose the site – Alternative uses of the project sites may be considered like agricultural and/or industrial and commercial development.
- 2) Enhance project resilience – Strengthen engagement with stakeholders to build support
- 3) Strategic partnerships – Collaboration with other interested stakeholders like energy companies, local government and communities foster knowledge sharing initiatives to learn from experiences
- 4) Abandonment of the Project – Considerations include cost benefit analysis, environmental liabilities and stakeholder impact. Other factors include asset liquidation, contract termination and legal compliance.

2.3.3 PROPOSED ACTIVITY IN REGIONAL CONTEXT

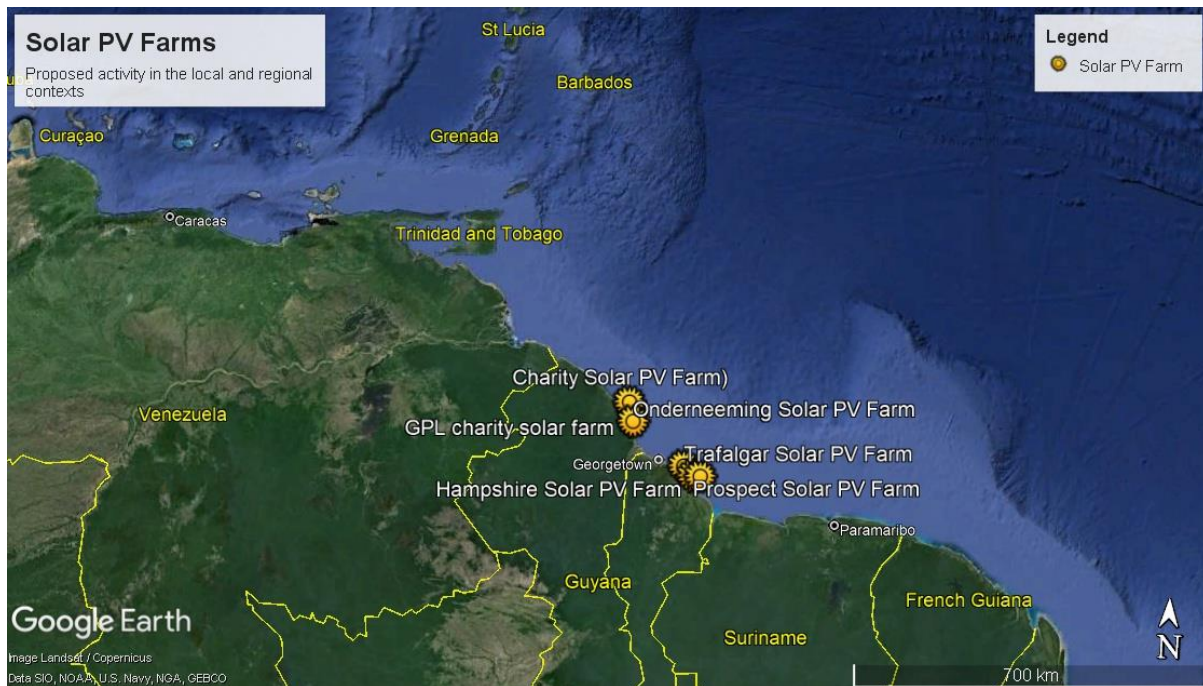


Figure 7: Solar PV Farms in local and regional contexts

3 ENVIRONMENTAL POLICY AND LEGAL FRAMEWORK

3.1 COMPANY PROFILE

SUMEC Complete Equipment & Engineering Co., Ltd. is a core enterprise of SUMEC Group Co. As a subsidiary of China National Machinery Industry Corporation (SINOMACH), a Fortune Global 500 company and one of the world's 250 largest international contractors, the company specializes in various engineering contracting and import and export trade businesses, holding multiple qualifications for general contracting and international contracting operations.

The Company operates in both domestic and international markets, providing comprehensive services in project consulting, financing, engineering design, complete equipment supply, construction, and operation management. It has successfully built hundreds of high-quality, safe, advanced, and environmentally friendly engineering projects in over thirty countries and regions worldwide. All completed projects are operating well, earning widespread recognition and praise from domestic and international clients. SUMEC has established branches in multiple countries and regions globally, maintains smooth financing channels, and possesses excellent global resource allocation and project management capabilities. With advanced technology and rich experience in various fields such as electromechanical engineering, environmental engineering, municipal engineering, and import and export trade, it is a respected international engineering contractor and service provider in the industry.

The Company has been contracted for various kinds of environmental engineering projects, including water supply, wastewater treatment, solid waste disposal, soil and groundwater remediation and risk management, mining environmental restoration, water

conservancy projects, river and lake environmental engineering; providing customers with services of project consulting, design, complete equipment supply, project construction and project operation. SUMEC owns a team of professional talents, in which the technical and project management staff accounts for more than 80%, which includes professor-level senior engineers, certified consulting engineers, registered electrical engineers, registered environmental protection Engineer, registered structural engineer, registered chemical engineer, certificated cost engineers and certified architects. SUMEC has established long term, extensive and in-depth cooperation relations with the leading design institutes, research institutes and universities home and abroad, the company has obtained rich experience in consulting and design in various fields.

Various types of energy engineering projects completed by the Contractor comprise coal-fired power plant, fuel oil power plant, gas fired power plant, hydropower plant, wind power plant, solar power plant, biomass power plant, waste heat recovery generation plant, power transmission and substation project, providing customers with services of project consulting, design, complete equipment supply, project construction, and operation management.

Table 2: Contact Information

| | |
|-----------------|--|
| Company Name | SUMEC Complete Equipment & Engineering Co., Ltd. |
| Company Address | 12th Floor, 198 Changjiang Road, Nanjing |

3.1.1 Management Policies

The Quality, Environment, and Occupational Health & Safety Management Manual prepared by the Contractor is based on the standards GB/T19001-2016³, GB/T24001-2016, GB/T45001-2020, and GB/T50430-2017, and stipulates the Quality, Environment, and Occupational Health & Safety Management Systems of all projects. It serves as a guiding document and action guideline for the company's management work in quality, environment, and occupational health and safety, providing the foundation for implementation to meet customer needs and enhance environmental and occupational health and safety performance. It also provides a basis for the evaluation of the company's management systems by certification bodies, customers, and other interested parties.

The manual is governed according to the GB/T19001-2016 standard, incorporating the requirements of GB/T24001-2016, GB/T45001-2020, and GB/T50430-2017 standards. The main contents include the quality, environment, and occupational health and safety policy, objectives, the division of management responsibilities, identification and determination of management system processes, and their interactions. This manual applies to the company's activities in electromechanical engineering, municipal public works, environmental engineering, electronic and intelligent engineering construction, import and export trade services, sales of laboratory equipment, and sales of Class I, II, and III medical devices. Among these, the electromechanical engineering, municipal public works, environmental engineering, and electronic and intelligent engineering

³ GB is an abbreviation of Guojia Biaozhun, meaning "national standard". GB standards are the Chinese national standards issued by the Standardization Administration of China (SAC), the Chinese National Committee of the ISO and the IEC. See Annex I: SUMEC Complete Equipment & Engineering Co. Ltd Quality, Environment and Occupational Health & Safety

construction activities also comply with the GB/T50430-2017 standard. It also covers the development of information system application software, the complete process management of computer information system integration, and intelligent engineering design and implementation. All levels of leadership and employees must strictly follow the provisions within the Management Manual and the referenced procedures and management systems documents to ensure the effective operation of the company's quality, environment, and occupational health & safety management systems, the realization of management policies, and the continuous improvement of the company's economic, environmental, and social benefits. The comprehensive management manual is reviewed annually and if deemed necessary by management, reviews may be conducted. The management and execution of the comprehensive management manual follow the provisions of the company's Document Control Procedure.

The Quality, Environment, and Occupational Health & Safety Management Manual was compiled by the Management Department in coordination with relevant departments has been reviewed and found to comply with the requirements of GB/T19001-2016 "Quality Management Systems Requirements", GB/T50430-2017 "Code for Quality Management of Engineering Construction Enterprises", GB/T24001-2016 "Environmental Management Systems Requirements and Guidelines for Use", and GB/T45001-2020 "Occupational Health & Safety Management Systems Requirements and Guidelines for Use".

It articulates the Company's comprehensive management policy, defines management responsibilities and authorities, and describes the quality, environment, and occupational health and safety management systems. It serves as a guiding document and action guideline for the company's management work in quality, environment, and occupational health and safety, providing the foundation for implementation to meet customer needs, regulate environmental behaviour, and ensure employees' occupational health and safety. It is hereby officially approved for release, and all employees must strictly comply with its provisions.

The responsibilities in Management for the Quality, Environment, and Occupational Health & Safety Management Systems are:

- a) Ensure that the management system meets the requirements of quality, environment, and occupational health & safety standards;
- b) Ensure the management system's interactions produce the expected results;
- c) Report the performance and any improvement needs of the management system to top management;
- d) Ensure awareness of meeting customer requirements throughout the organization.

All levels of personnel in the Company are expected to cooperate and fulfil their duties to ensure effective operation and continuous improvement of the management system.

3.1.2 Management Objectives

Based on laws and regulations, guided by industry standards, centred on contract management, and focused on cost control, SUMEC strives to create high-quality projects with honesty and integrity to prevent pollution, protect the ecological environment, care

for employees, ensure physical and mental health, and pursue excellence in continuous improvement.

Quality Objectives

1. 98% pass rate for one-time inspection of projects;
2. Zero critical defects in import and export product quality;
3. 100% contract period compliance rate;
4. Customs declaration amendment rate below 98%;
5. Customer satisfaction above 90 points.

Environmental Objectives

1. 100% timely classification, collection, and treatment of solid waste;
2. Noise emissions at construction site boundaries comply with internationally and locally accepted standards

Occupational Health & Safety Objectives

1. 100% certification rate for special job positions;
2. 100% occupational disease control rate for employees;
3. 100% control rate of major hazards, with zero fatalities and major injuries.

The manual is established, implemented, and effectively maintained according to GB/T 19001-2016 "Quality Management Systems - Requirements", GB/T 50430-2017 "Quality Management Standard for Construction Enterprises", GB/T 24001-2016 "Environmental Management Systems - Requirements with Guidance for Use", and GB/T 45001-2020 "Occupational Health and Safety Management Systems - Requirements with Guidance for Use". It is intended to demonstrate the Company's capability to consistently provide products that meet customer and applicable regulatory requirements. The improvement and effectiveness of the company's environmental and occupational health and safety management systems also contribute significantly to global environmental protection and occupational health and safety. The purposes of the manual are:

1. To enhance the company's quality, environmental, and occupational health and safety management, standardize management behaviour, and promote the improvement of management levels.
2. To ensure the ability to consistently provide engineering products that meet the requirements of clients and applicable laws and regulations.
3. To continually enhance customer satisfaction through effective application of the system, including quality management improvement and innovation, and continuous fulfilment of customer and regulatory requirements.
4. To establish environmental objectives and indicators based on legal requirements and significant environmental impact information, controlling key environmental factors.
5. To eliminate, reduce, or control occupational health and safety risks faced by employees or other related parties due to company activities.

Scope of Application

The manual applies to the company's electrical and mechanical engineering, municipal public engineering, environmental engineering, electronic and intelligent engineering

construction, import and export trade services, sales of laboratory equipment, and sales of Class I, II, and III medical devices. Electrical and mechanical engineering, municipal public engineering, environmental engineering, and electronic and intelligent engineering construction also comply with the GB/T 50430-2017 standard. It also includes the development of information system application software, computer information system integration, and intelligent engineering design and implementation quality management, as well as quality, environmental, and occupational health and safety management in the company's office areas and project sites. There are no exclusions.

It is also applicable for second-party or third-party audits of the company's quality, environmental, and occupational health and safety management capabilities.

Referenced Standards

- 1.0 GB/T 19001-2016 "Quality Management Systems - Requirements"
- 2.0 GB/T 50430-2017 "Quality Management Standard for Construction Enterprises"
- 3.0 GB/T 24001-2016 "Environmental Management Systems - Requirements with Guidance for Use"
- 4.0 GB/T 45001-2020 "Occupational Health and Safety Management Systems - Requirements with Guidance for Use"
- 5.0 Applicable Laws and Regulations:
 - i. Product Quality Law of the People's Republic of China
 - ii. Labor Law of the People's Republic of China
 - iii. Contract Law of the People's Republic of China
 - iv. Labor Contract Law of the People's Republic of China
 - v. Metrology Law of the People's Republic of China
 - vi. Construction Law of the People's Republic of China
 - vii. Tendering and Bidding Law of the People's Republic of China
 - viii. Regulations on the Management of Construction Projects
 - ix. Regulations on Environmental Protection Management of Construction Projects
 - x. Regulations on the Management of Construction Site Safety
 - xi. Regulations on the Management of Construction Enterprises Qualifications
 - xii. For environmental matters, see the "List of Environmental Laws, Regulations, and Other Requirements"
 - xiii. For occupational health and safety, see the "List of Occupational Health and Safety Laws, Regulations, and Other Requirements"

Applicable Technical Standards:

- 1.0 GB 12523-2011 "Standard for Noise Limits on Construction Site Boundaries"
- 2.0 GB/T 50430-2017 "Quality Management Standard for Construction Enterprises"
- 3.0 GB 50720-2011 "Technical Code for Fire Safety of Construction Site"
- 4.0 GB 50210-2013 "Code for Quality Acceptance of Building Decoration Engineering"
- 5.0 Additional technical standards are listed in the legal standards list.

3.2 INSTITUTIONAL ARRANGEMENTS

This arrangement allows the organization to identify the environmental factors within the defined scope of the environmental management system, and the relevant environmental impacts of its activities, products, and services that can be controlled and influenced by all interested and affected parties, Fig 8. When identifying and evaluating environmental factors, the following considerations should be made:

- a. Changes, including planned or new developments, as well as new or modified activities, products, and services;
- b. Abnormal conditions and foreseeable emergency situations. The HSE should use established guidelines to identify environmental factors that have or may have significant environmental impacts, namely significant environmental factors. When appropriate, the Department should communicate its significant environmental factors between its various levels and functions.

To maintain one or more processes to evaluate, one or more processes should be implemented to achieve the following:

- a. Occupational health and safety opportunities to enhance occupational health and safety performance when planning changes to the organization, policies, processes, or activities, and:
 - i. Opportunities to adapt work, work organization, and the work environment to employees;
 - ii. Opportunities to eliminate hazard sources and reduce occupational health and safety risks.
- b. Other opportunities to improve occupational health and safety management systems.

3.2.1 Main Responsibilities and Management Actions proposed In The CESMP

1. Project Manager (PM)

Overall Responsibility: Oversee project execution, ensuring that all environmental and social management actions are implemented according to the CESMP.

Specific Actions:

Coordination: Coordinate between various contractors and stakeholders.

Monitoring: Conduct regular monitoring and site inspections.

Reporting: Prepare and submit progress reports on CESMP implementation.

2. Environmental and Social Officer

Overall Responsibility: Implement and monitor environmental and social management measures and provide expert advice and conduct independent monitoring and evaluation.

Specific Actions:

Training: Conduct training programs for workers on environmental and social policies.

Compliance: Ensure all activities comply with environmental and social regulations.

Incident Management: Respond to environmental and social incidents and ensure corrective actions are taken.

Stakeholder Engagement: Manage community relations and ensure effective communication with local communities.

Audit: Conduct regular environmental and social audits.

Reporting: Provide independent reports on compliance and performance.

Advisory: Offer recommendations for improving ESMP implementation.

3. Onsite Staff

Overall Responsibility: Adhere to the CESMP requirements during construction and operational phases.

Specific Actions:

Implementation: Implement environmental and social mitigation measures as specified in the CESMP.

Waste Management: Manage construction waste according to the waste management plan.

Health and Safety: Ensure occupational health and safety measures are in place and followed.

Monitoring: Conduct self-monitoring and report findings to the PM and ESO.

4. Local Authorities and Regulatory Agencies

Overall Responsibility: Ensure the project complies with national and local environmental and social regulations.

Specific Actions:

Permits and Approvals: Issue necessary environmental and social permits.

Inspection: Conduct site inspections and audits.

Enforcement: Enforce compliance and act against violations.

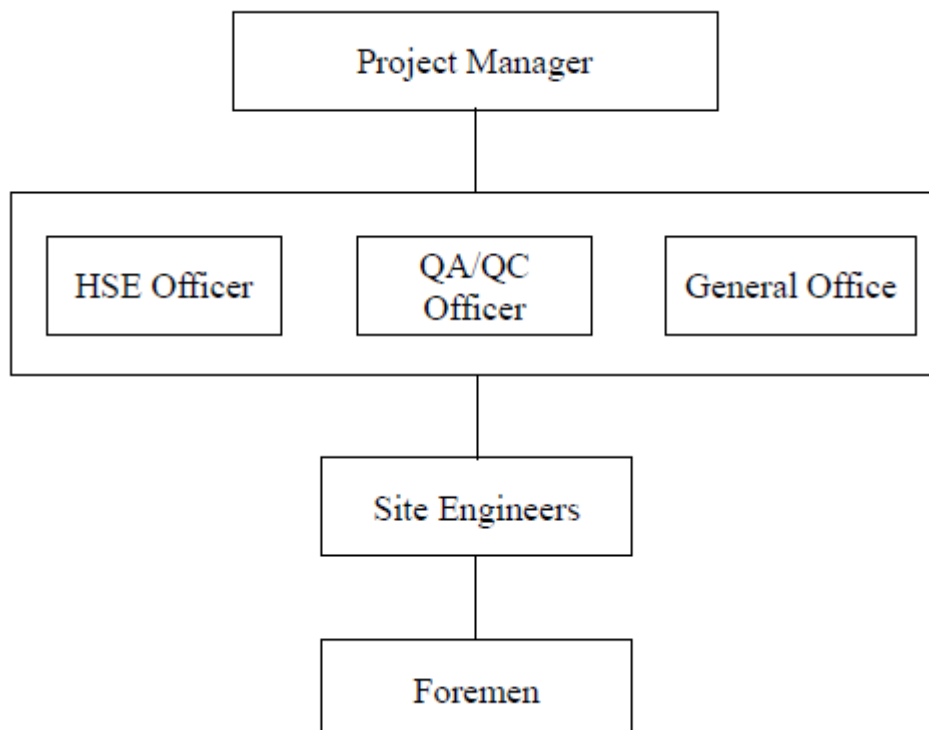


Figure 8: Organisational structure of the Contractor for the construction of the solar PV sites

3.3 LEGAL REQUIREMENTS

This CESMP will be administered in accordance with the institutional and legislative framework governing projects of this nature in the Cooperative Republic of Guyana, in addition to the policies of the IDB. The specific institutional and legislative arrangements that are of relevance to this Project are:

Land-related provisions:

- I. State Lands Act 1903
- II. Local Democratic Organs Act 1980
- III. Municipal and District Councils Act 28:01
- IV. Town and Country Planning Act 2001
- V. National Land Use Plan 2013

Environment-related provisions:

- I. Constitution of the Cooperative Republic of Guyana Act 1980
- II. National Environmental Action Plan 1994
- III. Environmental Protection Act 1996
- IV. Environmental Protection (Authorisation) Regulations 2000
- V. Environmental Protection (Water Quality) Regulations 2000
- VI. Environmental Protection (Air Quality) Regulations 2000
- VII. Environmental Protection (Hazardous Wastes Management) Regulations 2000
- VIII. Environmental Protection (Noise Management) Regulations 2000
- IX. Environmental Protection (Litter Enforcement) Regulations 2013
- X. Pesticides and Toxic Chemicals Control Act 2000
- XI. Wild Birds Protection Act 1919
- XII. Species Protection Regulations 1999
- XIII. Wildlife Management and Conservation Regulations 2013
- XIV. Wildlife Conservation and Management Act 2016
- XV. Forests Act 2009
- XVI. Forests Policy 2011
- XVII. Low Carbon Development Strategy 2009/2030
- XVIII. National Biodiversity Strategy and Action Plan 2012
- XIX. Green State Development Strategy Framework 2017

Health, Safety and Labour-related Provisions

- I. Labour Act 1942
- II. National Insurance and Social Security 1969
- III. Occupational Safety & Health Act 1997
- IV. Energy-related Provisions
- V. Guyana Energy Policy 1994
- VI. Guyana Energy Act 1997
- VII. Electricity Sector Reform Act 1999
- VIII. Public Utilities Commission Act 1999
- IX. National Development Strategy 2001-2010
- X. Land-related Provisions
- XI. State Lands Act 1903

1.1.1 Environmental Protection Act 1996

The EP Act under which the Environmental Protection Agency 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 administration of an EIA 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:

- Sample and analyse such contaminant or hazardous substance, or material contaminated by that person for specific constituents or characteristics.
- Install, use and maintain monitoring equipment, and implement environmental audit procedures as maybe specified in any environmental authorization issued pursuant to the Act.
- Establish and maintain records regarding such sampling, monitoring, and environmental auditing activities.
- 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).
- Submit reports including compliance reports and provide such other information as the authority may require.

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

- Environmental Protection Water Quality Regulations
- Environmental Protection Air Quality Regulations
- Environmental Protection Hazardous Wastes Management Regulations
- Environmental Protection Noise Management Regulations
- Environmental Protection (Authorization) Regulations 2000

Environmental Authorisation (Permitting) Process under the EPA

The Regulations also 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 solar PV farms and associated energy storage systems may have on the environment if not properly managed, the Project is 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.

- To date, Environmental Authorisations have been granted to all five (5) solar PV sites for the construction of the Utility Scale Ground-Mounted Solar PV Plants with Battery Energy Storage Systems, see Annex II: Environmental Construction Permits granted per site

Specifically, the Regulations under the act which govern the Project are as follows:

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 seeks to ensure that the air contaminants emitted during construction and decommission phases are controlled and restricted to a minimum value through comparison with international guidelines. Previously, the US National Ambient Air Quality Standards were used as the appropriate guidelines, however, the Developer will be guided by the ambient air quality standards recommended and used by the EPA which is the World Health Organisation air quality guidelines for particulate matter (PM_{2.5} and 10), ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide (Tables 3-4).

Table 3: Recommended AQG levels and interim targets

| Pollutant | Averaging time | Interim target | | | | AQG level |
|---------------------------------------|--------------------------|----------------|-----|------|----|-----------|
| | | 1 | 2 | 3 | 4 | |
| PM _{2.5} , µg/m ³ | Annual | 35 | 25 | 15 | 10 | 5 |
| | 24-hour ^a | 75 | 50 | 37.5 | 25 | 15 |
| PM ₁₀ , µg/m ³ | Annual | 70 | 50 | 30 | 20 | 15 |
| | 24-hour ^a | 150 | 100 | 75 | 50 | 45 |
| O ₃ , µg/m ³ | Peak season ^b | 100 | 70 | – | – | 60 |
| | 8-hour ^a | 160 | 120 | – | – | 100 |
| NO ₂ , µg/m ³ | Annual | 40 | 30 | 20 | – | 10 |
| | 24-hour ^a | 120 | 50 | – | – | 25 |
| SO ₂ , µg/m ³ | 24-hour ^a | 125 | 50 | – | – | 40 |
| CO, mg/m ³ | 24-hour ^a | 7 | – | – | – | 4 |

^a 99th percentile (i.e. 3–4 exceedance days per year).

^b Average of daily maximum 8-hour mean O₃ concentration in the six consecutive months with the highest six-month running-average O₃ concentration.

Table 4: AGQs for nitrogen dioxide, sulphur dioxide and carbon monoxide (short averaging times)

| Pollutant | Averaging time | Air quality guidelines that remain valid |
|-------------------------------------|----------------|--|
| NO ₂ , µg/m ³ | 1-hour | 200 |
| SO ₂ , µg/m ³ | 10-minute | 500 |
| CO, mg/m ³ | 8-hour | 10 |
| | 1-hour | 35 |
| | 15-minute | 100 |

Source: (World Health Organisation, 2021)

Environmental Protection (Hazardous Waste Management) Regulations 2000

The Regulations were 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 apply 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 utilize 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 observed in the different stages of development as well as operation of the various subsystems. This will be done to ensure that the integrity of the environment is protected and that all workers and nearby residents are protected from any potential negative health-related implications.

Environmental Protection (Noise Management) Regulations 2000

These Regulations seek to manage and control noise emission levels within Guyana. 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, Table 5. This Contractor will take all measures possible 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 5: Guyana National Bureau of Standards Guideline Values for Noise in Specific Environment

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

Source: (GNBS 2010)

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:

- a. To deposit litter in a public place.
- b. To deposit litter from a moving vehicle unto a public place.
- c. 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 sites.

3.3.1 Permitting, licensing and environmental considerations

The permits and agreements required for this Project include:

- Land lease agreements
- Environmental permits⁴
- Building permits/No Objections
- Permission to utilize access roads if any
- Permission to clear land

⁴ See Annex III: Environmental Construction Permits approved for each site

➤ Permission for transmission lines route

Table 6: Permits and Approvals under the GUYSQL Project

| PERMIT/LICENSE/ APPROVAL | PURPOSE | RELATED AUTHORITY/ENTITY | STATUS |
|---|--|--|----------|
| Land lease agreements | Grants legal permission to occupy the land for the designated purpose in the application. | Guyana Lands and Surveys Commission | Approved |
| Environmental permits | Provides terms and conditions under which Holders must comply under the EPA Act and Regulations for the construction and operation phases of the Project | Environmental Protection Agency | Approved |
| Building permits/No Objections | No objection to construct solar farms must be granted by local authorities within communities in proximity to site | Mayor and Town Council, if township and/or Neighbourhood Democratic Council and/or Regional Democratic Council | Approved |
| Permission to utilize access roads | Establishes respect through consent with local authorities especially in rural communities | Mayor and Town Council, if township and/or Neighbourhood Democratic Council and/or Regional Democratic Council | Approved |
| Permission to clear land (where applicable) | Formal approval must be granted to clear vegetation for the purpose of construction of a solar farm | Guyana Forestry Commission | Approved |
| Permission for transmission lines route | If transmission lines may run through any community, permission from the local authorities must be authorized. | Mayor and Town Council, if township and/or Neighbourhood Democratic Council and/or Regional Democratic Council | Approved |

3.3.2 Codes and Guidelines

National Grid Code

The National Grid Code by GPL outlines two objectives of the general conditions which are to ensure, insofar as it is possible, that the various sections of the grid code work together for the benefit of GPL and all users and to provide a set of principles governing the status and development of the grid code and related issues as approved by regulatory authority. The general conditions and the grid code apply to GPL and to all parties interconnected to the GPL system. The Grid Code comprises five distinct codes are as follows:

➤ Planning code

The Planning Code defines the criteria and procedures employed by GPL in evaluating the performance of its power system and the reinforcements necessary to maintain reliability. The overarching objective of the Planning Code is to set the minimum planning criteria that will be used as the basis for the expansion of the transmission network to reliably attend current and future loads while considering the need to minimize operating costs and capital investments.

➤ Interconnection Code

The Interconnection Code defines the requirements and processes that any Independent Power Producers (IPP) or GPL Generation Projects must comply with to interconnect new (or modified) generation to the GPL System. The information on the procedures, forms, requirements, timelines, fees and pro-forma standardized interconnection contracts are presented, along with the steps required in the interconnection process.

➤ Operational code

The Operational Code includes the criteria, procedures and information requirements necessary to execute the operational planning, the generation dispatch and coordination supervision and control of integrated operation of the GPL System. The Operating Code will procure a reliable and safe supply of energy and power demand by using the available resources in the most efficient and economical way. It will also define the procedures for the reporting and information exchange between the different entities connected to the GPL System.

➤ Minimum Technical Requirements (MTRs)

This Code defines the technical specifications and requirements that must be complied with by any new generation facility that will interconnect to the GPL System. It is critical to Renewable Generation Facilities (RGFs), since there are specific technical requirements that are required to address RGFs inherent variability, uncertainty, and limited dispatchability. On the other hand, complying with the Minimum Technical Requirements for conventional generation resources is normally less challenging, however they must also comply with the MTRs.

➤ Metering Code

This defines the regulations and technical aspects related to metering within the GPL System. The requirements are complimentary to the metering and data exchange requirements of agreements between persons to whom this code applies and the Distribution Code. The objectives of the metering code are to establish the standards to be met in the provision, location, installation, operation and maintenance of metering systems. It also defines the responsibilities of each person bound by this code in relation to ownership and management of metering systems and meters and the provision, use, and storage of meter data.

3.3.3 Environmental and social requirements

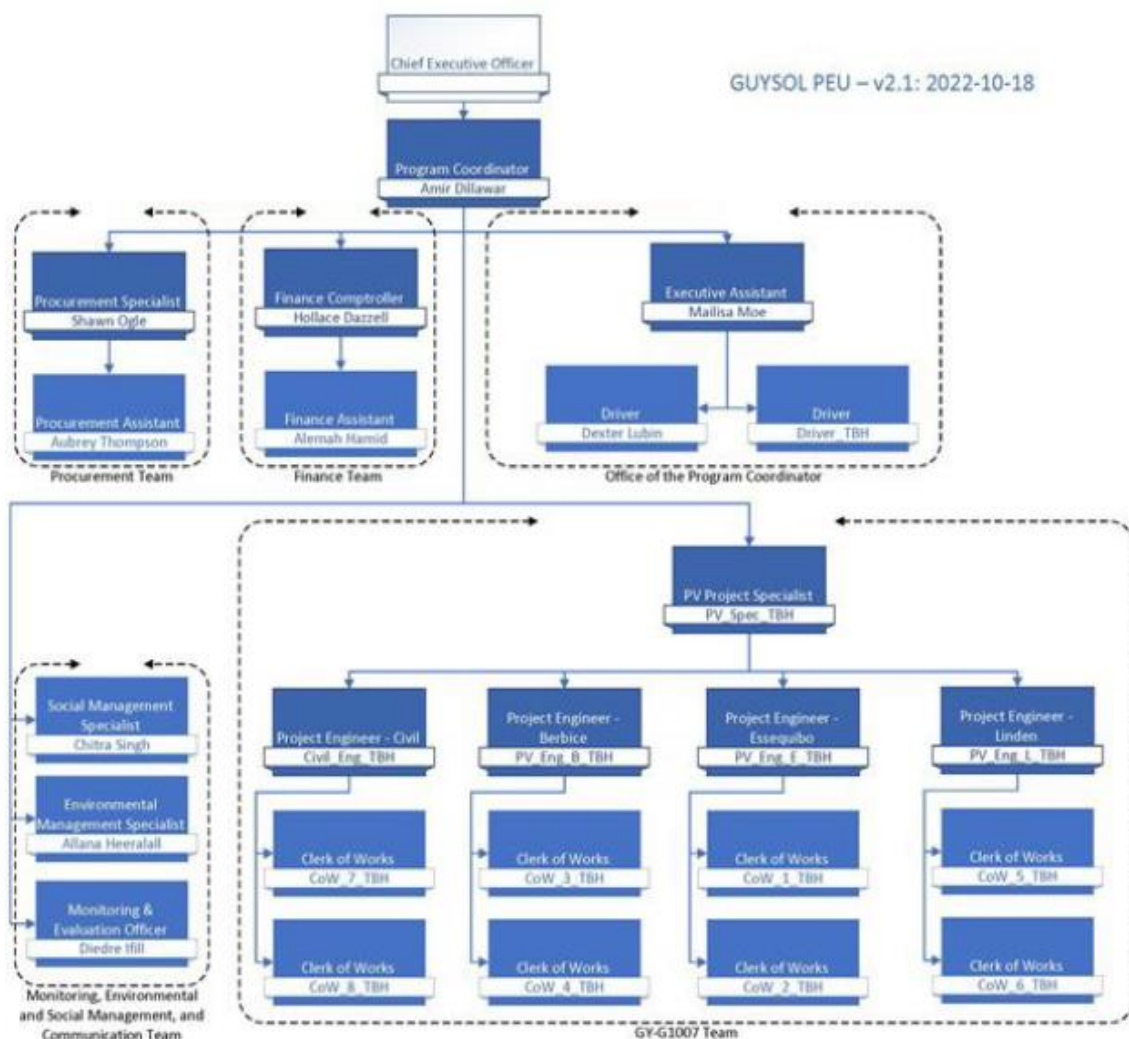
In accordance with Guyana's National Environmental Legislation and the Environmental and Safeguards Compliance Policy (OP-703), assessments must be conducted and address the environmental and social issues related to the proposed project. As part of the overall preparation and design process of any IDB operations, operations of this nature must be subject to environmental assessments according to the nature and significance of the potential impacts of the operation. This Project was classified as Category B which means it has potential environmental and/or social impacts and risks that are less adverse than those of Category A and which are generally limited to the project site, largely reversible and can be mitigated via measures that are readily available and feasible to implement in the context of the operation (IDB, 2011). Prior to commencement of works, several environmental and social management instruments were prepared with the objective of ensuring the integration of environmental and social criteria and indicators throughout the life of the Project including:

- Two ESAs and ESMPs of the Program, inclusive of environmental and social sustainability of the infrastructures and the activities to be financed by the operation and its associated facilities.
- An Environmental and Social Management Framework

3.3.4 Institutional Capacity of PEU

The GUYSOL Program will be executed by a Project Executing Unit under the GPL and monitored by IDB during the execution phase. To strengthen and avoid potential risks while managing the project, IDB will share recommendations based on experience and skills of GPL as an established executing agency. Capacity strengthening activities like organizational arrangements inclusive of the appointment of key staff and consultants will be exercised when needed. Implementation of all environmental and social obligations under the Program is dedicated to the Agency’s Monitoring, Environmental and Social Management and Communication Department to ensure environmental and social compliance, all environmental and social obligations to the Project and communities including the grievance Redress Mechanism.

Additionally, the management structure of GPL facilitates a unit related to Quality, Health, Safety, Environment Management (QHSE) Division. These management procedures are supported by the accreditation of ISO 9001 (ISO 9001:2015 - Quality Management System Implementation & Audit).



3.3.5 Main environmental and social considerations of the Project to be realised by the Contractor include:

- Minimize Environmental Impact
- Efficient Resource Use
- Waste Management
- Climate Resilience
- Labor and Working Conditions
- Health and Safety
- Regular Monitoring
- Reporting and Transparency
- Continuous Improvement

4 DESCRIPTION OF THE ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

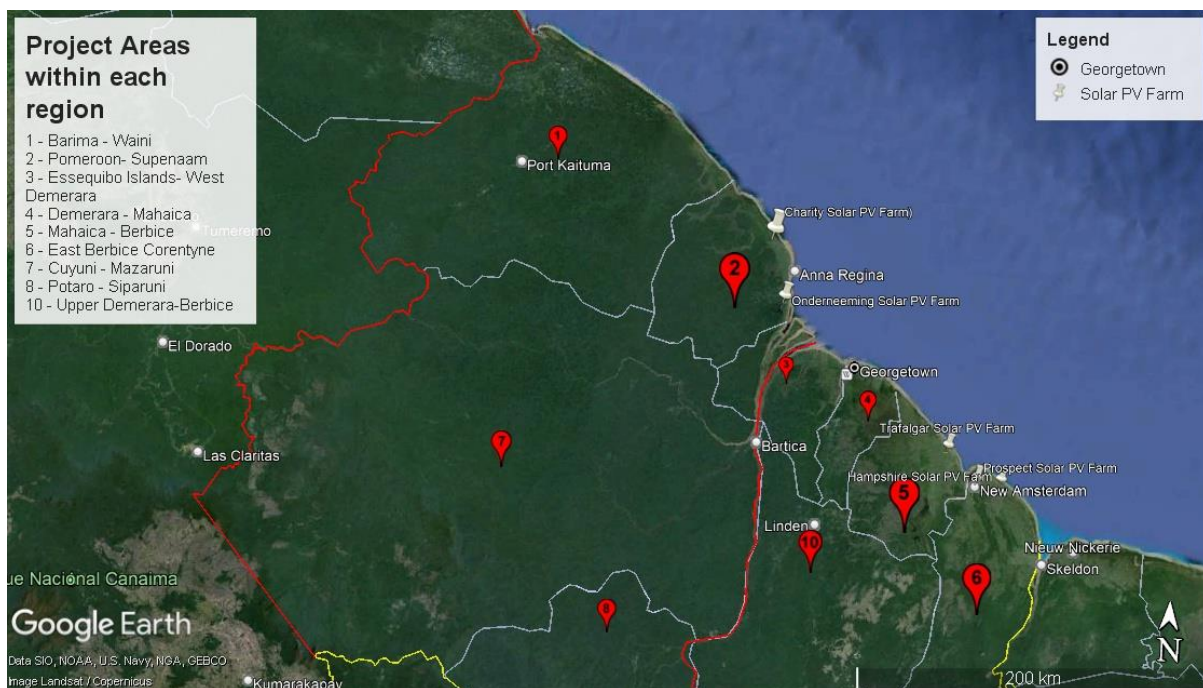


Figure 9: Project sites in local context

The Coastal Plain occupies 8.5 percent of the total land mass or an area of 18,033 km². It is a narrow belt (ranging between 8 and 65km in width with a length of 440km) stretching from the Corentyne River in the east to Waini Point in the west and providing most of the agricultural production in the country. 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 3-9 m above sea level. The normal tidal range is about 3m with resultant flooding (particularly sea invasion) especially during the wet seasons from April to August and November to January and during high tides.

Many areas of the coastal plain are below sea level while other areas are manufactured and built-up to raise them above the surrounding land level. An elaborate system of sea defences, along with irrigation and drainage canals, is required to protect the area from

flooding. West of the Essequibo River, the coastal plain narrows with extensive organic wetland 'pegasse' deposits inland. While these are most extensive in the west of the country primarily in Regions 1 and 2, they also occur scattered between the Essequibo, Demerara and Berbice Rivers. East of the Berbice River, the pegasse area is small and the coastal 'front land' and 'riverain' clays relatively wide (Government of Guyana, 2013).

4.1.1 Soils of the Coastal Plain

The coastal plain is part of the flat, low-lying coastal lands that extend along the coast of South America from the Amazon to the Orinoco. The plain is composed of a wide variety of soils developed from a variety of parent materials such as marine and fluvio-marine deposits with back-swamp organic soils. In general, the soils closer to the shore and along rivers are more fertile than the soils behind which can have extremely low fertility and toxicity in some instances. The soils have been mapped as:

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

4.1.2 Climate

Although the five solar PV farms are located within the Low Coastal Plain, the weather varies between each site. Charity and Onderneeming in Pomeroon-Supenaam (region 2) are characterized as wet with 2,200 -2,800 mm of precipitation annually. Trafalgar, Mahaica – Berbice (Region 5) is marked as moderately wet with 1,800 -2,800 mm of precipitation annually, while Hampshire and Prospect in the East Berbice-Corentyne region (6) is moist with 1,400-1,800 mm.

4.1.3 Hydrology

Fresh groundwater was recorded as abundant on the coastal plain, white sands plateau and in the Takutu basin, with other inland areas having only pockets of fresh groundwater in unexplored aquifers. Guyana has an annual per capita water availability of 314,963 m³ (water availability of 241km³ and a population of 765,169) indicating an enormous water surplus. Due to surface water shortage, groundwater is utilised. Groundwater from the coastal aquifer system, which consists of three distinct aquifers, provides about 90 percent of the domestic water for the country. Presently, these aquifers, particularly the 'A Sand' aquifer, provide ample water for the country's coastal population (US Army Corps of Engineers, 1998).

Region 2: Pomeroon-Supenaam

This region occupies 6,450 km² or 3 percent of the country. It is located on the west bank of the Essequibo River with the Atlantic Ocean to the north. About 75 percent of the interior of the region lies in the interior plains. From April to August and November to

January, there is an abundance of freshwater from perennial rivers and streams like Pomeroon and Supenaam Rivers. Large to very large quantities of fresh water are available the remainder of the year. In the coastal lowlands, there is brackish to saline water which is available throughout the year from tidal influenced river and streams, coastal marshes, mangroves swamps and tidal lowlands. The populated areas include Suddie, Spring Garden on the Atlantic coast and Charity on the Pomeroon River (US Army Corps of Engineers, 1998).

Region 5: Mahaica-Berbice

The area occupies 4,300 km² or 2 percent of Guyana. It is considered a densely populated region with the Atlantic Ocean on the northern border. Surface water accounts for half of this region, which lies within the coastal lowlands, where massive quantities of fresh water are available from April through August and November through January. Along the coast and along the Demerara and Mahaica Rivers, large to enormous quantities of brackish water are plentiful year-round, which is about half of the region. The Mahaica, Mahaicony, and Abary Rivers lie in this region. Small to moderate quantities of fresh water are available the rest of the year. Along the coast, large to enormous quantities of brackish water are available year-round, which covers about 30 percent of the region (US Army Corps of Engineers, 1998).

Region 6: East Berbice - Corentyne

This area is about 40,850 km² or 19 percent of the country and lies within the eastern part of the country with Suriname on the eastern border by the Corentyne river. Surface water occupies about 20 percent of the region and lies along the Corentyne, Canje, and New Rivers which have enormous quantities of fresh water year-round. About 40 percent of the region, mainly the interior plains, has enormous quantities of fresh water available from April through August and November through January, with large to very large quantities available the rest of the year. In about 30 percent of the region in the southern uplands, large quantities of fresh water are available from April through August, with meagre to moderate quantities available the rest of the year. Most of the population centres are on the coastal lowlands in the northernmost part of the region.

4.1.4 Geology

Guyana occurs within the northern part of the Guiana Shield. The Guiana Shield forms the northern part of the Amazonian Craton, the core of the South American continent. Most of the geology northern Guyana consists of Paleoproterozoic Orosirian greenstone belts (Barama-Mazaruni Supergroup) intruded by granites. These are overlain unconformably by the Statherian Burro-Burro Group, which consists of the Muruwa Formation sandstones and Iwokrama Formation felsic volcanics. Both are intruded by granites associated with the Iwokrama Formation. Some folding occurred before these were overlain by the locally unconformable almost flat lying Roraima Group. The northern Guiana Shield, including Guyana is separated from Southern Guiana Shield by ENE to NE trending Tumes/Guayaquil-Tacutu Tectonic Lineament. This is a major regional pre-Cambrian shear zone / mega-shear which believe to have re-activated several times. At the beginning of the Mesozoic when Africa and South America started to separate this reactivated again and was involved in formation of the Takutu Graben in the lower Rupununi area and the Guyana-Suriname basin near the coast and offshore.

4.1.5 Disasters Risk Assessment

The Global Facility for Disaster Reduction and Recovery, (2020) identified several disasters which places Guyana in a state of susceptibility specifically coastal floods (high), urban flood (high), river flood (high) tsunami (medium), extreme heat (medium), extreme heat (medium), landslide (low), cyclone (low), earthquake (very low) and water scarcity (very low). Due to the project locations, the potential for floods is most likely and therefore are expounded under separate headings under each project area.

Coastal floods are classified as high which means that potentially damaging waves are expected to flood the coast at least once in the next decade, (Figure 10) when it comes to climate change impact (Global Facility for Disaster Reduction and Recovery, 2020).

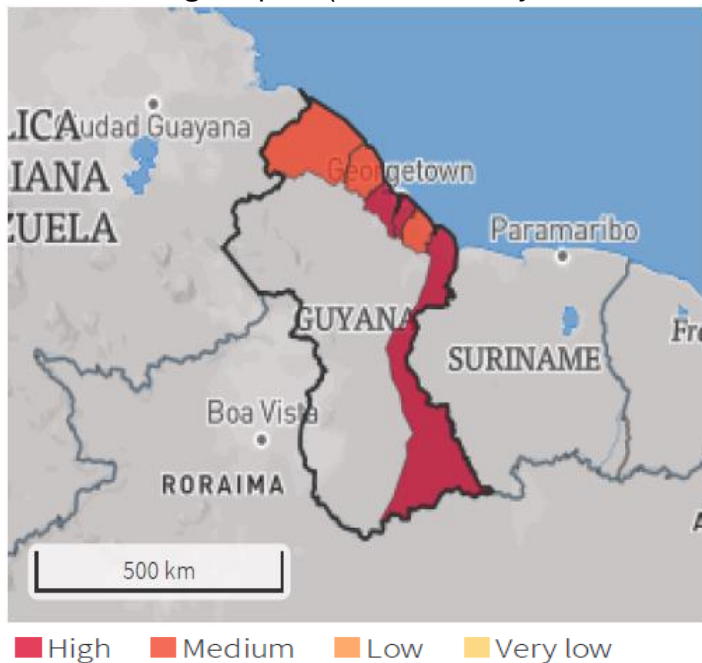


Figure 10: Classification of coastal flood in project areas

Source: (Global Facility for Disaster Reduction and Recovery, 2020)

Similarly, urban flooding is classified as high, meaning that potentially damaging and life-threatening urban flood are expected to occur at least once in the next decade, (Figure 11). Due to the effects of climate change, this hazard level may increase in the future (Global Facility for Disaster Reduction and Recovery, 2020).

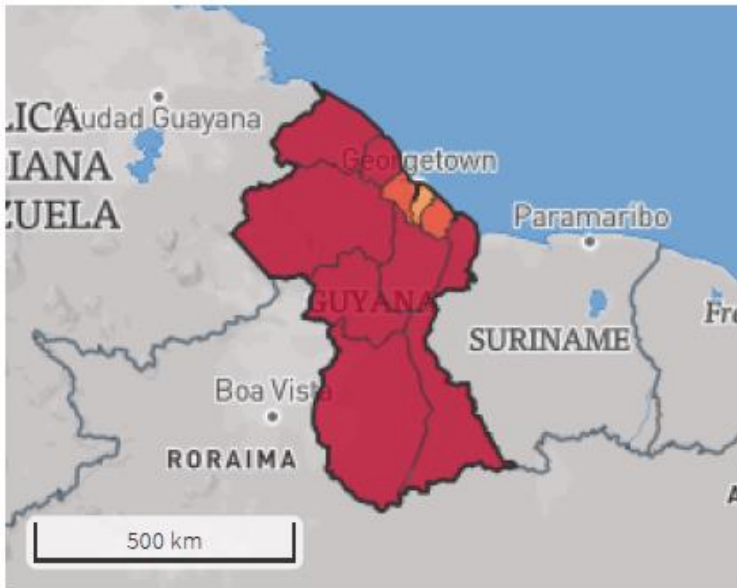


Figure 11: Classification of urban flood in project areas
 Source: (Global Facility for Disaster Reduction and Recovery, 2020)

River floods were also classified as a high-level hazard, which means that potentially damaging and life-threatening river floods are expected to occur at least once in the next 10 years, (Figure 12). Surface flood hazards, though not included, may also be possible (Global Facility for Disaster Reduction and Recovery, 2020).

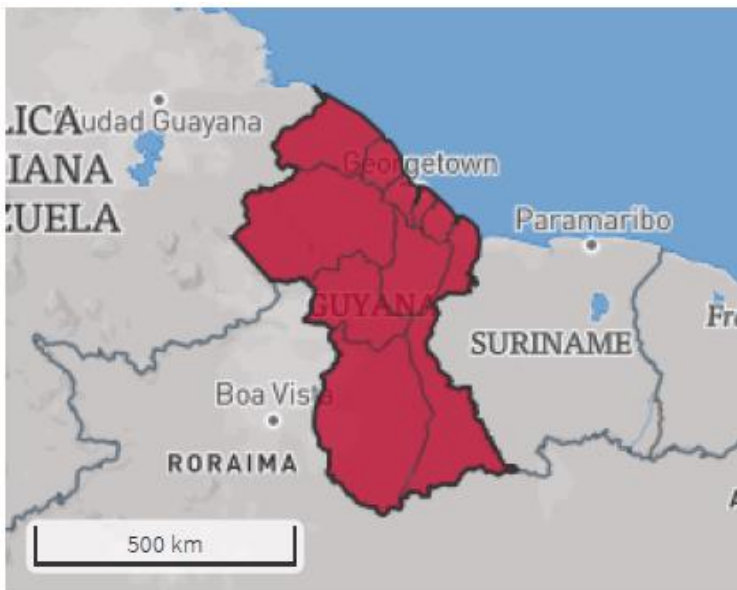


Figure 12: Classification of river floods in project areas
 Source: (Global Facility for Disaster Reduction and Recovery, 2020)

Tsunamis were classified as medium which means that there is a **10%** chance of a potentially damaging tsunami occurring within the next 50 years (Global Facility for Disaster Reduction and Recovery, 2020).

4.2 PROJECT AREAS

4.2.1 Hampshire



Figure 13: Project site – Hampshire and surrounding land uses

The site is located within the Guyana's Low Coastal Plain, which comprises of Plio-Pleistocene aged Demerara Clay and the Coropina Formation overlying the Pleistocene to recent aged White Sand Series. The White Sand Series was not encountered in our subsurface exploration. The Coropina Formation overlies the White Sand Series and is generally characterised by mottled, multicoloured, over-consolidated clays with some silt content. The Demerara Clays overlay the Coropina Formation and are generally characterized by very soft, grey/blue, normally consolidated clays deposited during post-glacial times.

Land Use

A dam is situated west of the site, and there are several residences in the west/north-western area of the site. Residences are also located within the south by a western boundary and continues onward. At the east/south-eastern boundary, there is another dam preceded by a drain. In the north-east direction of the site, there are a number of homes. The community of Hampshire is in the north/north-eastern direction with several amenities like Hampshire Nursery School, two churches, an auto repair shop, two general stores and hospitality services (hotel, bar, food and clothing).

Soil

The subsurface generally consists of one (1) major unit (layer) as sandy clay with some silt. Chemical tests indicate an undetectable sulphate content, a pH value ranging from 8.19-8.42 and a chloride content ranging from 1251.39-7632.39 mg/kg (0.12%-0.76%).

Water Table

The water levels were recorded and measured at depths of approximately 0.4m below grade. However, it should be noted that the water table is phreatic, and this level is expected to fluctuate with seasonal rainfall.

Air Quality

The PM_{2.5} concentration at the Hampshire solar PV farm site ranged from 10.7 - 18.2 g/m³ however, the levels are within the permissible levels outlined by the US NAAQS 24-hour average. Similarly, PM₁₀ levels did not exceed the limits stipulated by the US NAAQS with the maximum. Overall, the current baseline air quality within the area is good. The site did not contain any total volatile organic compounds.

Noise

At the site in Hampshire, the noise level did not exceed the limits specified by the EPA Guyana. The highest dB was recorded 48.4 dB.

Disaster risk

This region is characterized by lowlands with a significant percentage of geographic area lying below the mean sea level. Recent flood risk assessment investigations revealed that the project site is approximately 1.95m below normal conditions of high tide and some 3.65m below the flood water surface elevation where there is an incidence of high tide and spring tide (GUYSOL - DRMP , 2023).

These conditions make Hampshire project site highly susceptible to flooding, thus registering a flood risk indicator of “Very Extreme’ as noted in the Disaster Risk Assessment for the region by the Civil Defence Commission (CDC) (GUYSOL - DRMP , 2023).

Exposure to windstorms was identified as another disaster risk for this project site, given the occurrences in the region. The Caribbean Disaster Emergency Management Agency (CDEMA) reported incidences of vigorous tropical wave causing damages to homes in the region. Similar windstorm incidents in November 2022 across regions 6, 7 and 8, which resulted in the destruction of houses across the regions (Stabroek News , 2022). Additionally, localized flooding and ponding across the site during rain events can result following long and intense rainfall events. These events have the potential to adversely impact the integrity and performance of the physical infrastructure associated with the project (GUYSOL - DRMP , 2023).

Though, there is less than a 2% chance of potentially damaging earthquake shaking in the project area in the next 50 years according to the Global Facility for Disaster Reduction and Recovery, 2020, anecdotal information from residents of the area informs of earth tremors in recent years.

Considering the elevation of the site (16m GD), existing high tide conditions as well as the existing conditions at high hightide (HHT) and sea level, the risk level for the impact on the flood water surface elevation (FWSE) of the site was determined to be very high and extreme. At this elevation, current high tide conditions have an estimated impact of increasing FSWE to 17.95m GD. Similarly, existing conditions of HHT and SLR have an estimated impact of increasing FWSE to 19.56m GD. While increases to the FWSE from pluvial inputs are negligible, inputs from spring tide and sea level rise will result in the inundation of the site by flood water.

The following measures will be put in place to mitigate any potential risk identified: -

- The internal and external access roads to be built will be at the same level as the existing public access road to the site. All equipment and solar infrastructure will be elevated above the flood level for each site using the PHC pile arrangement proposed.

- Solar panels and electrical elements will be elevated at least 2.61 above design ground level, (20.55 m GD)
- The facilities will be designed to withstand a wind load of 244km/h
- There will be the installation of Early Warning System to alert for extreme weather event

4.2.2 Prospect

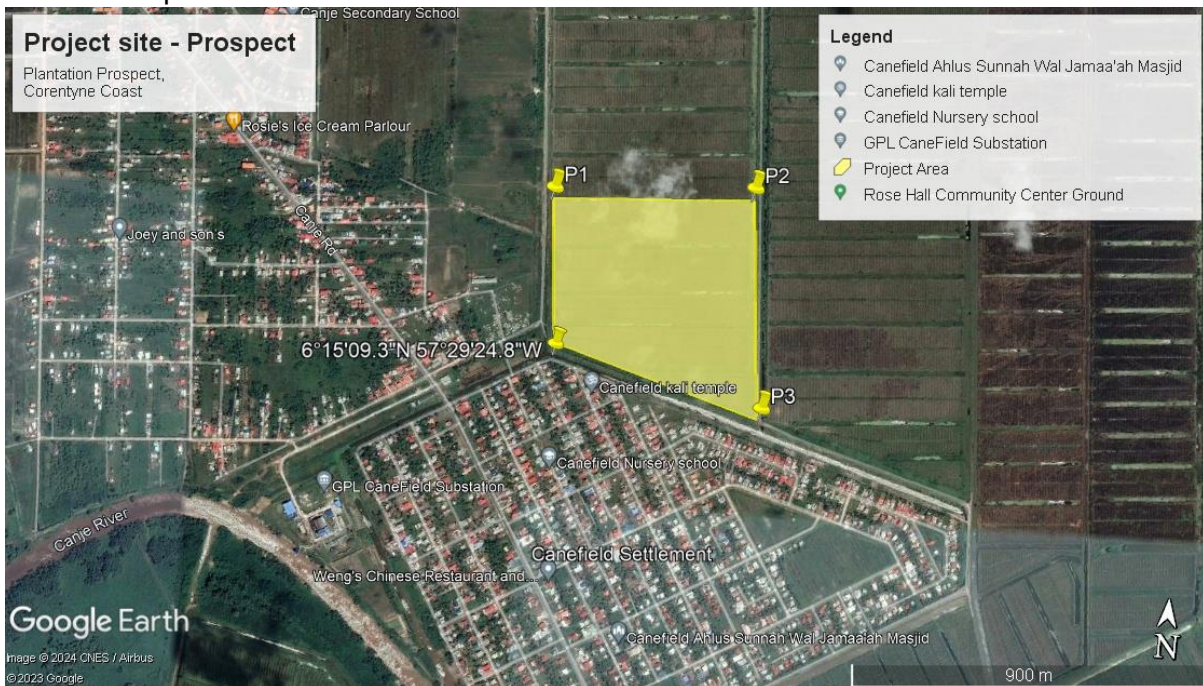


Figure 14: Project site - Prospect and surrounding land uses

The site is located within the Coastal Plain, which comprises Plio-Pleistocene aged Demerara Clay and the Coropina Formation overlying the Pleistocene to recent aged White Sand Series. The White Sand Series was not encountered in subsurface exploration. The Coropina Formation overlies the White Sand Series and is generally characterised by mottled, multicoloured, over-consolidated clays with some silt content. The Demerara Clays overlie the Coropina Formation and are generally characterized by very soft, gray/blue, normally consolidated clays deposited during post-glacial times.

Land use

The site is surrounded by a water filled ditch along the east, west and southern boundary lines and there is an existing dilapidated culvert crossing at the southeastern portion of the site. The site can be described as an open sparsely grassed lot with several areas that are waterlogged. In the recent past, the site was used for the cultivation of crops which included sugar cane.

Soil

The subsurface generally consists of one (1) major unit (layer) as sandy clay with some silt. Soils in the upper layers indicate an undetectable sulphate content, a pH value ranging from 7.60-8.11 and a chloride content of 1605.89mg/kg (0.16%).

Water Table

The water levels were measured at depths of approximately 1.4m and 1.8m below grade. However, the water table is phreatic, and this level is expected to fluctuate with seasonal rainfall.

Air Quality

The concentration of PM₁₀ at the Prospect Solar PV Site ranged from 9.6 – 111.1 µg/m³ during the initial monitoring period which is below the PM₁₀ USEPA 1971 - 2012 National Ambient Air Quality Standards (NAAQS) 150 µg/m³ 24-hours average.

Noise

The solar PV Farm at Prospect recorded noise levels ranging from 41.1 dB to 58.8 dB. The sample areas never exceeded 60 dB with the highest noise level recorded at 58.8 dB. During the time of monitoring, the highest noise level recorded was 58.8 dB which may have been attributed to frequent traversing of vehicles on the public road. Despite this, all levels recorded were negligible as outlined in the GNBS Guidelines.

Disaster Risk

The project site covers an area of 22.9 hectares and is situated approximately 1 kilometre northeast of the Canje River, about 4.5 kilometres upstream of its confluence with the Berbice River, at an elevation of approximately 16.2 meters Georgetown Datum (GD). The highest risk of submergence exists at a Recurrence Interval (RI) of 50 years. This site can be impacted by flooding from the backwater profile of the Canje River when the Berbice River is in flood stage, the latter of which is modulated by rainfall and tidal impact at the confluence point with Canje River. These conditions make the site highly susceptible to flooding, registering a flood risk likelihood of 'Very Extreme.' The highest risk category is "Extreme", and it is associated with a historical flood water depth (FWD) of 4.05m and a corresponding flood water surface elevation (FWSE) of 20.25m, as well as a historical FWD + sea level rise (SLR) scenario with a FWD of 4.55m and a corresponding FWSE of 20.75m (GUYSOL - DRMP , 2023).

The CDEMA reported incidences of vigorous tropical waves causing damage to homes in the region. Specifically, windstorm incidents in November 2022 across regions 6, 7 and resulted in the destruction of houses (Stabroek News , 2022). Moreover, flooding and ponding during rain events can result from long and intense rainfall events (GUYSOL - DRMP , 2023).

The following measures will be put in place to mitigate any potential risk identified: -

- The internal and external access roads to be built will be at the same level as the existing public access road to the site.
- All equipment and solar infrastructure will be elevated above the flood level for each site using the PHC pile arrangement.
- The site will have a weather station as part of its design.
- Site is required to be grassed as per contract requirements and recommendations of the Flood Risk Assessment.
- All other major equipment will be installed above the flood level.
- Foundation Design has been done in accordance with geotechnical recommendation and pile testing was successfully done to validate the same.
- All metal parts are galvanized.

- The facilities are designed to withstand a wind load of 244km/h

4.2.3 Trafalgar



Figure 15: Solar PV site - Trafalgar and surrounding land uses

The site is located within the Guyana Coastal Plain, which comprises of Plio-Pleistocene aged Demerara Clay and the Coropina Formation overlying the Pleistocene to recent aged White Sand Series. The White Sand Series was not encountered in our subsurface exploration. The Coropina Formation overlies the White Sand Series and is generally characterised by mottled, multicoloured, over-consolidated clays with some silt content. The Demerara Clays overlie the Coropina Formation and are generally characterized by very soft, gray/blue, normally consolidated clays deposited during post-glacial times (Geotechnical Investigations, 2022).

Land Use

Southeast of the site is a reserve with a dam immediately outside, followed by a drainage canal then the Onverwagt Road (0.03km from the site) which connects to the public road. Beyond the road, there is an irrigation canal, then state lands (in the rear of Plantation Onverwagt). Northeast of the facility is an abattoir, which is the property of the Guyana Livestock Development Authority, whilst farmlands characterise the opposing boundary (southwest). Northwest of the site is a reserve inclusive of a dam and irrigation canal which is followed by more state lands, in the rear of centre one third of Plantation Trafalgar, Figure 12 (Guyana Lands and Surveys Commission, 2021).

From the north-eastern boundary of the solar PV site, the 28 Railway Line is 1.49km, followed by the community of Trafalgar with several amenities available including two schools (Trafalgar Nursery School and Number 29 Primary School), a Number 28 Cemetery, a church, a convenience store, the GPL West Coast Berbice Generating Plant, Mahaica Mahaicony Abary - Agricultural Development Authority, the Guyana Water Incorporated – Region 5, a recreation centre and an entertainment park Figure 12.

Soil

The subsurface generally consists of one major unit (layer) as follows:

- Sandy Clay with Some Silt

The results of chemical tests conducted on the soils in the upper layers indicate an undetectable sulphate content, a pH value ranging from 7.60-8.11 and a chloride content of 1605.89mg/kg (0.16%).

Water Table

The water levels (24-hour reading) were recorded at depths of approximately 1.4m in and 1.8m below grade. However, it should be noted that the water table is phreatic, and this level is expected to fluctuate with seasonal rainfall.

Air Quality

When assessing the air quality at the Trafalgar solar PV site, no points were above the stipulated level by the US National Ambient Air Quality, PM10 ranged from 16.8 to 54.2 µg/m³ but did not exceed allowable limits. Total volatile organic compounds were not detected at the site.

Noise

Although situated in an agricultural-commercial zone with a steady movement of heavy machines and trucks, the site did not record limits above the guidelines outlined by the EPA Guyana. The highest dB was 53.2 dB.

Disaster Risks

Recent flood risk assessment investigations revealed that this project site is approximately 1.05m below normal conditions of high tide and some 2.56m below the Flood Water Surface Elevation where there is an incident of High Tide and Spring Tide. These conditions make the site highly susceptible to flooding, thus registering a flood risk likelihood of 'Very High'. This flood hazard is in keeping with the disaster risk assessment for the region completed by the CDC (GUYSOL - DRMP , 2023).

Exposure to windstorm was identified as another disaster risk for this project site given the disaster occurrences in the region. Several news agencies over the last 3 years have reported incidences of high winds causing significant disruption to infrastructure in the region (Guyana Times, May 2021; Stabroek News, May 2022; Guyana Chronicle, July 2023). Similarly, localized flooding and ponding during rain events can result after a period of long and intense rainfall events (GUYSOL - DRMP , 2023).

At this current elevation of 16.5m GD, current high tide conditions have an estimated impact of increasing FSWE to 17.95m GD. Similarly, existing conditions of HHT and SLR have an estimated impact of increasing FWSE to 19.56m GD. This indicates risk levels of high and extreme for the respective conditions.

The following measures will be put in place to mitigate any potential risk identified: -

- All Solar infrastructure (including access road, foundations, etc.) will be above highest flood water level.
- Solar panels will be elevated at least 1.5M above design ground level.
- There will be periodic review and update of existing erosion and flood assessments.
- Implementation Flood Response Procedures.
- The site will have a weather station as part of the design

- There will be regular inspections and maintenance of the surrounding drainage channels and sluice gates
- The facilities will be designed to withstand a wind load of 244km/h

4.2.4 Onderneeming

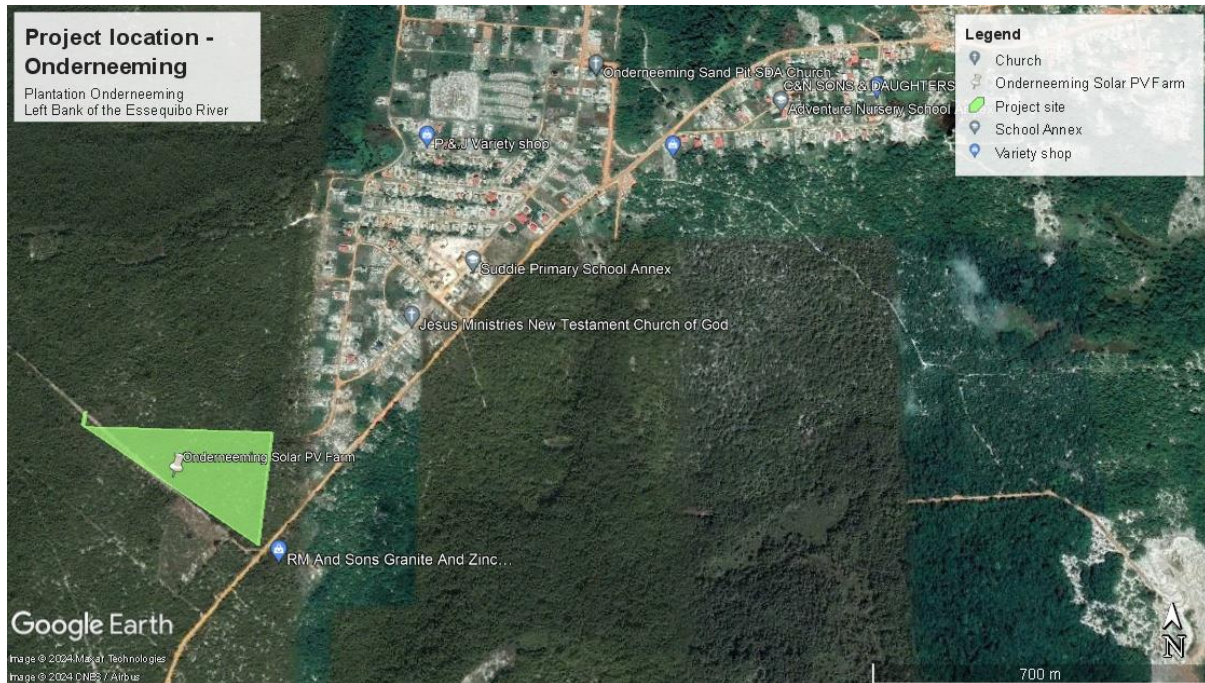


Figure 16: Project site - Onderneeming and surrounding land uses

The western and southern parts of the Guyana are relatively high in terrain and gently dips to the northeast. The Coastal Plain, which lies near sea level, is underlain by clays of the Demerara Clays and Corpina Formations; and crossed by old shorelines and sand ridges, which runs mostly parallel with the present shorelines. The sediments of the Coastal Plain, together with those of the White Sand Series, referred to as Coastal Sediments, are described as a series of coarse to fine sandstones where their composition and configuration give rise to the artesian conditions on which the coastal water supply demands. Along the Essequibo coast, the conditions are vastly different in comparison to the Greater Georgetown area. In this area, the crystallines rise to 300 feet of the surface ridge or shelf. The upper members of the White Sand Series thin out as they approach it and there is evidence of gradual uplift. In areas along the Essequibo coast, the Demerara Clay is completely absent, as such and the presence of considerable bodies of lignite throughout the White Sand Series points to more terrestrial conditions.

Land Use

North of the project site is “Land” and east is government reserve. A sand pit road connects to the public road in the southwest direction. Southwest of the site is another reserve, which is followed by leased state plantations. The sandpit’s road also runs through the solar PV site. There is a granite and zinc processing factory within the area. Other amenities include two churches, a boutique, a variety shop and one governmental agency, i.e., the Onderneeming Village Office and the Suddie Primary School Annex Figure 13.

Soil

The chemical test show that the upper 1.5m layer at the site is characterized as a loose fine grained white sand with traces of organic material, while the lower layer (from 1.5m to the termination depth) consist of dense fine grained white sand. The moisture content and dry density of the soil varies from 3.9% to 8.67% and 1.445g/cm³ to 1.603g/cm³ with pH is 5.51-5.88.

Water Table

The A Sand aquifer is considered ideal for ground water exploration in this area and is located at depths between 150 – 215m. The remaining parts of the region lies within the interior plains where access to the aquifer is limited to lack of roads (US Army Corps of Engineers, 1998).

Air Quality

Particulate matter (PM2.5) concentration ranged from 7.6 – 15.5 µg/m³. Currently, the level of PM recorded at the site does not exceed the permissible limits outlined by the US National Ambient Air Quality Standards 24-hours average with the other seven values. Similarly, PM10 values did not exceed the levels stipulated. Overall, the current baseline air quality within the area is good. Total volatile organic compounds were not detected at the site.

Noise

Noise limits have not exceeded the limits stipulated by the EPA with a range of 31.2 dB to 44.1 dB.

Disaster Risk

While this region is characterized by lowlands, with a large percentage of geographic area laying below the mean sea level, the site's elevation was reported above the Flood Water Surface Elevation. Using the Ikuraka Lake as a reference, the elevation of the site was noted as above the flood zone of the lake with a 'Low' flood risk potential. (GUYSOL - DRMP , 2023). Consequently, the impact on FWSE is negligible.

However, the flat, rolling plains are elevated and exposed, and the CDEMA reported several high winds during storm incidents, resulting in destruction of infrastructure. The CDC also identified Region 2 to have high propensity for windstorms. The flat topography and limited existing stormwater management system can increase the risk of localized flooding of the site during rain events resulting in stormwater runoff and pooling. The minimum recurrence period or recurrence interval for design would be 10-years (GUYSOL - DRMP , 2023).

The following measures will be put in place to mitigate any potential risk identified: -

- The internal and external access roads to be built will be at the same level as the existing public access road to the site. All equipment and solar infrastructure will be elevated above the flood level for each site using the PHC pile arrangement.
- The site will be grassed as per contract requirements
- Solar panels will be elevated at least 1m above design ground level, (38m GD)
- The drainage plan for the site includes a gravity and pump-assistance discharge into the public drainage facilities around the site.
- Flood response procedures will be implemented.

4.2.5 Charity



Figure 17: Solar PV site - Charity and surrounding land uses

The western and southern parts of the Guyana are relatively high in terrain and gently dips to the northeast. The Coastal Plain, which lies near sea level, is underlain by clays of the Demerara Clays and Corpina Formations; and crossed by old shorelines and sand ridges, which runs mostly parallel with the present shorelines. The sediments of the Coastal Plain, together with those of the White Sand Series, referred to as Coastal Sediments, are described as a series of coarse to fine sandstones where their composition and configuration give rise to the artesian conditions on which the coastal water supply demands. Along the Essequibo coast, the conditions are vastly different in comparison to the Greater Georgetown area. In this area, the crystallines rise to within 300ft of the surface ridge or shelf. The upper members of the White Sand Series thin out as they approach it and there is evidence of gradual uplift. In areas along the Essequibo coast, the Demerara Clay is completely absent as such and the presence of considerable bodies of lignite throughout the White Sand Series points to more terrestrial conditions.

Land Use

In the southwest by west direction of the site, there is a drainage canal bordered by a dam. These structures continue along the northeast direction, bordering both the south-eastern and north-western boundaries. East of and south-eastern areas of the project site are characterised as farmlands (as close as 0.30km). The main road is approximately 1.28km from the south/southeast boundary, with the town centre southwest of the project site at 1.62km. Several residences are observed along the main road. A gas station (1.32km from the site) and welding supply store (1.31km from the site), Figure 13.

Majority of services are located within immediacy to the Pomeroun River (2.18km southwest of the site) which include two schools (Charity Nursery School and Charity Secondary School), places of worship (four churches and one mosque), Charity Police

Station, Charity Wharf, government agency (NAREI Plant Nursery), one pharmacy and two more filling stations. Other facilities include food and entertainment services (Figure 13).

Soil

The soil strata are classified as Soft silty clays with layers of organic material. The soils were noted as being very soft, grey clay with some being very soft, brownish silty clay. The rate of corrosion of zinc and steel particles in clay soils is 20 microns per year ($\mu\text{m}/\text{year}$), which is relatively high due to the high moisture content, chloride concentration, and pH in this soil type (American Galvanizers Association, 2020).

Water Table

The water table was encountered at 450mm below the surface level.

Air Quality

Measurements recorded at the solar PV farm in Charity indicated a good air quality with the highest value of $\text{PM}_{2.5}$ recorded at $48.2 \mu\text{g}/\text{m}^3$. All PM_{10} values were regarded as within limits except one $67.4 \mu\text{g}/\text{m}^3$. Despite this, the total average of the site indicates that the air quality is good. Total volatile organic compounds were not detected at the site.

Noise

In Charity, the noise level recording at the solar PV site did not exceed the limits stipulated by the EPA Guyana. The highest dB was 44.2.

Disaster Risk

This site can be regarded as a flood transition zone in an area predominantly utilized for agriculture. The land is generally flat and bordered by wide-width drainage channels. The area is characterized by lowlands, which are usually submerged during periods of persistent rainfall, which sees the channels overtopping onto the land (GUYSOL - DRMP , 2023).

The site is surrounded by agricultural plots where recent flood risk assessment investigations indicate that the site is dominated by tidal influence, which results in widespread flooding. The flood water depth (FWD) and flood water surface elevation (FWSE) at Existing Condition of Average High Tide (HT): 2.95m, Flood Water Depth (FWD) = 17.95m GD and 2 HHT + sea level rise: 4.56m, FWD = 19.56m GD (GUYSOL - DRMP , 2023).

Data revealed that the project site is approximately 2.95m below normal conditions of high tide and some 4.56m below the FWSE where there is an incident of high tide and spring tide. These conditions make the site highly susceptible to flooding, thus registering a flood risk category of 'Very Extreme'. This flood hazard is in accordance with the disaster risk assessment for the region located on the coastal belt as noted by the CDC (GUYSOL - DRMP , 2023).

The following measures will be put in place to mitigate any potential risk identified: -

- The internal and external access roads to be built will be at the same level as the existing public access road to the site. All equipment and solar infrastructure will be elevated above the flood level for each site using the PHC pile arrangement
- The site will have a weather station as part of the design. The early warning bulletin system
- Solar panels will be elevated at least 2.6 m above design ground level, (29.35 m GD)

- There will be periodic reviews and updates of existing erosion and flood assessments
- The implement Flood Response Procedures
- There will be regular inspections and maintenance of the surrounding drainage channels and sluice gates
- Emergency Response Plans will be tested and updated are required.
- A drainage plan for the site with a gravity and pump-assistance discharge into the public drainage facilities around the site will be implemented.
-

4.3 BIOLOGICAL ENVIRONMENT

The five sites are situated on the coastal plain of Guyana which may be designated as both a natural region as well as a physiographic region with a depth ranging from 8 to 65 km (GLSC, 2013). The project areas in Berbice and Essequibo lie within the coastal biogeographical province of Guyana characterized by the following biotic communities (NAREI, 1995):

- The Marine ecosystem includes mudflats, mangrove forests and shell beaches. The mangroves protect the shoreline against erosion.
- The Estuarine ecosystem is characterized by wetlands which occurs at the mouths of the rivers
- The Riverine ecosystem is characterized by tidal wetlands which occur along riverbanks.
- The Palustrine ecosystem comprises of marshes and swamps in river flood plains, as well as water savannahs.
- The Lacustrine ecosystem consists of natural lakes and the water conservancies. Some flora includes water lilies, razor grass and ite palm and ferns.

Flora and fauna diversity within most of the sites is almost low compared to forested areas beyond due to low levels of disturbance and anthropogenic activities. In such areas, the most common species are those considered generalists and those that are not disturbance sensitive. Expanding infrastructure for housing and commercial activities within the area influences flora and fauna diversity within these PV locations. The scale and extent of disturbance influences composition and abundance.

Specifically, the areas proposed for the solar PV sites in Charity is considered open swamp whereas Onderneeming is regarded as Dakama Forest. Trafalgar and Hampshire are currently regarded as cultivated/residential area. The site which has been identified for Prospect can be considered as disturbed since much of its primary vegetation and natural habitats have been lost over many years of infrastructure development and expansion of commercial and industrial activities.

Most of the species recorded during the surveys for each site were listed as Least Concerned or Non-CITES according to IUCN/CITES and are not within proximity to areas labelled nationally as important biodiversity areas, including protected areas and forest reserves as identified in the National Land Use Plan 2013.

4.4 SOCIAL ENVIRONMENT

The total population of Hampshire was recorded at 1823 people (Bureau of Statistics, 2012). The area currently has two government schools. There was no indication of the presence of health clinics/outposts, police station, fire station, post office, financial institutions, shops/ markets/ grocery stores. There were two public spaces (grounds/ facility) and four places of worship. There were indications of public spaces, but the amounts were not identified. Moreover, observation made revealed unpaved roads in the area. As such, the community's well-being is in a fair standing, but there is much room for improvements in several social services and physical and economic assets.

The Local and Regional Body comprise:

- a. Kilcoy/Hampshire Neighbourhood Democratic Council, Albion Complex, Corentyne.
- b. Regional Democratic Council - Vryman's Erven, New Amsterdam

In 2021, when the Social Survey was conducted for ESA 2021, the Prospect area currently had no government or private schools; no government and private health clinics/outposts/hospitals; no private financial institutions; markets; privately-owned shops and stores; places of worship; public spaces; no police station/outpost; no fire service station; no government post office in the Prospect area. Moreover, paved roads and fair telephone services were provided. As such the well-being of the community is greatly affected due to the limited number of physical and economic assets, and social services. Furthermore, the Census 2002 and 2012 contain no specific information on Prospect area specifically, however, information was provided on the Canefield area which recorded a population of 921 in the Population and Housing Census in 2021.

The Local and Regional Body comprise:

- a. Canefield/Enterprise Neighbourhood Democratic Council, Canefield, East Canje Berbice.
- b. Regional Democratic Council - Vryman's Erven, New Amsterdam

Trafalgar is an estate located in Mahaica-Berbice, Guyana. The village is referred to as Number 28 Village and is bordered by Union and Number 27 villages. It is a highly agricultural area and is home to approximately 904 residents (Bureau of Statistics, 2012). The Trafalgar area currently has two government schools, one government health clinics/outposts, one fire station, two public spaces, and four places of worship. No police station or post office were observed, however, there is a Guyana Revenue Authority, MMA Office and GPL Office and Substation. Additionally, the Hugo Chavez home for the Elderly is also situated within the area. Moreover, analysis of data collected revealed unpaved roads in the area. As such, the community's well-being is in a fair standing with room for improvements in several social services and physical and economic assets.

The Local and Regional Organs for residents of Trafalgar are:

- a. Regional Democratic Council in Fort Wellington, West Coast Berbice
- b. Union/Naarstigheids Neighbourhood Democratic Council in Bush Lot Village, West Coast Berbice

Onderneeming is a village situated in the region: Pomeroon-Supenaam, located approximately 50km from Guyana's capital, Georgetown. The village is located along the Atlantic Coast and yields a population of approximately 1095 residents (Bureau of Statistics, 2012). The Onderneeming area currently has two government schools; one government health clinics/outposts; a police station, several shops/ markets/ grocery stores; two public spaces (grounds/ facility); and four places of worship. There are, however, no fire station/ outpost, nor financial institutions. Moreover, analysis of data collected revealed good, stabilized roads in the area. As such, the community's well-being is in a fair standing with room for improvements in several social services and physical and economic assets.

The Local and Regional Body governing Onderneeming are:

- a. Regional Democratic Council – Anna Regina, Essequibo Coast
- b. Annandale/Riverstown Neighbourhood Democratic Council

Charity is a village located in the region: Pomeroon-Supenaam, which is a part of the county of Essequibo. The village lies on the banks of the Pomeroon River, which is sandwiched between the Orinoco and Essequibo Rivers. The current population of Charity stands at 1485 people (Bureau of Statistics, 2012). The Charity area currently has five schools, both government owned and private. There is one government health clinics/outposts, a police station, and a post office. There are also several shops/ markets/ grocery stores, public spaces (grounds/ facility), and places of worship. There are, however, no fire station/ outpost, nor financial institutions. Moreover, analysis of data collected revealed both paved and unpaved roads in the area. As such, the community's well-being is in a fair standing with room for improvements in several social services and physical and economic assets.

The Regional and Local Democratic Organ for Charity are:

- a. Regional Democratic Council located – Anna Regina, Essequibo Coast
- b. Charity/Urasara Neighbourhood Democratic Council - Charity, Essequibo Coast

5 SUMMARY OF IMPACTS ASSOCIATED WITH THE PROPOSED ACTIVITY

The potential environmental and social impacts of the proposed works for each site were identified in the previous ESAs and ESMPs to inform adequate actions of control and measures of prevention of any possible environmental and social risks. Impacts were assessed considering duration of the impact, regarding its geographical extent and magnitude. Based on these three factors, the significance of an impact was either determined as major, moderate or minor. The biophysical aspects included air quality, noise, soil, land use, solid waste, surface water, groundwater, biodiversity/natural habitat, landscape and visual amenities. Socioeconomic aspects included demography, displacement, employment livelihood, socio-cultural, infrastructure, health and safety and gender.

5.1.1 Air Quality

The impact on air quality is minor as dust and other pollutants like Nitrogen and Carbon oxides generated during projects works is expected to be brief, frequent and localized at

all project sites during construction. It can be attributed to site preparatory works mainly involving heavy machinery (clearing, levelling, excavation, grading), the effects are mitigable. This impact is not expected during operation. In the decommission phase, it is expected to be brief, frequent, and localized due to dismantling of the site and use of heavy machinery (clearing, levelling, excavation, grading). At this stage, it is also considered minor.

Reduction of carbon emissions is a positive impact occurring in the O&M phase. Given the current and projected loads at each site, the Berbice and Essequibo components are expected to save a total of 10,671 tCO₂ and 9,390 tCO₂ annually, respectively. The generation of energy through the PV system provides a source of green power generation and significantly reduces dependence on fossil fuels. This impact was regarded as major.

5.1.2 Noise Quality

In the construction and decommission phases, the presence and operation of light and heavy vehicles, transportation trucks, generators, compressors and other construction equipment increase as heavy machines generate noise.

5.1.3 Soil

The ESA and ESMP looked at loss of topsoil, soil contamination, soil compaction, soil erosion. Though loss of topsoil is long term and localized, it is regarded as minor as most of the solar PV sites were previously disturbed areas. However, the Onderneeming solar PV site is covered with vegetation, though marked as disturbed. Despite this, the significance of impact was regarded as medium as an estimated 14 acres will be cleared for works. Soil compaction and contamination were also stated, as minor impacts occurring in the construction and decommission phases. Erosion/disturbance of the soil is recorded during construction from activities including land clearance and assembling of foundation structures for mounting of solar modules on a localised scale. This impact is considered minor and temporary.

5.1.4 Water

Potential impacts during construction activities like pollution of nearby surface water due to runoff (increased turbidity, organic load) is documented. Potential spills of oil could cause contamination of the nearby surface water through run-off. This impact is temporary and avoidable. Wastewater generation from construction staff living quarters may also cause increased organic load to nearby water bodies, if not adequately managed. During operation, wastewater will be generated from security/maintenance staff offices and cleaning of the PV cells. Impacts on groundwater resources must be noted during the construction stage from oil spills and leaks or due to improper storage and handling. Improper solid and wastewater management can also impact the groundwater resources.

5.1.5 Waste

Impacts ensuing from generation of waste is mentioned as significant during the construction phase. Minimal to no green waste is expected at the sites considering the land was previously disturbed except solar PV site, Onderneeming. Construction and domestic waste generation is another impact. As an indirect impact, it likely that

temporal food supply businesses will increase nearby the project site. These businesses will also be a source of increased generation of solid waste that must be considered. Poor solid waste management on site may lead to improper disposal, burning, and pollution of water resources. Domestic waste generation may be expected during operation from permanent maintenance staff. Solid waste generated is expected to increase in the decommissioning stage.

5.1.6 Land Use

The solar PV sites have no competing uses as most sites are commercial/industrial and state-owned. The installation of the PV systems was regarded as not significantly impact the economic activities of the communities and the surrounding area. The impact is considered minor. During O&M, all sites will be used for energy generation for the lifetime of the facility. As such, no significant change in the land use of the site is noted. The installation of the PV systems will not significantly impact the economic activities of the area, therefore, this impact is considered insignificant. In decommission, the farms will be dismantled, and the facilities removed so the land use may revert to old practices or adopt new uses.

5.1.7 Natural Habitat

The natural habitat considered creation/loss of habitat, noise levels, aesthetics. As most project areas are described as disturbed, loss of habitat was noted at the Onderneeming Solar PV site due to its vegetative cover. There are also high levels of faunal biodiversity within the wider project area, though no indication or presence of threatened or protected flora or fauna species was recorded in the direct area of influence. During O&M, the increase in ground shade and humidity may promote growth of vegetation. The reflection of solar panels may affect birds as the main wildlife in the surroundings, and transmission lines may affect bird mortality. Solar PV farms can impact bird communities through habitat loss and the risk of avian collision mortality. The increased traffic and machines during construction was noted as a potential impact that may affect faunal biodiversity within areas of influence causing migration to other areas of the forest.

5.1.8 Supply Chain Management

During construction, unforeseen circumstances can cause changes in the supply chain management. The solar PV supply chain is vulnerable to impacts like natural disasters, wars, pandemics, technical incapacities, individual company decisions which can impact project costs and management. This impact is considered medium as it is unpredictable and direct, however, it can only be expected during this phase. This impact can be reduced by greater understanding of price mechanisms and competition by the PEU to inform decisions about capital costs before hiring a Contractor.

5.1.9 Socio-Economic Activity

Increased activities due to construction activities is regarded as a positive impact as it will temporarily increase the economic activities within proximity to the construction sites to accommodate the current needs of the workers. An expected indirect impact of the operation of the PV systems recorded was the increase of population in the area. The increase of energy production, with the current reliable service from GPL will naturally promote an expansion of socio-economic activities in the area thus also impacting the

demography. This effect is considered high spread, long term and significant for the community. In the final phase, an influx of construction workers will increase economic activities within the area temporarily.

5.1.10 Public Health and Safety

During construction, increase vehicular traffic, heavy machinery operation, excavation, and other construction activities are recognised as potential hazards. Though localized and temporary, the effects can be minimized by strict adherence of the approved safety procedures mandatory under the Laws of Guyana. Influx of construction workers may lead to increase in the prevalence of sexually transmitted diseases among the local population, as well as sexual violence. Considering that labour is expected to be filled locally, this concern can be regarded as low. However, health and awareness campaigns as well as a code of conduct indicating clear repercussions can minimize any potential effects. The impact is considered indirect and moderate. During operations, workers be exposed to occupational hazards especially during maintenance. The probability of occurrence can be minimized by strict adherence to occupational safety procedures. Increased exposure to hazards is expected in the decommissioning activities. Strict adherence to health and safety procedures will minimize these effects.

5.1.11 Infrastructure

No expected disruption of energy or other services during construction activities was noted. However, any unexpected disruptions can be expected to be brief but widespread. However, effects are expected to be minimal with adequate planning. Upgrading of the access road to the proposed site may create traffic disturbances. The use of any current trail should be considered, and relevant stakeholders contacted to ensure no significant disruption of activities to local users. The impact was regarded direct and moderate. During the operation of the PV system, the energy service is expected to be reliable. Modular PV systems are resilient to disruptive events. If a module is damaged, the system remains operational. This will benefit the customers and will minimize power outage in the area. Water supply service is expected to be impacted positively, since power disruptions to the distribution system will also be minimized. Effects will be long term and at the community level. The impact is considered direct and major. For this assessment, it was assumed that GPL service after decommissioning will be maintained, therefore, decommissioning of the system is not considered to have any impact.

5.1.12 Employment

During the construction phase, the ESA and ESMP noted that opportunities will be generated for skilled and unskilled labour including a demand for local goods and services which will have an impact on the earning capacity of local businesses. These impacts while positive are expected to be only temporary and localized. The operation of the PV systems will be managed by GPL staff, however permanent roles like security services and scheduled maintenance. Therefore, a direct impact on employment generation was noted during this phase. During the decommission phase, there may be temporary employment opportunities during the dismantling of the plant. However, this is expected to be in a much lesser extent than in the construction phase.

5.1.13 Risk Analysis

Each site was analysed for specific risks and vulnerabilities, propensity of occurrence (high medium, low) and potential impact of occurrence. The Risk Analysis also considered which phase of management these potential impacts should be considered, Table 7.

Table 7: Risk Analysis

| Project Site | Type of Hazard | Probability or likelihood of Occurrence | | | Potential Impact | | | Management Phase | | |
|--------------|----------------|---|-----|-----|------------------|-----|-----|------------------|--------------|-----------|
| | | High | Med | Low | High | Med | Low | Design | Construction | Operation |
| Hampshire | Flooding | | ✓ | | | ✓ | | ✓ | ✓ | |
| | Windstorm | | | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| | Earthquake | | | x | | | x | | | |
| Prospect | Flooding | | | ✓ | | ✓ | | ✓ | ✓ | |
| | Windstorm | | | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| | Earthquake | | | ✓ | | | x | x | x | x |
| Trafalgar | Flooding | | ✓ | | | ✓ | | ✓ | ✓ | |
| | Windstorm | | | ✓ | | ✓ | | ✓ | | |
| Onderneeming | Flash Flooding | | ✓ | | | ✓ | | ✓ | ✓ | ✓ |
| Charity | Flooding | ✓ | | | ✓ | | | ✓ | ✓ | |

Source: (GUYSOL - DRMP , 2023)

Specific wind and flood data inserted here showing predictions.

5.1.14 Positive Impacts

Overall, positive socio-economic impacts are expected to benefit the residents and customers in all regions, through reliable provision of electricity. In addition, the significant reductions in fuel and operational costs will contribute to the improvement of the financial performance of the electricity sector and support the establishment of a Low Carbon Development Strategy for Guyana. Government subsidies are also anticipated to be significantly reduced, making valuable resources available for other developmental activities in the country. As a result of the improved and reliable provision of electricity sector, other indirect benefits include:

- i. increases and diversification of economic activities in the area
- ii. improved efficiency in the health, education, water, and public safety sectors
- iii. contribution to mitigation of global climate change by reduced emissions of greenhouse gases compared to the baseline (stand-alone diesel supply)
- iv. increased income generation opportunities for women.

The main negative impacts of the project are related to the construction and permanent presence of the installations in the physical environment. The significance of these impacts depends on the type of installations and the specific site. Given that the areas for installation are developed with existing access roads, there is in general a low level of biophysical impacts expected and limited to the construction phase (for example, clearing of vegetation, land preparation, compaction from the transport of materials). However, bird fatalities rate should be assessed to determine the likelihood of occurrence. Generally, most of the analysed impacts are considered minor or moderate at the sites. The effects of these impacts can be significantly reduced or minimized by the implementation of mitigation measures. The mitigation measures for the construction, operation and decommissioning phases are presented below. This will be complemented by previous ESAs and ESMPs, the Environmental Construction and Operation Permits and the Environmental and Social Management Framework.

5.1.15 Contractor's commitment

The Contractor shall adopt a reasonable design and construction plan to ensure that the plant facilities and construction activities have minimal impact on the existing topography and surrounding environment and geology. Furthermore, as previously stated in Management Objectives of the Quality, Environment, and Occupational Health & Safety Management Manual, the Contractor's operations shall be guided by industry standards, centred on contract management, and focused on cost control, high-quality with honesty and integrity to prevent pollution, protect the ecological environment, care for employees, ensure physical and mental health, and pursue excellence in continuous improvement.

5.2 DESCRIPTION OF MITIGATION MEASURES

| ACTIVITY | PARAMETER | MITIGATION MEASURES CHECKLIST |
|---|------------------------------------|--|
| General Conditions | Notification and Worker Safety | <ul style="list-style-type: none"> (a) The local construction and environment inspectorates and communities have been notified of upcoming activities. (b) The public has been notified of the works through appropriate notification in the media and/or at publicly accessible sites (including the site of the works). (c) All legally required permits have been acquired for construction and/or rehabilitation. (d) The Contractor formally agrees that all work will be carried out in a safe and disciplined manner designed to minimize impacts on neighbouring residents and environment. (e) Workers' PPE will comply with local and international good practice (always hardhats, as needed masks and safety glasses, harnesses and safety boots). (f) Appropriate signposting of the sites will inform workers of key rules and regulations to follow. |
| General Rehabilitation and/or Construction Activities | Air Quality | <ul style="list-style-type: none"> (a) During excavation works dust control measures shall be employed, e.g. by spraying and moistening the ground. (b) Demolition debris excavated soil, and aggregates shall be kept in controlled area and sprayed with water mist to reduce debris dust. (c) During pneumatic drilling or breaking of pavement and foundations dust shall be suppressed by ongoing water spraying and/or installing dust screen enclosures at site. (d) The surrounding environment (sidewalks, roads) shall be kept free of soil and debris to minimize dust. (e) There will be no open burning of construction / waste material at the site. (f) All machinery will comply with polish emission regulations, shall well maintained and serviced and there will be no excessive idling of construction vehicles at sites. |
| | Noise | <ul style="list-style-type: none"> (a) Construction noise will be limited and restricted to the times agreed to with the relevant authorities. (b) During operations the engine covers of generators, air compressors and other powered mechanical equipment shall be closed, and equipment placed as far away from residential areas as possible. |
| | Waste management | <ul style="list-style-type: none"> (a) Waste collection and disposal pathways and sites will be identified for all major waste types expected from excavation, demolition and construction activities. (b) Construction waste will be collected and disposed properly in areas approved by the engineers. (c) The records of waste disposal will be maintained as proof for proper management as designed. (d) Whenever feasible Contractor will reuse and recycle appropriate and viable materials (except when containing asbestos). |
| Impacts on surface drainage system | Water Quality | <ul style="list-style-type: none"> (a) There will be no unregulated extraction of groundwater, nor uncontrolled discharge of process waters, cement slurries, or any other contaminated waters into the ground or adjacent streams or rivers; the Contractor will obtain all necessary licenses and permits for water extraction and regulated discharge into the public wastewater system. (b) There will be proper storm water drainage systems installed, and care taken not to silt, pollute, block or otherwise negatively impact natural streams, rivers, ponds and lakes by construction activities. (c) There will be procedures for prevention of and response to accidental spills of fuels, lubricants and other toxic or noxious substances. (d) Construction vehicles and machinery will be washed only in designated areas where runoff will not pollute natural surface water bodies. |
| Toxic materials | Toxic / hazardous waste management | <ul style="list-style-type: none"> (a) Temporarily storage on site of all hazardous or toxic substances will be in safe containers labelled with details of composition, properties and handling information. |

| | | |
|--|--|--|
| | | <p>(b) The containers of hazardous substances shall be placed in a leak-proof container to prevent spillage.</p> <p>(c) The wastes shall be transported by specially licensed carriers and disposed in a licensed facility.</p> <p>(d) Paints with toxic ingredients or solvents or lead-based paints will not be used.</p> |
| | <p>Direct or indirect hazards to public traffic and pedestrians by construction activities</p> | <p>(a) In compliance with national regulations the Contractor will ensure that the construction site is properly secured, and construction related traffic regulated. This includes but is not limited to</p> <ul style="list-style-type: none"> ▪ Signposting, warning signs, barriers and traffic diversions: site will be clearly visible, and the public warned of all potential hazards. ▪ Traffic management system and staff training, especially for site access and near-site heavy traffic. Provision of safe passages and crossings for pedestrians where construction traffic interferes. ▪ Adjustment of working hours to local traffic patterns, e.g. avoiding major transport activities during rush hours or times of livestock movement. ▪ If required, active traffic management by trained and visible staff at the site for safe passage for the public. <p>(e) Ensuring safe and continuous access to all adjacent office facilities, shops and residences during construction.</p> |

Joint Venture of SUMEC Complete Equipment & Engineering Co. Ltd and XJ Group Corporation
Description of Mitigation Measures and Implementation Responsibility
Construction, Operations, Decommissioning Phases

| | Issue/ Impact | Mitigation Measures | Monitoring Indicators | Responsibility for Implementation | Responsibility for Monitoring |
|----------------|---|--|--|--|--|
| Air Quality | Dust generation | <ul style="list-style-type: none"> ▪ Suppress dust from construction, stockpiles and increased vehicular traffic by sprinkling water. ▪ Consider wind direction when stockpiling construction materials. Orientation shall avoid downwind residences or sensitive locations. ▪ Implement vehicle speed control through signage and whenever necessary. | <ul style="list-style-type: none"> ▪ PM monitoring ▪ Dust generation observation ▪ Complaints register | All contractors on site | HSE, Site Engineer, Project Manager |
| | NO _x and CO _x emissions | <ul style="list-style-type: none"> ▪ Regular maintenance of vehicles and on-site construction equipment. | <ul style="list-style-type: none"> ▪ Equipment maintenance records according to schedule ▪ Vehicle fitness certificates | All contractors on site | HSE, Site Engineer, Project Manager |
| | Noise | <ul style="list-style-type: none"> ▪ Use of padding/noise isolators for construction equipment and machinery. ▪ Fixed noise sources or activities to be carried out away from site boundaries, particularly boundaries close to sensitive environments. ▪ Adequate maintenance of construction vehicles and machinery. ▪ Use of ear plugs or earmuffs for specific activities by workers. ▪ Stakeholders' consultation (immediate surroundings of site) to plan activities accordingly. | <ul style="list-style-type: none"> ▪ Monitoring of dB ▪ Complaints register ▪ Equipment maintenance records according to schedule ▪ Workers compliance with H&S procedures ▪ Consultation records | All contractors on site | HSE, Site Engineer, Project Manager |

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|--|-----------------------------|---|--|--------------------------------------|---|
| Description of mitigation measures and implementation responsibility | | | | | |
| Construction, Operations, Decommissioning Phases | | | | | |
| | Issue/ Impact | Mitigation Measures | Monitoring Indicators | Responsibility for Implementation | Responsibility for Monitoring |
| Soil | Topsoil loss | <ul style="list-style-type: none"> ▪ Limit the removal of vegetation to the site footprint. ▪ Whenever possible, removed topsoil should be conserved and used for remediation of affected areas. | <ul style="list-style-type: none"> ▪ ESMP Compliance records | All contractors on site | HSE, Site Engineer, Project Manager |
| | Soil compaction and erosion | <ul style="list-style-type: none"> ▪ Adequate drainage will be developed for the site. | <ul style="list-style-type: none"> ▪ ESMP Compliance records | All contractors on site | HSE, Site Engineer, Project Manager |
| | Soil contamination | <ul style="list-style-type: none"> ▪ Adequate disposal of waste materials. ▪ Provision of bounded areas or secondary containment for storage of oil/fuel with 110% capacity of the stored material. ▪ Construction vehicles and machinery will be serviced regularly and off-site or on impervious surfaces to avoid soil contamination. ▪ Contaminated soil will be treated and/or disposed of adequately. | <ul style="list-style-type: none"> ▪ Complaints register ▪ ESMP Compliance records | All personnel on site | HSE QA/QC Site Engineer, Project Manager |

Joint Venture of SUMEC Complete Equipment & Engineering Co. Ltd and XJ Group Corporation
Description of mitigation measures and implementation responsibility
Construction, Operations, Decommissioning Phase

| | Issue/Impact/ Hazard | Mitigation Measures | Monitoring Indicators | Responsibility for Implementation | Responsibility for Monitoring |
|-------|---------------------------------|--|--|--|--|
| Waste | Solid waste generation | <ul style="list-style-type: none"> ▪ Waste will be disposed of in an authorized landfill. ▪ Adequate planning and coordination will be done with the landfill management to manage the increased volume expected to be generated from the site. ▪ The site will be provided with an adequate number of bins for the disposal of domestic waste. ▪ Waste such as spent oil, oily rags, etc. will be stored on site and disposed of through an approved waste disposal contractor. ▪ Burning of waste on-site will be prohibited. ▪ Adequate arrangements will be made for the frequent collection of domestic, construction and hazardous waste. ▪ The project will facilitate bins outside the site to food supply entrepreneurs and will arrange for the collection of such waste. ▪ Site and immediate surroundings cleanliness will be maintained always. | <ul style="list-style-type: none"> ▪ ESMP Compliance records ▪ Consultation records with solid waste management authorities ▪ Complaint records ▪ Existence of at least one container bin outside the project site where food services providers are located (if necessary). | All contractors on site | All contractors on site |

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|--|----------------------------|--|---|--------------------------------------|---|
| Description of mitigation measures and implementation responsibility | | | | | |
| Construction, Operations, Decommissioning Phase | | | | | |
| | Issue/Impact/ Hazard | Mitigation Measures | Monitoring Indicators | Responsibility for Implementation | Responsibility for Monitoring |
| Water | Surface water pollution | <ul style="list-style-type: none"> ▪ Adequate drainage will be designed for the site to minimize run-off, where necessary. ▪ Drainage systems will be monitored and frequently maintained. ▪ Adequate temporary sanitary facilities will be provided for workers on-site while permanent facilities are constructed. ▪ Frequent collection of waste generated by sanitary facilities will be collected by a locally approved contractor. | <ul style="list-style-type: none"> ▪ ESMP compliance records ▪ The existence of temporary sanitary facilities | All contractors on site | HSE QA/QC Site Engineer, Project Manager, Foreman |
| | Groundwater pollution | <ul style="list-style-type: none"> ▪ Oil spills, fuel spills and other site contaminants will be rapidly cleaned. ▪ Store any hazardous material, if any, in secure impermeable containers. ▪ Use existing roads and paths as much as possible to minimize new construction. ▪ Maintain vegetation cover wherever possible to prevent erosion and promote natural infiltration. | <ul style="list-style-type: none"> ▪ ESMP compliance records ▪ Existence of appropriate facilities | All contractors on site | HSE QA/QC Site Engineer, Project Manager, Foreman |
| | Loss of natural habitat | <ul style="list-style-type: none"> ▪ At site the loss of natural habitat impact is considered minor, and no mitigation measures are foreseen. ▪ Noise levels will be monitored and controlled as described above to minimize additional effects on fauna in the surrounding areas. | <ul style="list-style-type: none"> ▪ dB monitoring | All contractors on site | HSE QA/QC Site Engineer, Project Manager, Foreman |

| Joint Venture of SUMEC Complete Equipment & Engineering Co. Ltd and XJ Group Corporation Description of mitigation measures and implementation responsibility Construction, Operations, Decommissioning Phase | | | | | |
|--|---------------------------------|--|---|--|---|
| | Issue/Impact/ Hazard | Mitigation Measures | Monitoring Indicators | Responsibility for Implementation | Responsibility for monitoring |
| Social | Demography and Employment | <ul style="list-style-type: none"> ▪ Employment of local laborers should be maximized. ▪ A transparent recruitment process will take place. | <ul style="list-style-type: none"> ▪ Employment records ▪ Number of local laborers employed at the site | All contractors on site | HSE, Site Engineer, Project Manager, Foreman |
| | Socio-cultural | <ul style="list-style-type: none"> ▪ Regular stakeholder engagements will take place. | <ul style="list-style-type: none"> ▪ Called as needed /if necessary with a six-month community consultation Meeting proposed | All contractors on site | HSE QA/QC Site Engineer, Project Manager, Foreman |
| | Infrastructure | <ul style="list-style-type: none"> ▪ Timely and adequate public announcements with regards any service interruption due to the project, including road closures if necessary. | <ul style="list-style-type: none"> ▪ Service interruption records. ▪ Duration of service interruption | All contractors on site | HSE, Site Engineer, Project Manager, Foreman |
| | Health and Safety and Security | <ul style="list-style-type: none"> ▪ The Contractor's operations shall be guided by industry standards, centered on the Company's Quality, Environment, and Occupational Health & Safety Management Manual and the CESMP. These will be implemented by all personnel on site. ▪ Worker's awareness sessions on health and safety issues will be carried out regularly. | <ul style="list-style-type: none"> ▪ H&S Plan compliance records. ▪ H&S awareness sessions attendance records | All contractors on site | HSE, Site Engineer, Project Manager, Foreman |

| Joint Venture of SUMEC Complete Equipment & Engineering Co. Ltd and XJ Group Corporation | | | | | |
|--|---|---|---|---|--|
| Description of mitigation measures and implementation responsibility | | | | | |
| Construction, Operations, Decommissioning Phase | | | | | |
| | Issue/Impact/ Hazard | Mitigation Measures | Monitoring Indicators | Responsibility for Implementation | Responsibility for Monitoring |
| Social | | <ul style="list-style-type: none"> ▪ Awareness sessions to the communities and training of workers to mitigate potential community health and safety impacts ▪ Training security forces on proportional use of force and employment of unarmed security ▪ All individuals on site will use personal protective equipment (PPE). ▪ Adequate fire-fighting equipment will be provided on site. ▪ Adequate signage on site and in surrounding areas should be visible and properly maintained. ▪ Traffic control and speed limits will be observed. ▪ Occupational hazards should be marked on site and staff trained in hazard recognition. ▪ Regular sanitation of the site is maintained. | <ul style="list-style-type: none"> ▪ ESMP compliance records ▪ Visible traffic and speed signage | All contractors on site | HSE, Site Engineer, Project Manager, Foreman |
| | Health: Exposure to diseases and dangers | <ul style="list-style-type: none"> ▪ Use code of ethics, conduct, and good practices from GPL standards and guidelines ▪ Training, awareness, and education on the use of infection control measures in the workplace during the period of construction phase. ▪ Equip with appropriate equipment and materials to protect colleagues from the risk of exposure to infectious diseases and dangers. ▪ Disseminate information on occupational health and first aid training. | <ul style="list-style-type: none"> ▪ Compliance with the code of ethics ▪ Behaviors which facilitate unintentional injuries and violence, tobacco use, alcohol and drug use, ▪ Sexual behaviors related to pregnancy and diseases, ▪ Unhealthy dietary behaviors, and | The health and safety manual should comply with local laws. | HSE Officer |

| | | | | | |
|--|--|--|--|--|--|
| | | | <ul style="list-style-type: none"> Physical inactivity and being overweight | | |
|--|--|--|--|--|--|

Table 8: Disaster Risk Mitigation and Response Measures

| Joint Venture of SUMEC Complete Equipment & Engineering Co. Ltd and XJ Group Corporation | | | | | | | | |
|--|--|--|--|---|---------------------------------|---------------------------|---------------------------------|-----------------------------------|
| Description of mitigation measures and implementation responsibility | | | | | | | | |
| Construction, Operations, Decommissioning Phase | | | | | | | | |
| Hazard | Description of Measure | Baseline | Target | Indicator | Stage of Application of Measure | Priority (High, Med, Low) | Time Horizon (Short, Med, Long) | Responsibility (Entity or Person) |
| HAMPSHIRE | | | | | | | | |
| Flooding | Elevation of infrastructure above flood water surface level elevation (FWSE) | Establishment of FWSE datum at project site | All solar infrastructure installed above FWSE | Design clearly, identify FWSE, and provisions included for ground preparation | Design, Construction | High | Short-term | GPL Contractor |
| | Design and installation of internal and external drainage system to reduce adverse impact of flood | Drainage system designed as part of infrastructure design for project | Drainage system for part of project design scope | Design | Design | High | Short term | GPL Contractor |
| | Maintenance of internal and external drainage system through project life | Drainage system maintenance included in site operations and maintenance plan | All internal and external drains maintained to allow movement of water | Drain maintenance included as part of O&M plans for project | Design, O&M | High | Short-term | GPL Contractor |
| Damage to elements | Elevate solar panels and | Historical FWSE | Annual inspection of SPVS | Frequency of inspections | Construction | High | Long-term | Contractor |

| | electrical elements least 2.61m above ground level (20.55m GD) | | | | | | | |
|-----------|---|--|---|--|---------------------------------|---------------------------|---------------------------------|---------------------------------------|
| Hazard | Description of Measure | Baseline | Target | Indicator | Stage of Application of Measure | Priority (High, Med, Low) | Time Horizon (Short, Med, Long) | Responsibility (Entity or Person) |
| Windstorm | Installation of natural or artificial windbreakers upwind of project site | No windbreak facility exists at sites | Natural or artificial windbreak system installed at site to reduce the velocity of winds directly on the solar infrastructure | Wind breaker system adequately designed and installed | Design, Construction, O&M | Medium | Short | GPL Contractor |
| | Infrastructure design to eliminate wind induced damage | To be determined in EPC | Engineering design of infrastructure/material selection roust to withstand wind forces | Engineering design to consider wind forces on infrastructure | Design | High | Long-term | GPL Contractor |
| | Adequate anchoring of infrastructure to prevent uplift during wind event | No information on design available. Structures are supported by 9m piles which are driven 6 m into the ground with 3m remaining above ground. | Design give consideration for infrastructure anchoring for withstanding forces | Effect of wind force on infrastructure given consideration during engineering design of infrastructure; inspections of anchorage included as part of maintenance protocols | Design, Construction, O&M | High | Short-term | GPL Contractor |
| | Installation of smart monitoring and early | No disaster early warning system currently | Establish a form of early warning system for extreme weather event | Early warning system installed and | Design | High | Long-term | IDB GPL Hydrometeorol ogical |

| | warning system to alert for extreme weather event | exists in the region | | adequately functioning | | | | Department - Ministry of Agriculture CDC |
|-----------------|--|---|---|--------------------------------------|--------------------------------------|---------------------------|---------------------------------|--|
| Hazard | Description of Measure | Baseline | Target | Indicator | Stage of Application of Measure | Priority (High, Med, Low) | Time Horizon (Short, Med, Long) | Responsibility (Entity or Person) |
| PROSPECT | | | | | | | | |
| Flooding | All solar infrastructure (including access road, foundations, etc. to be above highest flood water level | Establishment of high flood water datum | No critical infrastructure installed below high flood level datum | Infrastructure above water datum | Design construction | High | Short term | GPL, Contractor |
| | Improved density of weather stations | Installation of a weather station and early warning bulletin alert system | 1 (estimated) | 1 AWS installed at site | Number of AWS installed | High | Long term | GPL |
| | Periodic review and update of existing erosion and flood assessments | 1 recent flood assessment report | Every 5 years | Frequency of update risk assessments | Maintenance operation | High | Long term | GPL |
| | Implement flood response procedures | Flood response procedures in place | Flood response procedures implemented in flooding | 1 flood response procedure per site | Construction, Operation, Maintenance | High | Longterm | GPL |
| | Placement and maintenance of grassed | 0 | Bimonthly | Frequency of inspections | Construction, Operation, Maintenance | High | Long term | Councils: NDC, RDC |

| | | | | | | | | |
|---|---|--|---|--|--|---|-----------|--|
| | surfaced area across the project site | | | | | | | |
| | Elevate solar panels at least 1m above design ground level (20.6m) | Historical FWSE | Annual inspection for settlement | Frequency of inspections | Design Construction | High | Long term | GPL Contractor |
| | Filling and compacting of project site and access roads to at least 18.1 GD elevation | Existing site conditions | Every 5 years | Frequency of inspections | Design Construction | High | Long term | GPL Contractor |
| | Test and update Emergency Response Plans | ERP now in place | Annually | Frequency of testing and updating of the ERP | Operations and Maintenance | High | Long term | GPL, Regional Disaster Committees, Guyana Fire Service, Police, etc. |
| Settlement of module mounting structure | Apply geotechnical recommendations for the site to guide foundation design | | Every 5 years/major flooding of site | Frequency of inspections | Design | Medium | Long term | Contractor |
| Corrosion of elements from brackish water contact | Use galvanised or stainless steel for corrosion resistance | | Annual inspection | Inspection for corrosion after flood event | Construction | High | Long term | Contractor |
| Windstorm | Wind breaker incorporated in design, Both natural and artificial | No consideration for wind breaker system | Wind breaker system considered and incorporated in design | Windbreaker design for sites where windstorm risks exist | Wind breaker system included in design | During design review, Frequent monitoring | Long term | GPL Contractor Technical Supervisory |

| | | | | | | | | |
|------------------|---|---|----------------------------------|--------------------------|--|----------------------------------|--|---|
| | infrastructure duly considered. Space utilization measure on site for critical infrastructure should consider impact of windstorm | | | | | During implementation | | Consultant of Works |
| Earthquake | Review Preparedness and Response Procedures | Procedures prepared | Review done once biannually | Review conducted | report on review | After implementation | Long term | GPL, CDC |
| Hazard | Description of Measure | Baseline | Target | Indicator | Stage of Application of Measure | Priority (High, Med, Low) | Time Horizon (Short, Med, Long) | Responsibility (Entity or Person) |
| TRAFALGAR | | | | | | | | |
| Flooding | All solar infrastructure (including access road, foundations, etc. to be above highest flood water level | No critical infrastructure installed below high flood level datum | Infrastructure above water datum | Design construction | High | Short term | GPL, Contractor | No critical infrastructure installed below high flood level datum |
| | Improved density of weather stations | Installation of a weather station and early warning bulletin alert system | 1 (estimated) | 1 AWS installed at site | Number of AWS installed | High | Long term | GPL |
| | Elevate solar panels at least 1.5 above | Historical FWSE | Annual inspection for settlement | Frequency of inspections | Design Construction | High | Long term | GPL Contractor |

| | | | | | | | | |
|-----------|--|--|--|--|--|--|-----------|---|
| | design ground level | | | | | | | |
| Flooding | Periodic review and update of existing erosion and flood assessments | 1 recent flood assessment report | Every 5 years | Frequency of update of risk assessments | Maintenance and Operation | High | Long term | GPL Contractor |
| | Implement flood response procedures | Implement response procedures in ESMP | Flood response procedures implement in flood | 1 flood response procedure per site | Construction Operation Maintenance | High | Long term | GPL Contractor |
| | Regular inspections and maintenance of surrounds drainage channels and sluice gates | Monthly inspections | Annual inspections | Frequency of inspections | Operation | High | Long term | GPL Contractor |
| | Test and update ERPs | ERP not in place | Annually | Frequency of testing and updating of the plan | Operation and Maintenance | High | Long term | GPL Contractor |
| Windstorm | Wind breaker incorporated in design Both natural and artificial infrastructure duly considered | No consideration for wind breaker system | Wind breaker systems considered and incorporated in design | Windbreaker design for sites where windstorm risks exist | Windbreaker system included in design | During design review Frequent monitoring During implementation | Long term | GPL Contractor Technical Supervisory Consultant of Works |
| | Space utilization measure on site for critical infrastructure should | | | | | | | |

| Hazard | Description of Measure | Baseline | Target | Indicator | Stage of Application of Measure | Priority (High, Med, Low) | Time Horizon (Short, Med, Long) | Responsibility (Entity or Person) |
|---------------------|---|---|---|---------------------------------------|--|---------------------------|---------------------------------|-----------------------------------|
| ONDERNEEMING | | | | | | | | |
| Flooding | All solar infrastructure (including access road, foundations, etc.) to be above highest flood water level | Establishment of high flood water datum | No critical infrastructure installed below high flood level datum | Infrastructure above high-water datum | Design Construction | High | Short term | GPL Contractor |
| | Placement and maintenance of grasses surfaces across the project site | Existing site vegetation | Bimonthly | Frequency of inspections | Construction Operation and Maintenance | High | Long term | Councils: NDC, RDC |
| | Elevate solar panels 1m above design (38m GD) | Historical FWSE | Annual inspection for settlement | Frequency of inspections | Design construction | High | Long term | GPL Contractor |
| | Filling depressed areas of site and grading towards established outfall | - | Every 5 years | Frequency of inspections | Design Construction | High | Long term | Contractor |
| | Implement flood response procedures | Flood response procedures in ESMP | Flood response procedures implemented in flooding | 1 flood response procedure per site | Construction Operation and Maintenance | High | Long term | GPL |

| Erosion of foundation in high intensity rainfall-runoff | Design internal drainage to limit velocity to 2m/s maximum | Site drain undeveloped | Annual inspection | Frequency of inspections | Design | High | Long term | Contractor |
|---|--|---|---|---------------------------------------|---------------------------------|---------------------------|---------------------------------|-----------------------------------|
| Settlement of module mounting structure | Apply geotechnical recommendations for the site to guide foundation design | | Every 5 years/major flooding of site | Frequency of inspections | Design | Medium | Longterm | Contractor |
| Hazard | Description of Measure | Baseline | Target | Indicator | Stage of Application of Measure | Priority (High, Med, Low) | Time Horizon (Short, Med, Long) | Responsibility (Entity or Person) |
| CHARITY | | | | | | | | |
| Flooding | All solar infrastructure including access road, foundations, etc. to be above highest flood water level. | Establishment of high flood water datum | No critical infrastructure installed below high flood level datum | Infrastructure above high-water datum | Design Construction | High | Short term | GPL Contractor |
| | Improved density of weather stations | Installation of a weather station and early warning bulletin alert system | 1 estimated | 1 AWS installed at site | Number of AWS installed | High | Long term | GPL |
| | Elevate solar panels at least 2.6m above design ground level (29.55m GD) | Historical FWSE | Annual inspection for settlement | frequency of inspections | Design Construction | high | long term | GPL Contractor |

| | | | | | | | | |
|----------------------------|--|---|---|---|--|------|------------|---|
| Flooding | Periodic review and update of existing erosion and flood assessments | 1 recent flood assessment report | Every 5 years | Frequency of update of risk assessments | Maintenance and Operation | High | Long term | GPL |
| | Implement flood response procedures | Flood response procedures in ERP | Flood response procedures implemented in flooding events | 1 flood response procedure on site | Construction Operation and Maintenance | High | Long term | GPL |
| | Regular inspections and maintenance of surrounding drainage channels and sluice gates | Monthly inspections | Annual inspections | Frequency of inspections | Operation | High | Long term | NDC, RDC (Regions 2,5,6,10) |
| | Test and update ERP | ERP not in place | Annually | Frequency of testing and updating of plan | Operation and Maintenance | High | Long term | GPL Regional Disaster Committees, Guyana Fire Service, Police, etc. |
| Flash flooding/ Erosion | Conduct a stormwater flood risk assessment based on the location and topographical features of the site. | Installation of surface water management system | All stormwater collected and effectively transferred to natural stormwater management systems | Designed stormwater management system based on local geophysical characteristics. | Maintenance | High | Short term | GPL Contractor |
| | Examine slopes, valleys, soil cover, | Identify catchment zones around project site. | Flood catchment zone determined | Vegetation control plan developed and implemented | Design Construction Maintenance | High | Short term | GPL Contractor |

| | | | | | | | | |
|--|--|--------------------|---|--|---|------|------------|----------------|
| | vegetation cover, catchment, stormwater drains, water bodies, etc. | | | | | | | |
| | No storm water moving uncontrolled across site | Site not developed | No uncontrolled stormwater runoff across project site | Site maintenance plan to incorporate stormwater management | Design Construction Operation and Maintenance | High | Short term | GPL Contractor |

Source: (GUYSOL - DRMP , 2023)

5.3 ESMP IMPLEMENTATION SCHEDULE AND REPORTING REQUIREMENTS

The Executing Agency/Project Owner/Project Developer ensures that the Contractor complies with the requirements outlined in the ESA and ESMP, Environmental Construction Permits and any other requirements. GPL's Health, Safety and Environmental Officer will coordinate with the Contractor to ensure that the latter develops and implements an effective environmental and social management system (ESMS) for the construction period. The Contractor shall be responsible for ensuring that its subcontractors and employees establish an ESMS to effectively implement the requirements of this CESMP.

The Monitoring, Environmental and Social Management and Communication Department in coordination with the Contractor's HSE Department will be responsible for communicating necessary information about the project to relevant stakeholders. Managing stakeholder's concerns and complaints will be done according to Grievance Redress Mechanism outlined by the IDB and GPL's Procedure for dealing with Environmental Complaints from members of the public (GPL-OSH-009) especially those regarding disturbances due to increased level of activity at the project site, noise, vehicular traffic, and presence of construction workers.

Appointed personnel with direct oversight and responsibility to implement the mitigation measures and monitoring programme must be designated. The designated personnel will coordinate with management to ensure environmental integrity and workers health and safety. The designated personnel will also work in coordination with the EPA, and Environmental and Health Officer to ensure compliance with the details of the EAMP and the laws of Guyana, where necessary.

The Monitoring Programme (Table 9) outlines the environmental parameters to be monitored during the operation of terminal. The primary monitoring activities are highlighted below:

- Air quality and particulate (dust) monitoring will include ensuring that the implemented dust suppression methods are effective and will be visual or the particulate concentrations measured. Monitoring will be continuous and conducted as needed by QA/QC and HSE Officers. Any complaints on blowing dust or nuisance dust will be recorded and investigated, and appropriate measures immediately taken to control dust from roads, concrete, rotten wood, or any other kind of dust source.
- Monitoring of waste from the project will include the preparation of inventories on types and quantities of solid and hazardous waste generated, and methods of collection, storage, and disposal.
- Health and safety monitoring will be undertaken weekly through the recording of incidents and accidents.
- Noise monitoring will be conducted by measuring noise levels at 15m from the source or property boundary as stipulated in the Environmental Permit to ensure compliance with the noise level standards established by the GNBS.

Table 9: Proposed monitoring programme to be implemented at each solar PV Farm

| Parameters | Responsibility | Frequency/ Duration | Location of Monitoring Points |
|---|--|---|---|
| Air Quality | HSE, QA/QC | Biannually | Boundaries and surrounding areas |
| a. Particulate Matter (PM _{2.5} , PM ₁₀) | | | |
| b. CO | | | |
| c. NO ₂ | | | |
| d. O ₃ | | | |
| e. SO ₂ | | | |
| f. CO | | | |
| Noise Levels | HSE Department | Quarterly | 15m (50 ft) from the source or property boundary (whichever is closer) |
| a. Decibels (dB) | | | |
| Surface Water Quality | HSE Department | Biannually (once in dry and once in wet season) | Boundaries and surrounding areas |
| a. pH | | | |
| b. Temperature | | | |
| c. Biological Oxygen Demand (BOD) | | | |
| d. Chemical Oxygen Demand (COD) | | | |
| e. Total Suspended Solid (TSS) | | | |
| f. Oil & Grease | | | |
| g. Total Dissolved Solid | | | |
| Aesthetics | HSE Department, QA/QC, all personnel on site | | Waste Disposal Containers for offices and housing, general area of the operation site |
| a. Visual | | | |
| b. Waste Management | HSE Department, QA/QC, all personnel on site | | Project area and compound |
| c. OH&S | | | |
| d. Site Inspection | | | |
| e. Health Inspection | | | |
| f. Documentation | HSE Department, QA/QC, all personnel on site | Annually | Data Filing and Records |
| g. Auditing | | | |
| h. Environmental Reports | HSE Department | Annually | On site and areas of influence |

5.3.1 Disaster Risk Management Plan

The overall responsibility for ensuring that the mitigation measures under this DRMP is implemented lies with the Project Execution Unit (PEU), Table 10.

Table 10: Responsibility Matrix for DRMP

| Task Bearer | Responsibility |
|--|---|
| PEU Project Manager Environmental and Social Specialist | Coordinate implementation of the Plan Monitor and revise Plan including conducting simulation exercises Facilitate specific DRMP training and awareness to the contractor, consultant, and related teams engaged in the works |
| Technical Supervisor of Works | Monitor and document the contractor’s compliance with all work specifications and implementation of the plan and report to the GPL |
| Contractor Project Manager Environmental and Social Specialist | On the ground implementation of the plan Ensure compliance with the contract clauses, recommendations, and mitigative measures detailed for the management of risks Training for staff and other workers |

The PEU will utilize the current framework (forms and templates) of the DRMP for the construction phase and proposed works. The Environmental and Social Safeguards Specialist will facilitate specific DRMP training and awareness to the contractor, consultant, and related teams engaged in the works. The training will utilize the GPL and IDB protocols for construction sites. Ultimately, GPL will have the final responsibility for implementation of the works, operations, and maintenance of the facility. This will include the implementation of the DRMP.

The GPL will engage a consulting firm to provide support for the design, installation, and supervision of the works. The consulting firm will function as a supervisor to document the contractor’s compliance with all work specifications and will report to the GPL. The consulting firm will engage the services of an expert for daily monitoring of compliance and reporting to the GPL including DRMP measures.

The Contractor would be required to have trained personnel who are experienced in implementing the DRMP mitigation measures as part of its team. The Contractor will be responsible for the on-ground implementation and ensuring compliance with the contract clauses, recommendations, and mitigative measures detailed for the management of risks.

Monitoring will include weekly meetings to determine site changes and environmental conditions, the adequacy of the mitigative measures, and the overall ability of the contractor to execute the works as specified and in a sustainable manner (GUYSOL - DRMP , 2023).

Contractor Responsibilities

Standard environmental and social-related matters including those related to the DRMP are developed and are to be appended to or incorporated into the works and shall remain enforced throughout the contract period. For purposes of cost estimation and budgeting, the Contractors should be aware of the existence of the DRMP mitigation measures and associated requirements and include cost items for such purposes in their proposals (GUYSOL - DRMP , 2023).

5.3.2 Capacity Building and Training

Environmental, Health and Safety Training

The Contractor will train employees with respect the environmental impacts, environmental plans and procedures relevant to the project. The training will educate staff on the occupational and environmental risks associated with the work. All staff employed will be trained in the following:

- General operation of the plant;
- Environmental management;
- Specific job roles and procedures;
- Occupational health and safety;
- Contingency plans and emergency procedures.

Training will include:

- Induction training on appointment;
- Specialist training (as required for specific job role);
- Refresher training, as required

In addition, environmental training will be extended by the HSE Department to onsite personnel. They will receive training in the following:

- Day-to-day monitoring activities;
- Collection and analysis of water quality samples;
- Industrial hygiene;
- Occupational health and safety;
- Emergency and contingency procedures.

5.4 SOCIAL AND COMMUNITY ENGAGEMENT

5.4.1 Consultation Plan

A stakeholder engagement consultation ensures that all stakeholders are adequately informed, consulted, and their feedback is considered. This Plan serves a guideline and may be adopted and tailored as needed per site and stakeholder requirements.

1. Identification of Stakeholders

Project Team: Engineers, Project Managers, And Site Supervisors

Company Management: Senior executives and decision-makers

Local Communities: Residents and local businesses near the project sites

Government Authorities: Regulatory bodies, local municipalities, and environmental agencies

Investors and Financiers: Banks, funding agencies, and investors

Suppliers and Contractors: Vendors providing materials and services

Non-Governmental Organizations (NGOs): Environmental and community advocacy groups

II. Stakeholder Mapping and Analysis

High Influence, High Interest: Engage closely (e.g., government authorities, investors)

High Influence, Low Interest: Keep satisfied (e.g., senior executives)

Low Influence, High Interest: Keep informed (e.g., local communities)

Low Influence, Low Interest: Monitor with minimal effort (e.g., distant NGOs)

III. Develop Engagement Strategies

Informative: Regular updates through newsletters, emails, and project websites

Consultative: Workshops, public meetings, and focus groups

Collaborative: Joint committees, advisory panels, and partnership agreements

Empowerment: Decision-making roles for key stakeholders in relevant areas

IV. Engagement Activities

Kick-off Meetings: Introductory meetings with key stakeholders to present the project and its objectives

Stakeholder Workshops: Conduct workshops to gather initial feedback and understand stakeholder concerns

V. Continuous Engagement

Regular Updates: Newsletters, progress reports, emails, text messages,

Community Meetings: Engage with local communities to provide updates and address concerns through various mediums every biannually.

Consultation Sessions: Periodic sessions with regulatory authorities and NGOs to ensure compliance and address environmental and social impacts

VI. Feedback and Reporting

Surveys and Questionnaires: Periodic surveys to gather stakeholder feedback

Suggestion Boxes: Physical or digital suggestion boxes for ongoing input

Regular Reports: Detailed reports on stakeholder engagement activities and outcomes

Issue Resolution Logs: Maintain logs of issues raised and how they were addressed

VII. Timeline and Responsibilities

Pre-Construction: Initial engagement and consultation activities

Construction Phase: Ongoing engagement and regular updates

Post-Construction: Final consultations and feedback sessions

Project Manager: Oversee the entire stakeholder engagement process

HSE Department: Primary contact for local communities and NGOs.

Communication and HSE Department: Handle all communications and reporting.

5.4.2 Grievance Redress Mechanism (GRM)

Implementing a robust GRM as part of the CESMP for solar PV farms ensures that grievances are addressed effectively, maintaining positive community relations and ensuring project sustainability. By adhering to these guidelines, contractors can manage and mitigate potential conflicts, leading to smoother project execution and operation.

Objectives of a GRM

- **Address Complaints Promptly:** Ensure timely and effective resolution of grievances from communities and workers.
- **Enhance Trust:** Build trust and maintain positive relationships between the project, local communities, and other stakeholders.
- **Improve Project Outcomes:** Identify and address issues early to avoid escalation and improve project management.

Principles

- The GRM must be easily accessible to all stakeholders.
- Maintain transparency in the process of handling grievances.
- All grievances must be treated fairly and impartially.
- Protect the confidentiality of complainants to the extent possible.
- Provide timely responses and resolutions to grievances.

Steps in the GRM Process

Step 1: Grievance Submission

- Allow grievances to be submitted through various channels such as in-person, by phone, email, online forms, and suggestion boxes.
- Permit anonymous complaints to encourage more stakeholders to voice concerns.

Step 2: Grievance Acknowledgment

- Acknowledge receipt of the grievance within a specified timeframe (e.g., 2-3 days).
- Log the grievance in a grievance register with details of the complainant (if not anonymous), date, nature of the complaint, and any other relevant information.

Step 3: Grievance Assessment and Classification

- Initially Assess the grievance to determine its validity and classify it based on its nature and severity.
- Then categorize grievances (e.g., environmental, social, health and safety, labor-related) for appropriate handling.

Step 4: Investigation and Resolution

- Conduct a thorough investigation of the grievance, involving relevant departments or external experts if necessary.
- Develop a resolution proposal and discuss it with the complainant to seek their input and agreement.
- Implement the agreed resolution and take corrective actions to prevent recurrence.

Step 5: Feedback to Complainant

- i. Communicate the resolution to the complainant and ensure they are satisfied with the outcome.
- ii. Document the resolution process and outcome in the grievance register.

Step 6: Appeal Process

- i. Provide a mechanism for complainants to appeal if they are not satisfied with the initial resolution.
- ii. Involve an independent panel or higher management for reviewing and addressing appeals.

Step 7: Monitoring and Reporting

- i. Monitor the effectiveness of the grievance redress process through regular reviews and audits.
- ii. Report grievance statistics and outcomes in regular project reports to stakeholders and regulatory bodies.

Institutional Responsibilities

- i. Designate a Grievance Officer responsible for managing the GRM, handling grievances, and ensuring timely resolution.
- ii. Project Manager: Oversee the overall implementation of the GRM and ensure that grievances are addressed as part of the project's ESMP.
- iii. Onsite personnel: Ensure all workers and subcontractors are aware of the GRM and know how to use it.
- iv. Appointed Community Liaison Officer: Act as a point of contact between the project and the local community, facilitating communication and grievance submission.
- v. Communication and Training
- vi. Awareness: Inform stakeholders about the GRM and how to access it.
- vii. Training Programs: Provide training for project staff, contractors, and community representatives on the GRM process and their roles in it.

5.5 DOCUMENTATION AND RECORD KEEPING

The objective of socio-environmental monitoring is to verify the timely and effective implementation of the CESMP, and any other safeguards instruments agreed for the Project. In addition, it should identify changes in the socio-environmental management measures and, if necessary, require the contractor to supplement or improve the effectiveness of the agreed measures. Finally, it provides technical guidance to resolve problems related to socio-environmental compliance or performance. To adequately monitor the socio-environmental and occupational health and safety management of construction works, the supervision process must include the following responsibilities, among others:

- Verify compliance with ESMPs within agreed timeframes.
- Ensure that all personnel are aware of their roles and responsibilities and maintain regular interaction to ensure that responsibilities are carried out properly.
- Conduct field visits to monitor environmental and social issues.
- Conduct occupational health and safety assessments and audits, including accident and incident reports.

- Notify the Executing Agency of any significant non-compliance with socio-environmental requirements.
- Verify that there is adequate grievance mechanism and report on stakeholder complaints and concerns.
- Verify that the occupational health and safety policy is adequate and worker safety provisions are implemented in all labour contracts.

5.5.1 Documentation of Information

To facilitate environmentally sound practices throughout the construction phase of the project, the following Regulations must be established by the Contractor as mandated by the regulatory bodies (EPA, GPL, IDB):

➤ *Air quality*

Air quality must be monitored as needed with sample points within and around the project area, see Table 7 for parameters which are based on the WHO AGQs.

➤ *Water quality*

Water quality must be monitored, reported and submitted annually. Discharges into the environment shall be in accordance with the GNBS Interim Guidelines for Industrial Effluent Discharge into the Environment for inclusion in the Environmental Annual Report.

➤ *Noise Quality*

Noise emissions shall be monitored to determine the compliance with the GNBS Guidelines for Noise Emissions into the Environment for inclusion in the Environmental Annual Report.

➤ *Hazardous Materials/Waste Management*

Hazardous Waste Management Report detailing:

- Identification information of the project,
- Type and quantities of hazardous waste generated, if any
- Data concerning off-site shipments of waste,
- Any applied treatment standards,
- A summary of any accidents that may have occurred and any action taken
- Any waste minimization efforts undertaken by the generator
- A pollution prevention plan for the project
- Any other matter the EPA may require

➤ *Emergency Preparedness Plan*

- The accident prevention procedures
- First person response
- Notification procedures
- Location of clean-up equipment
- And analysis of potential accident and responses
- Material safety data sheets for all materials could be spilled.

➤ *Environmental Annual Report*

- This report details the progress of the operation and compliance with the conditions under which this Permit was granted on or before March 31 of each year.

5.5.2 Report Management

- *Incident/ Accident Reports*

An incident report is a report where all the details of a specific incident is recorded. This report should be submitted to the Foreman, Accident Prevention and the General Office for further action and investigation on the specific incident. It also defines steps for solutions and improvement. The Contractor will make all efforts to safeguard the health and safety of workers with the provision of personnel protective gears, and employee training in HSE awareness. Hence, to maintain a safe and healthy work environment at the operation, a thorough accident investigation will be undertaken, immediately after an incident or accident to ascertain the cause, risk and to recommend and implement corrective actions and/ preventative measures. The individual(s) discovering an incident/accident or fault must report the matter to the Superintendent immediately. The relevant officer will gather and record the details about the matter/ occurrence. This report will be submitted for review and the necessary corrective action implemented with the assistance from relevant personnel.

- *Complaint Reports*

Any complaint made against the service/ actions of the staff will be comprehensively documented by the Site Supervisor on the ground and reported to the Plant Manager within 8 hours. All complaints received must then be acknowledged within five (5) working days. An investigation of the complaint is to be undertaken by the appropriate officers to analyse and recommend actions to resolve the complaint. The appropriate department will then be required to take the necessary actions recommended.

A response must be provided to the complainant within 30 working days on the outcome of their complaint and the action taken. If the complaint is still pending after 30 working days, feedback must be provided to the complainant at 15-day intervals until resolved. If the complaint cannot be resolved internally it must be referred to an external agency.

- *Disaster Risk*

| Disaster Phase | Actions |
|------------------|---|
| Normal Operation | Business as usual |
| | Review disaster plans |
| | Monitor disaster response supplies and equipment |
| | Conduct simulation response exercises a |
| Alert | Activate disaster response committee |
| | Alert and inform all staff |
| | Liaise with REOC and NDC as applicable |
| | Liaise and monitor Hydromet and other agencies' reports |

| | |
|-------------|---|
| Preparation | Alert and inform all line departments Mobilize resources Request assistance from REOWC if needed Liaise with the REOC and NDC as applicable Liaise and monitor Hydromet and other agencies' reports |
|-------------|---|

Source: (GUYSOL - DRMP , 2023)

Supervision, Monitoring and Reporting of DRMP

It is ultimately the responsibility of the PEU to ensure that the measures in the DRMP are being followed by the Contractor(s) and site workers. During the construction phase, environmental and social monitoring will be carried out by the GPL. A Supervision Consultant will be engaged to provide oversight on technical aspects, and this should also include risk reduction. In addition, the Contractor is required to provide regular reports to the GPL which should include reports on the DRMP implementation (GUYSOL - DRMP , 2023).

- *Monitoring*

Environmental monitoring is an important feature of the project execution. Monitoring is key to knowing whether the quality of the environment is maintained within the set parameter threshold or has degraded and needs to be addressed. Environmental monitoring will provide the basis for making informed decisions about the quality of the environment; measure and evaluate the environmental performance, assess compliance with legal requirements and ensure the health, well-being of all stakeholders. Environmental parameter tests will be conducted in accordance with local standards and guidelines by the HSE Department within, and around the project sites through the construction phase. Data measured and recorded will be analysed and evaluated by a certified laboratory where necessary and followed by an assessment report for submission to the relevant regulatory bodies.

- *Inspections (Audits)*

Effective safety and health inspections would be one of the most important incident prevention objectives of the solar PV Farms. The main purpose of the audit is to reveal potential dangers, confirm smooth working operation and ensure compliance of the organization's environmental, occupational safety and health. Health, Environment and Safety inspections will be conducted based on scheduled and unscheduled inspections times. Upon the completion of the scheduled HSE inspections, non-compliance issues discovered will be recorded and submitted to the Project Manager. These non-conformities represent potential breaches or a need for improvement. The source of the non-conformity will be investigated, if needed, followed by recommendation of appropriate corrective and/ preventative measures and lastly, adoption. After the implementation of the appropriate corrective/ preventative measure, qualified onsite personnel shall verify confirmation of its effectiveness.

- *Annual Reporting*

The Contractor will prepare an Environmental Annual Report, which will provide a record of any changes in the baseline conditions including air, water and noise quality. It will also include any monthly records of stakeholder engagements and grievances, environmental compliances, incidents, enhancements and inspections within the period of construction. This information will be made available to the Executing Agency upon request.

5.5.3 Mitigation Costs

The estimated costs budget for the implementation of the monitoring plan and mitigation measures are outlined in Table 8 below:

Table 11: Monitoring and Mitigation Costs

| Activity | Total estimated cost (G\$) |
|--|-----------------------------------|
| Training | Internal Expenditure |
| Environmental & Occupational Health and Safety | Internal Expenditure |
| Monitoring & Inspection | Internal Expenditure |
| Air Quality | \$20,000 |
| Noise Levels | \$20,000 |
| Water Quality | \$252000 |
| Aesthetics, Occupational Health and Safety | Internal Expenditure |
| Documentation | Internal Expenditure |
| Mitigation Measures | Internal Expenditure |
| Physical mitigation design structures for potential disaster risks | Internal Expenditure |
| Socialization of the DRMP | Internal Expenditure |
| Emergency Response Equipment | Internal Expenditure |
| Monitoring Plan | TBD |
| Mock Emergency Response Exercises | Internal Expenditure |

5.5.4 Proposed ESMP Monitoring Checklist

Table 12: ESMP Monitoring Checklist

| Monitoring Activities | Triggering Indicators for Corrective measures | Evaluation of compliance to proposed measures | Comments |
|--|--|---|----------|
| AIR QUALITY | | | |
| <ul style="list-style-type: none"> ▪ Noise and air quality ▪ Complaints register | <ul style="list-style-type: none"> ▪ Noise and PM levels frequently and above recommended limits (90 dB <p>During construction: Limits: 90 dB during the daytime (06:00 h – 18:00h)</p> <ul style="list-style-type: none"> ▪ >5 daily complaints related to air quality and noise | <ul style="list-style-type: none"> <input type="checkbox"/> Suppress dust from construction and increased vehicular traffic by sprinkling water. <input type="checkbox"/> Consider wind direction when stockpiling construction materials. Orientation shall avoid downwind residences or sensitive locations. <input type="checkbox"/> Covering of trucks to avoid spillage <input type="checkbox"/> Speed control signage, to reduce dust generation <input type="checkbox"/> Regular maintenance of vehicles and on-site construction equipment <input type="checkbox"/> Use of padding/noise isolators or enclosure for construction noise generating machines. <input type="checkbox"/> Fixed noise sources or activities to be carried out away from site boundaries, particularly boundaries close to sensitive environments. <input type="checkbox"/> Adequate maintenance of construction vehicles and machinery. <input type="checkbox"/> Use of ear plugs or earmuffs for specific activities by workers. <input type="checkbox"/> Stakeholders' consultation (immediate surroundings of site) to plan activities accordingly. | |

| Monitoring Activities | Triggering Indicators for Corrective measures | Evaluation of compliance to proposed measures | Comments |
|---|--|---|---|
| SOIL | | | |
| <ul style="list-style-type: none"> ▪ Observation of soil conditions at the site ▪ Oil/fuel spills records verification. | <ul style="list-style-type: none"> ▪ Water pooling at site. ▪ Soil subsidence close to water ways. ▪ Evidence of soil contamination at the site. ▪ Reported oil/fuel spills incidents. | <ul style="list-style-type: none"> <input type="checkbox"/> Adequate drainage will be developed for the site. <input type="checkbox"/> Adequate disposal of waste materials. <input type="checkbox"/> Provision of spill kits, if needed. <input type="checkbox"/> Construction vehicles and machinery will be serviced regularly and off-site or at impervious surfaces to avoid soil contamination due to oil spills. | |
| WASTE MANAGEMENT | | | |
| <ul style="list-style-type: none"> ▪ Verification of site order and cleanliness, including waterways. ▪ Complaints register verification. ▪ Solid waste and septage collection contract verification. ▪ Verification of number of available garbage bins at site. ▪ Verification of availability and cleanliness of temporary sanitary facilities at site. | <ul style="list-style-type: none"> ▪ Existence of compliance with regards solid waste management. ▪ Site conditions not orderly or clean. ▪ Solid waste polluting waterways. ▪ Evidence of mismanagement of septage/temporary sanitary facilities. | <ul style="list-style-type: none"> <input type="checkbox"/> All waste generated on site will be collected by an approved local contractor. <input type="checkbox"/> Waste will be disposed of at the landfill. Local authorities will be consulted to ensure adequate coordination for the reception of construction waste. <input type="checkbox"/> The site will be provided with an adequate number of bins for the disposal of domestic waste. <input type="checkbox"/> Designate an area for storage of storage of fuel, used oil, washing detergents, sanitisers and other hazardous materials. <input type="checkbox"/> Burning of waste on-site is strictly prohibited. <input type="checkbox"/> Adequate temporary sanitary facilities will be provided for workers on-site. <input type="checkbox"/> Construction materials will be located at least 5m away from water ways and canals whenever possible. | <ul style="list-style-type: none"> ▪ ESMP compliance records ▪ Existence of temporary sanitary facilities |

| Monitoring Activities | Triggering Indicators for Corrective measures | Evaluation of compliance to proposed measures | Comments |
|--|--|--|----------|
| BIODIVERSITY CONTROL | | | |
| <ul style="list-style-type: none"> ▪ Complaints register verification. ▪ Animal mortality reports. ▪ Visual verification of area. | <ul style="list-style-type: none"> ▪ Visual evidence of increased mortalities. ▪ Visual evidence of disturbances in the natural environment. ▪ Public complaints/grievances. | <ul style="list-style-type: none"> <input type="checkbox"/> Workers' activities will be monitored in sensitive areas e.g., project site - Onderneeming. <input type="checkbox"/> Dumping of solid waste or other disturbance to the project areas is prohibited. | |
| SERVICES AND TRAFFIC CONTROL | | | |
| <ul style="list-style-type: none"> ▪ Complaints register verification. ▪ Visual verification on site. ▪ Service disruption reports. ▪ Consultation minutes verification. ▪ Project execution schedule | <ul style="list-style-type: none"> ▪ Public complaints with regards disruption of services and traffic are evident in the complaints register. ▪ Public announcements are not designed and distributed on time. ▪ Adequate signalling is not present on site. | <ul style="list-style-type: none"> <input type="checkbox"/> Construction activities should be planned in a way to minimize service interruptions. <input type="checkbox"/> Whenever service interruption is unavoidable, timely advisory should be issued to the affected areas through relevant communication means. <input type="checkbox"/> Unavoidable disruption of services should be planned in consultation with relevant stakeholders to minimize negative effects on economic activities. <input type="checkbox"/> Working hours should consider sensitive activities conducted in nearby locations (i.e., church gatherings). <input type="checkbox"/> Movement of construction vehicles or heavy machinery should be avoided during rush hours. <input type="checkbox"/> Night work should be considered, when possible, in consultation with relevant stakeholders. <input type="checkbox"/> Timely public advisory with regards road closures. <input type="checkbox"/> Identification of alternative routes to divert traffic. <input type="checkbox"/> Adequate signage informing road closures and alternative routes. | |

| Monitoring Activities | Triggering Indicators for Corrective measures | Evaluation of compliance to proposed measures | Comments |
|--|---|---|--|
| OCCUPATIONAL HAZARDS AND PUBLIC SAFETY | | | |
| <ul style="list-style-type: none"> ▪ Visual verification of site. ▪ Verification of compliance reports. ▪ Verification of reported incidents. | <ul style="list-style-type: none"> ▪ High number of recorded non-compliances. ▪ Awareness H&S sessions are not conducted. ▪ Lack of adequate signalling. ▪ Frequent incidents reported. ▪ Frequent non-compliances reported. | <ul style="list-style-type: none"> <input type="checkbox"/> Health and Safety Plan will be implemented by personnel on site. <input type="checkbox"/> Workers' awareness sessions on health and safety issues will be carried out regularly. <input type="checkbox"/> All persons on site will use personal protective equipment (PPE). <input type="checkbox"/> Adequate fire-fighting equipment will be provided on site. <input type="checkbox"/> Adequate signage on site and in surrounding areas should be visible and properly maintained. <input type="checkbox"/> Traffic control and speed limits will be observed. <input type="checkbox"/> Occupational hazards should be marked on site and staff trained on hazard recognition. <input type="checkbox"/> Cleanliness of the site will be always maintained. | <ul style="list-style-type: none"> ▪ H&S Plan compliance records. ▪ H&S awareness sessions attendance records. ▪ Site emergency response and Fire Safety plans developed and implemented. ▪ ESMP compliance records. ▪ Visible traffic and speed signage. ▪ Number of accidents. |

Table 13: Disaster Risk Mitigation and Response Measures

| Hazard | Description of the measure | Baseline | Target | Indicator | Means of Verification | Frequency | Responsibility |
|----------|--|--|---|---|--|----------------------|-----------------|
| Flooding | Review engineering design to ensure flood datum is incorporated and taken into | No flood datum established for project sites | Flood datum level establish at each site prior to design and construction | Establishment of flood datum mark at each construction site | Permanent and visible mark identifying flood datum level | Once (before design) | GPL, Contractor |

| | | | | | | | |
|------------------------|---|---------------------------------------|---|---|--|--|--|
| | consideration during design; All primary and second project infrastructure design above flood datum level | No infrastructure installed on sites | All primary and secondary infrastructure installed above the flood datum level. | Design incorporated flood datum level. | Design review, Construction, Supervision and monitoring | During design review Monthly during construction | GPL, Contractor, Technical Supervisor of Works |
| Flash Flooding/Erosion | An assessment of factors affecting storm water management on site. Design of adequate stormwater water management on site. Review and monitoring system to reduce soil erosion due to surface water runoff. | No site drainage assessment completed | Stormwater management assessment completed prior to initiation of project design Stormwater management system included as part of infrastructure design. Soil erosion system incorporated in design | Assessment completed Design including stormwater management system. Erosion and vegetation control plans. | Review of report Design review Erosion and vegetation control plan developed | Before design committee During design review Construction progress monitoring During design review At construction commencement Frequent monitoring during construction | |

| | | | | | | | |
|-----------|---|---|--|--|---------------------------------------|--|--|
| | | | | | | | |
| Windstorm | Windbreakers incorporated in design (natural and artificial infrastructure) Spatial considerations for critical infrastructure should consider impact of windstorm | No consideration for windbreaker system | Windbreaker system considered and incorporated into design | Windbreaker design for sites where windstorm risks exist | Windbreaker system included in design | During design review Frequent monitoring During implementation | GPL, Contractor, Technical Supervisor of Works |

Table 14: Frequency and duration of management actions

| Environmental Attribute | Schedule | Parameters | Location | Frequency | Method |
|--------------------------------|----------------------------------|--|---|------------------------------------|-----------------------------------|
| Air Quality | Construction | PM ₁₀ , PM _{2.5} , O ₃ , NO ₂ , SO ₂ , CO | Midpoint and points at boundaries of the site | Monthly for construction phase | Portable air monitoring equipment |
| Noise | Construction | Decibels | 15m from the source of project boundary | Monthly for the construction phase | Portable sound level equipment |
| Hazardous waste | Construction and operation phase | Quantities (kg, gal, ltr, each) | Storage areas | Annually | Record of estimated use |
| Solid waste | Construction and operation phase | Cleared bins | Waste bins, disposal sites and onsite | Weekly | Good housekeeping record |
| Wildlife | Construction and operation phase | Number of wildlife sightings recorded | On site and within proximity to site | On observation | Biodiversity Observance List |

5.6 LABOUR ASSESSMENT

The joint venture between SUMEC Complete Equipment & Engineering Co Ltd and XJ Group Corporation, or "JV of SUMEC-XJ Group," included a labour assessment to identify measures to assess, prevent, mitigate, and continuously monitor any risks to labour and working conditions for workers directly engaged by the, i.e. contractors, subcontractors, and primary suppliers of solar panels.

To manage all HR matters, including advising the Project Manager on all HR regulations and labour laws, a Human Resource Manager would be hired through the joint venture of the SUMEC-XJ Group. SUMEC-XJ Group's JV will abide by Articles 22, 40, 140, and 147 of the Guyana Constitution and will act to access, prevent, ameliorate, and continuously monitor the working and labour circumstances based on Statutory Laws, Common Laws, and Customs and more critically, laws affecting employment relationships using the primary labour laws listed below. i.e.

1. Labour Act, Chapter 98:01 Act No. 2 of 1942
2. Termination of Employment and Severance Pay Act, No. 19 of 1997
3. Employment of Young Persons and Children Act No. 14 of 1938
4. The Holiday with Pay Act No. 3 of 1952 repealed and re-enacted in 1995 Act No. 6 of 1995.
5. Occupational Safety and Health Act, No 32 of 1997.

As stipulated the above laws set out minimum conditions of service. Further the Contract of Employment for JV of SUMEC-XJ Group employees, Sub-Contractor would include the following:

- 1) Probation Period
- 2) Severance Payment
- 3) Working time and rest time
- 4) Hours of work
- 5) Overtime payment
- 6) Public Holidays
- 7) Maternity Leave
- 8) Minimum age and protection of young workers
- 9) Minimum wages

Labour Laws

JV of SUMEC-XJ Group shall comply with all the relevant labour Laws applicable to its Personnel, including Laws relating to their employment, health, safety, welfare, immigration, and emigration, and shall allow them all their legal rights.

JV of SUMEC-XJ Group shall always during the progress of the Contract use its best endeavours to prevent any unlawful, riotous or disorderly conduct or behaviour by Section VII. General Conditions of Contract (CGC) 3-168 or amongst its employees and the labour of its Subcontractors.

JV of SUMEC-XJ Group shall, in all dealings with its labour and the labour of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs and all local laws and regulations pertaining to the employment of labour.

Rates of Wages and Conditions of Labour

JV of SUMEC-XJ Group shall pay rates of wages, and observe conditions of labour, which are not lower than those established for the trade or industry where the work is conducted. If no established rates or conditions are applicable, JV of SUMEC-XJ Group shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by Employers whose trade or industry is like that of the JV of SUMEC-XJ Group. JV of SUMEC-XJ Group shall inform the JV of SUMEC-XJ Group's Personnel about their liability to pay personal income taxes and remittances to the National Insurance Scheme (NIS) in the Country in respect of such of their salaries, wages and allowances as are chargeable under the Laws for the time being in force, and the JV of SUMEC-XJ Group shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

Health and Safety

JV of SUMEC-XJ Group shall always take all reasonable precautions to maintain the health and safety of the JV of SUMEC-XJ Group's Personnel. In collaboration with local health authorities, the JV of SUMEC-XJ Group and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

JV of SUMEC-XJ Group shall send to the Project Manager, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Project Manager may reasonably require.

The Occupational Safety and Health Act, No. 99:06, mandates that accidents be reported to the Ministry of Labor via the first and second schedules.

Fatal accidents are to be reported to the GPL and IDB within 24 hours of occurring.

General Conditions of Contract (CGC) 3-170

Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labour (including all the JV of SUMEC-XJ Group 's employees, all Sub-Contractors and Employer 's and Project Manager's' employees, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behaviour with respect to of Sexually Transmitted Diseases (STD)—or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular; (ii) provide male or female condoms for all Site staff and labour as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counselling and to a dedicated national STI and HIV/AIDS program, (unless otherwise agreed) of all Site staff and labour.

The Contractor shall include in the program to be submitted for the execution of the Facilities under Sub clause 18.2.

Payment to the Contractor for preparation and implementation this program shall not exceed the Provisional Sum dedicated for this purpose.

Additionally, JV of SUMEC-XJ Group would address the following according to its contractual obligations;

- a) Funeral Arrangements
- b) Records of Contractor's Personnel
- c) Supply of Water
- d) Measures against Insect and Pest Nuisance
- e) Alcoholic Liquor or Drugs
- f) Arms and Ammunition
- g) Prohibition of All Forms of Forced or Compulsory Labour
- h) Prohibition of Harmful Child Labor Section VII. General Conditions of Contract (CGC) 3-172

The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

Site Regulations and Safety

The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employer's approval, which approval shall not be unreasonably withheld.

5.7 EMERGENCY RESPONSE PLAN

5.7.1 GENERAL EMERGENCIES

The Emergency Response Plan has been prepared to provide employees at the PV plants for the proposed solar PV farms at Prospect, Trafalgar, Hampshire, Onderneeming and Charity with the useful information to respond to potential emergency situations in an expedient and safe manner to prevent harm/impairment to employees, residents, or the natural environment. This plan provides response procedures to incidents that may be encountered during operations at the PV Plants.

The procedures are designed 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 PV 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 the PV Plant 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
- Incident Reporting Formats

GPL has developed a policy for occupational, health and safety matters, which is relevant also for the execution of the proposed project and the Emergency Response Plan (ERP). GPL's Policy is included in this report to provide guidance for the implementation of the proposed ESMP and ERP.

**GUYANA POWER AND LIGHT INC.
OCCUPATIONAL SAFETY & HEALTH POLICY**

The following policy statement reflects the commitment of the Company to the adoption of proactive risk assessment and safety management and principles and practices in all aspects of its operations. This includes activities in its Head Office, in the content of studies and proposals for clients and in the management of premises and projects within the company.

IT IS THE POLICY OF GUYANA POWER AND LIGHT Inc. in so far as is reasonably practicable, and in consultation with its employees and customers:

1. To apply safe working procedures and practices and to act in conformity with the OCCUPATIONAL SAFETY AND HEALTH ACT No.32 OF 1997.
2. To create and maintain a working environment having adequate facilities and arrangements for the safety, health and welfare for its customers.
3. To provide safe means of entry and exit and to maintain premises, plants, equipment and work systems that are safe and free from health risk.
4. To make suitable arrangements concerning the safe use, handling, storage and transport of articles and substances.
5. To provide such information, instructions, training and supervision as may be necessary to protect the safety and health of employees.
6. To provide such facilities, equipment and staff as may be necessary to deal with accidents and emergencies.
7. To encourage and promote co-operation between management and employees on all matters relating to safety and health at work, including establishing such safety committees as appropriate to oversee safety matters at each location.
8. To continuously strive to attain improvement by utilizing measurable safety performance indicators, with the goal of Zero Lost Time Accidents.
9. To subscribe to and participate in the activities of international, national and local agencies and associations promoting safety awareness and risk management.
10. To monitor the progress of Safety and Health and matters on all locations.

The following GPL Occupational, Health and Safety Procedures are relevant for this ERP:

- Procedure for Industrial Accident Reporting, Recording and Investigation - (GPL-OSH-002) – April 2018.
- Procedure for conducting fire equipment audit at Guyana Power and Light Incorporated work locations – (GPL-OSH-003) – Revised April 2018.
- Procedure for Occupational Safety and Health Inspection at Guyana Power and Light Incorporated (GPL) worksites – (GPL-OSH-004) – Revised April 2018.
- Procedure for Evacuation in The Event of a Fire/ Bomb Scare or Other Emergency at Guyana Power and Light Incorporated (GPL) Work Locations – (GPL-OSH-005) – Revised April 2018.
- Procedure for corrective action to deal with Environmental Incidents and Non – Conformities – (GPL-OSH-007) – January 2018.
- Procedure for dealing with Environmental Complaints from members of the public – (GPL-OSH-009) – Revised January 2018.
- Procedure for Handling Oil Spills – (GPL-OSH-010) – Revised January 2018.

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 well beyond the individual or the operation involved.

Identification of an Environmental Emergency

The UNEP's Governing Council, defined an environmental emergency 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
6. Minor and major accidents

Authority of Control

The Manager of the substation in each location 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.

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 PV Plant 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 nearest clinic or hospital will be alerted and the Manager will arrange transportation to the hospital, in case of specialized medical attention the Georgetown Public Hospital will be alerted when, however the closest hospital within the Region will be prioritised.
- 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 PV Plant 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.

Internal and External Emergency Contact Details

To ensure a safe work environment for all employees and visitors of the PV Plants, GPL will disseminate and post on the notice boards at the security entrance of the plant, 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 TPC'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:

Emergency Equipment

The GPL will have several key equipment on site that will be utilised in the event of an emergency, this equipment are fire extinguishers, spill kits and first aid kits, Table 12. Incident response contacts and telephone numbers, both on-site and off-site, are presented in Table 15 to facilitate a rapid response to incidents.

Table 15: Emergency Contact Information

| Organization | Telephone Number |
|--|---|
| Georgetown | |
| GPL Main Office | (592) 231 4144 |
| CDC | 226-1114, 226-0066 |
| GPL Region 2 - Anna Regina | (592) 771 4391 |
| Georgetown Public Hospital | (592) 227 8241 |
| Emergency Fire Station | 912 |
| Environmental Protection Agency | (592) 225-5467-69, 225-5471-72, 225-6044/48, 225-0506 |
| Guyana Police Force | (592) 227-2128 |
| Air Services Ltd | (592) 222-4368 |
| Emergency Fire Station | 912 |
| Prospect, Trafalgar, Hampshire | |
| Police Station | TBD |
| EPA | 337-2201 |
| Fire Station | 333-2556 |
| Kilcoy/ Hampshire NDC - Hampshire | 322-3147 |
| Canefield/Enterprise NDC - Prospect | 326-0575 |
| Union/Naarstigheid - Trafalgar | 232-0045 |
| Regional Democratic Council 6 | 333-6121 |
| GPL Region 5 – Corriverton, Corentyne | (592) 339 2228 |
| Commercial Office, New Amsterdam | (592) 333-2716, 333-3137 |
| GPL Region 5 – Corriverton, Corentyne | (592) 339 2228 |
| New Amsterdam Hospital | (592) 333 2381 |
| GPL Prospect (Prospect Village)/ Mr. Oswald Benn (Plant Engineer) | (592) 333 2186 (592) 624 2026 |
| Onderneeming and Charity | |
| Police Station | 771-4142 |
| Fire Station | 771-5261, 771-5347 |
| Annadale / Riverstown NDC | 774-4302 |
| Charity District Hospital | (592) 771 4243 |

Roles

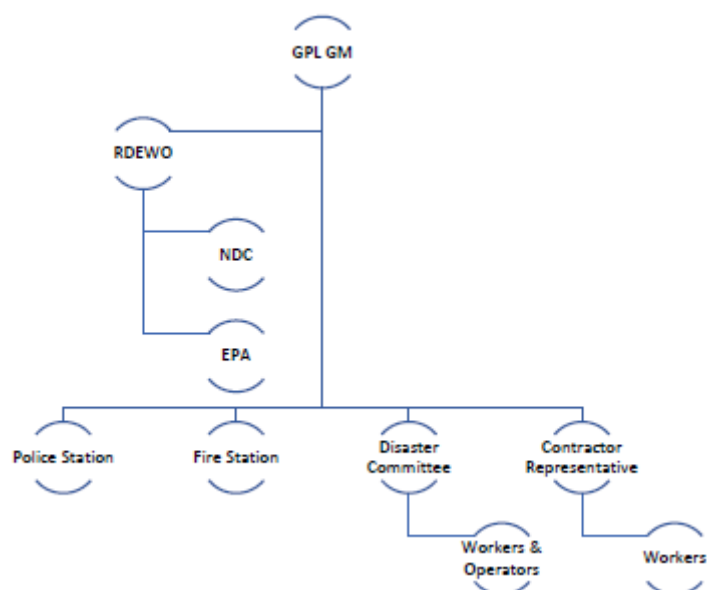


Figure 18: Responsibility Flow Chart

Accepted Facts

Disaster results in catastrophic damages to property and personnel casualties. The disaster will occur any moment without any warning. Emergency response may not always be as prompt as expected. Emergency response actions may continue for a prolonged period. Post emergency status may be extremely complicated.

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 well beyond the individual or the operation involved.

Authority of Control

The Manager of the substation in each location 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, 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 hazard incident.

Occupational Health and Safety Manual

Emergency Equipment include key equipment on site that are valuable in the event of an emergency include fire extinguishers, spill kits and first aid kits.

a. Fire Extinguishers and Sand Buckets

All PV plants must 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 locations. 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 biannual basis to ensure that they are functioning effectively and are in accordance with recommendations of the GFS with regards to the maintenance. Additionally, all employees of 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:

- 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 firefighting 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.

b. Spill Kits

Fuel secondary containment bonds that will have 115% containment capacity in event of a spill. GPL has recognised that spills due to fuel, oil and other lubricants may emanate from the operation. If this occurs, it can pose a great threat and cause adverse impacts on the facility and associated works. In this regard, GPL 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 PV Plant 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 possible, 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.

c. First Aid Kits

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 PV Plants 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. GPL 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. 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.

GPL 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 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 Cardiopulmonary resuscitation (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, 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 plant/animal/ 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/waterproof appropriate container. Each first aid kit shall contain but not limited to the following items:

Table 16: Contents of a first-aid kit

| | |
|---|--|
| 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 | Protective facemask |
| Triangular bandages | Elastic wraps |
| Rubbing alcohol / alcohol wipes | Splint |
| Scissors | Directions for requesting emergency assistance |
| Burn cream | Eye wash kit |
| Antiseptic Cream | Cotton balls |
| Antibiotic Ointment | Hand Sanitizer |

5.8 DISASTER RISKS

Detailed Disaster Event response procedures are presented, *Table 16* and Emergency Contact Information will be updated on all copies of this plan and at all posted locations to ensure rapid response to incidents. This aspect of the ERP enables employees at the PV plants of the proposed solar farms at Trafalgar, Prospect, (Region 5), Hampshire (Region 6), Ouderneeming and Charity (Region 6) to prepare for and respond to disaster events (mainly flash floods, high winds and earthquakes) (GUYSOL - DRMP , 2023).

Table 17: Communication Channels and Actions

| Disaster Phase | Actions | Responsible |
|------------------|--|--|
| Normal operation | Business as Usual Review Disaster Plans Monitor disaster response supplies and equipment Conduct simulation response exercises | PEU Project Manager Contractor Representative |
| Alert | Activate Disaster Response Committee Alert and inform all staff Liaise with the REOC and NDC as applicable Liaise and monitor Hydromet and other agencies reports | Project Manager Disaster Committee |
| Preparation | Alert and inform all line departments Mobilize resources | Disaster Committee |

| | | |
|-----------|--|--------------------|
| | Request assistance from REOWC if needed Liaise with the REOC and NDC as applicable Liaise and monitor Hydromet and other agencies reports | |
| Emergency | Deploy Resources Implement applicable response procedures Inform REOC request assistance as needed | Disaster Committee |
| Recovery | Prepare Damage Assessment Report Request assistance from REOWC as needed Restore operations after necessary clean-up Disaster Committee standdown | Disaster Committee |

5.9 FLOODS

A flood is defined as a general and temporary condition of partial or complete inundation of two or more acres of normally dry land from:

- an overflow of inland or tidal waters,
- an unusual rapid accumulation of runoff surface waters from any source, or mudflow.

The primary purpose of the flood disaster/emergency protocols is to provide a basic course of action for all personnel on-site to follow in the event of a flood. The plan does not cover all possible scenarios but is a guideline to be used in the event of a flood. Well-planned policies and procedures and training along with drills will help ensure the safety of the personnel and minimize damage to infrastructure.

Equipment List

The following list of equipment and supplies will be provided for response to flooding:

- Pumps
- Boats
- Sandbags
- Radios
- Gloves
- First Aid Kit
- Emergency Lights
- Cellular Phones

Response Procedures

Take the following measures to mitigate damage to the site and structures and harm to personnel. If the site is the subject of flooding, ensure the following are done:

Before Flooding Occurs (Construction and Operations)

- Establish Disaster Committee and focal points.
- Ensure the resources are available to deal with the threat of flood including, vehicles, First Aid Kit ready with extra medication for snake bite and diarrhea.
- Other equipment includes pumps, strong ropes (for tying purposes), radios, flashlights, and spare batteries.

During Flooding

- i. Activate Disaster Committee and focal points.
- ii. Liaise with the Regional Emergency Operations Centre (REOC) Region 6 to access/included in the EWS
- iii. Take all reasonable steps necessary to contain and isolate the flooding if possible. This can include where applicable, stopping work or operations.
- iv. Ensure the resources are available to deal with the threat of flood including First Aid Kit, water pumps, sandbags, boats etc.
- v. Monitor nearby River and other drainage system water levels and rate of run-off and forecast future resource requirements.
- vi. Arrange for equipment to be positioned on higher ground or specific locations based on rate of runoff, etc.
- vii. Arrange external resources such as sub-contractors, transportation, etc. if required.
- viii. Liaise with the REOC and other Local authorities as necessary.
- ix. Keep vigil of flood warning given by local authorities including any evacuation orders.
- x. All Evacuation orders should be observed. Move to a safe area before access is cut off by flood water. Evacuation is much simpler and safer before flood waters become too deep for vehicles to drive through.
- xi. Resource and liaise with the Network Operations Department.
- xii. Ensure communication lines are in place between the main office, the Operations Department, and the project site.

Operations Response

- i. In conjunction with Network Operations and Customer and Market Operations, ensure that premises are isolated in a timely manner before water reaches wiring or switchboards.

Post Flooding Procedures

Construction and Operations Phases

- i. Seek necessary medical care at the nearest hospital or clinic. Contaminated flood waters lead to a greater possibility of infection. Severe injuries will require medical attention.
- ii. Continue to liaise with REOC and other emergency personnel on instructions.
- iii. Report damage especially broken utility infrastructure to the authorities.

Construction Phase

- i. An assessment of the flooding impacts should be conducted using form in Appendix 6.1.2.

- ii. Flooding report with damage assessment and injuries should be prepared.
- iii. Contractor and Consultant engineer will decide on resumption of work.
- iv. The restoration of assets should be undertaken in accordance with standard business emergency processes.

Operations Phase

- i. The restoration of assets should be undertaken in accordance with standard business emergency processes.
- ii. GPL will coordinate with local authorities for the restoration of electrical supply to residential properties affected by floods at the project sites.
- iii. The restoration of electricity supply will be done through the distribution network and an initial assessment of and damage to homes that may affect the installation's electrical safety. If through a visual inspection, the assessment of the premises indicates not affected by flooding, re-energization will be affected.
- iv. If the premises have been affected, local authorities will be advised who will coordinate the need for an electrical contractor to assess the damage and effect repairs (which may be temporary).
- v. If meters have been affected by the flooding, the company will coordinate their replacement on a prioritized basis.
- vi. Inspection of structures and cable routes structures (towers and poles) that are in the area and have been flood-affected should be inspected to ensure structural members have not been damaged and the foundation has not been compromised.

Reporting

A damage assessment report should be produced detailing the assets damaged, injuries and other information on the flood.

A review of the Flood Risk Management Plan will be conducted on an annual basis. Operational plans will be continually developed for key critical infrastructures such as zone substations. Other reporting aspects can include:

- Upgrades of overhead line crossing of waterways
- Specific projects for critical infrastructure to address flood risk
- Liaise with other emergency organizations to address flood risk

5.10 HIGH WIND EVENTS

High winds can pose serious hazards for construction and operation sites. It is important to follow some safety precautions to prevent injuries, damages, or delays. The primary purpose of the high winds protocols is to provide a basic course of action for all personnel on-site to follow in the event of high winds. The plan does not cover all possible scenarios but is a guideline to be used in the event high winds. Well-planned policies and procedures and training along with drills will help ensure the safety of the personnel and minimize damage to infrastructure.

Definition

High wind can be defining as "sustained wind speeds of at least 40 mph lasting for 1 hour or longer, or winds of 58 mph or higher for any duration"

Equipment List

The following list of equipment and supplies will be provided for response to high winds:

- Safety gear, such as hard hats, goggles, gloves, and harnesses
- Weights, ropes, chains, or stakes to secure loose items and materials
- Tarps to cover wall openings and protect from dust and debris.
- Tag lines to control hoisted material and avoid swinging loads.
- Pumps to remove water from flooded areas.

Response Procedures

Take the following measures to mitigate damage to the site and structures and harm to personnel. If the site is the subject of high winds, you should ensure the following are done:

Before High Winds (Construction and Operations)

- i. Establish Disaster Committee and focal points.
- ii. Ensure the resources are available to deal with the threat of high winds including, First Aid Kit ready with extra medication.
- iii. Other equipment includes strong ropes for tying things, radios, flashlights, and spare batteries.
- iv. Check the weather forecast regularly and plan for high or gusty winds. If possible, reschedule or modify the riskier tasks in windy conditions, such as working on scaffolds, roofs, or other elevations.
- v. Secure all loose items, materials, and signage on the site. Use weights, ropes, chains, or stakes to prevent them from being blown away or falling over. Store tools and equipment safely when not in use.

During High Winds

- i. Activate Disaster Committee and focal points.
- ii. Liaise with the Regional Emergency Operations Centre (REOC) Region 6 to access/included in the EWS.
- iii. Secure all loose items, materials, and signage on the site. Use weights, ropes, chains, or stakes to prevent them from being blown away or falling over. Store tools and equipment safely when not in use.
- iv. Wear appropriate safety gear, such as hard hats, safety glasses, and gloves. Use goggles instead of glasses to protect your eyes from dust and debris. Ensure your hard hat is fitted properly and does not fly off in a gust of wind.
- v. Ensure that structures under construction, such as walls, panels, formwork, or falsework, are adequately braced or supported to withstand wind loads. Consult the designer or an engineer if you are unsure about the stability of the structures.
- vi. Communicate effectively with your co-workers and supervisors. Use radios, hand signals, or whistles to alert each other of potential hazards or changes in the wind conditions. Report any incidents or near misses to the site manager.

Operations Response

In conjunction with Network Operations and Customer and Market Operations, ensure that premises are isolated in a timely manner before wind damages PV panels, wiring etc.

Post High Winds Procedures

Construction and Operations Phases

- i. Seek necessary medical care at the nearest hospital or clinic. Severe injuries will require medical attention.
- ii. Continue to liaise with REOC and other emergency personnel on instructions.
- iii. Report damage, especially dam utility infrastructure, to the authorities.
- iv. An assessment of the high wind impacts should be conducted using the form in Appendix 6.1.3.
- v. High Winds reports with damage assessment and injuries should be prepared.
- vi. Contractor and Consultant engineer will decide on resumption of work.
- vii. The restoration of assets should be undertaken in accordance with standard business emergency processes.

Operations Phase

- i. The restoration of assets should be undertaken in accordance with standard business emergency processes.
- ii. GPL will coordinate with local authorities to restore electrical supply to residential properties affected by high winds at the project sites.
- iii. The restoration of the electricity supply will be done through the distribution network and an initial assessment of damage to homes that may affect the installation's electrical safety. If, through a visual inspection, the assessment of the premises indicates not affected by flooding, re-energization will be affected.
- iv. If the premises have been affected, local authorities will be advised who will coordinate the need for an electrical contractor to assess the damage and effect repairs (which may be temporary).
- v. If meters have been affected by the flooding, the company will coordinate their replacement on a prioritized basis.
- vi. Inspection of structures and cable routes structures (towers and poles) that are in the area and have been wind-affected should be inspected to ensure structural members have not been damaged and the foundation has not been compromised.

Reporting

A damage assessment report should be produced detailing the assets damaged, injuries and other information on the High Winds.

A review of the High Winds Protocols should be done, and necessary updates made.

5.11 EARTHQUAKES

Earthquakes generally have no warning and cannot be predicted accurately. However, some measures can be taken to protect people and infrastructure from injury or damage during and after an earthquake.

Earthquakes have four main risks as follows:

- Ground displacement can cause uneven surfaces.
- Fire is a serious risk. Broken power lines leave the site vulnerable to fire.
- Flooding is possible near waterways. Broken dams or levees can allow flooding in normally safe areas.

- Structures can topple in an earthquake. This includes incomplete structures.

The primary purpose of the earthquake protocols is to provide a basic course of action for all personnel on-site to follow in the event of an earthquake. The plan does not cover all possible scenarios but is a guideline to be used in the event of an earthquake. Well-planned policies and procedures and training along with drills will help ensure the safety of the personnel and minimize damage to infrastructure.

Equipment List

The following list of equipment and supplies will be provided for response to earthquakes or earth tremors:

- Radios
- Gloves
- First Aid Kit
- Emergency Lights
- Cellular Phones/Radios
- Hard hats
- Excavation machinery

Response Procedures

Take the following measures to mitigate damage to the site and structures and harm to personnel. If the site is the subject of flooding, ensure the following are done:

Before Earthquake Occurs (Construction)

- i. Establish Disaster Committee and focal points.
- ii. Ensure the resources are available to deal with the hazard including, vehicles, First Aid Kit ready with extra medication.
- iii. Have a safe place designated on the construction site for earthquakes. The safe places normally chosen, like under a table or desk or against an interior wall, will not work during construction site. Aim to be away from collapsible structures.
- iv. Hold earthquake drills to ensure that construction and operations staff know the proper response during an earthquake.

During Earthquake

- i. Activate Disaster Committee and focal points.
- ii. Liaise with the Regional Emergency Operations Centre (REOC) Region 6
- iii. Practice “Drop, Cover, and Hold On” Drop, cover, and hold on is an earthquake safety measure that anyone can practice, regardless of where they are when an earthquake hits. It refers to dropping to hands and knees, covering your head and neck with one arm, and crawling to the closest shelter, then holding on to something steady until the shaking stops. Finding shelter is the challenge during an earthquake on a construction site, but even a large piece of equipment or a tree can serve as a shelter when needed.
- iv. If operating equipment when an earthquake hits, stop, and exit the vehicle as soon as safely possible.

- v. Arrange external resources such as sub-contractors, transportation, etc. if required.
- vi. Ensure communication lines are in place between the main office, the Operations Department, and the project site.

Operations Response

In conjunction with Network Operations and Customer and Market Operations, ensure that premises are isolated in a timely manner before water reaches wiring or switchboards.

Post-Earthquake Procedures

Construction and Operations Phases

- i. Seek necessary medical care at the nearest hospital or clinic if necessary.
- ii. Continue to liaise with REOC and other emergency personnel for guidance.
- iii. Report damage especially broken utility infrastructure to the authorities.

Construction Phase

- i. Report with damage assessment and injuries should be prepared.
- ii. Contractor and Consultant engineer will decide on resumption of work.
- iii. The restoration of assets should be undertaken in accordance with standard business emergency processes.

Operations Phase

- i. The restoration of assets should be undertaken in accordance with standard business emergency processes.
- ii. GPL will coordinate with local authorities for the restoration of electrical supply to residential properties affected at the project sites.
- iii. The restoration of electricity supply will be done through the distribution network and an initial assessment of and damage to homes that may affect the installation's electrical safety.
- iv. If the premises have been affected, local authorities will be advised who will coordinate the need for an electrical contractor to assess the damage and effect repairs (which may be temporary).
- v. If meters have been affected the company will coordinate their replacement on a prioritized basis.
- vi. Inspection of structures and cable routes structures (towers and poles) that are in the area and have been affected should be inspected to ensure structural members have not been damaged and the foundation has not been compromised.

Reporting

A damage assessment report should be produced detailing the assets damaged, injuries and other information on the earthquake.

A review of the Earthquake Preparedness and Response Protocols will be conducted on an annual basis.

6 APPENDIX

6.1 FORMS FOR EMERGENCY PLANS

6.1.1 I: TOR for Disaster Committee

The Project Manager with assistance from the Environmental and Social Specialists are responsible for overseeing the formation of the Disaster Management Team/Safety Committee and is the designated leader. Other members of the disaster management team will include:

| No. | Members | Name | Contact No. |
|-----|---------|------|-------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |

Responsibilities of Disaster Management Committee:

- i. Coordinates with all internal and external stakeholders identifying specific needs and requesting volunteers to serve on the Disaster Management Team/Safety Committee
- ii. The coordinator creates a list of interested staff, making sure all major areas of need are addressed, including Main Office, Office Managers, Maintenance and Operations, Management, and Security.
- iii. A meeting is held with potential team members to discuss what will be expected for team membership.
- iv. The coordinator or designee follows up with all staff to update on Team/Committee formation, and to fill in areas where deficits exist (NOTE: Although an individual may seem “perfect” for a role, no one should be required to have a primary position on an emergency team if he/she does not feel capable of fulfilling his/her duties in time of need).
- v. An initial meeting is held to formally establish the Disaster Management Team/Safety Committee, and to begin the process of implementing the Disaster Management Plan
- vi. The coordinator will conduct a formal presentation of the DRMP Biannually
- vii. Hold regular team meetings throughout the year (every 6 months) to review protocols and ongoing issues as they arise that may affect the site.
- viii. Set dates to conduct orientation, review, and update of plan.
- ix. Prepare and support the organization and delivery of Awareness Programs on disaster management for GPL, and the communities.
 - x. Facilitates the organization of training on disaster management issues.
 - xi. Identify and advise on the purchase of equipment for emergency situations.
 - xii. Carry out regular reviews of the structural safety requirements for various hazards (floods, etc.)
- xiii. Recommend budget arrangements for carrying out preparedness and mitigation measures.
- xiv. Prepare guidelines and procedures for emergency drills.

- xv. Liaise with Civil Defence Commission (CDC) and Regional Disaster Committees to develop and disseminate materials, posters, pamphlets, and simple tips on dos and don'ts of different disasters.
- xvi. Keep an updated list of important telephone numbers and radio contacts in case of emergency.
- xvii. During and Emergency assist the National/Regional focal point in facilitating and coordinating the emergency plans.
- xviii. Evaluate and update the disaster management plan.

6.1.2 II: Flood Damage Report Form

Recording of Flood Incidents (Location)

| SECTION 1: TO BE COMPLETED BY THE PERSON SUBMITTING THE REPORT | | | | |
|---|-----------------------------|--------------|-----------|----------|
| Name | | | | |
| Organisation/Section/MD | | | | |
| Report Date | | | | |
| Date of Site Visit | | | | |
| Contact Details | Email: | | | Phone: |
| Other Contacts OR Relevant Sources of Information? | | | | |
| SECTION 2: LOCATION OF THE FLOOD EVENT | | | | |
| Location of Flood Event (Address) | | | | |
| Road Name (where relevant) | | | | |
| Grid Ref (where known) | | | | |
| | Flood Start | Flood Peak | Flood End | |
| Date | | | | |
| Time | | | | |
| Other Relevant Information | | | | |
| SECTION 3: SOURCE AND CAUSE OF FLOODING | | | | |
| Flood Source (e.g. from where the flood waters originated) | | | | |
| Flood Cause (e.g. Suspected causes of flooding) | | | | |
| Other Relevant Information | | | | |
| SECTION 4: FLOOD DATA | | | | Comments |
| Flood Extent Mapped? (please circle) | Yes | No | Not Known | |
| Map Available | Yes | No | Not Known | |
| (A map is of great assistance and value in showing the location and extent of flooding) | | | | |
| Flood Depth | Maximum (cm) | Minimum (cm) | | |
| Has this Location Flooded Previously? (Please Circle) | Yes | No | | |
| Frequency of Previous Flooding | Never | | | |
| | Occasionally | | | |
| | Many times Every Year | | | |
| | Always After Heavy Rainfall | | | |
| | Once Before | | | |
| | Annually | | | |
| | Other | | | |

| SECTION 5: FLOOD IMPACT | | | | Comments |
|---|-----|----|-----------|----------|
| Was there any serious loss of life? (please circle) | YES | NO | NOT KNOWN | |
| Were there any serious injuries? (please circle) | YES | NO | NOT KNOWN | |

| Impacts on Assets | Y/N | No. Impacted | No. Persons Impacted | Further Details & Comments |
|-------------------|-----|--------------|----------------------|----------------------------|
| i) | | | | |
| (ii) | | | | |
| (iii) | | | | |
| (iv) | | | | |
| (v) | | | | |
| (vi) | | | | |
| (vii) | | | | |
| (viii) | | | | |
| (ix) | | | | |
| (x) | | | | |
| (xi) | | | | |

| SECTION 6: ADDITIONAL INFORMATION (photos, video footage, rainfall data, press & internet articles) |
|---|
| |

6.1.3 III: Wind Damage Assessment Form

| High Wind Damage Report Form | |
|---|--|
| Site | |
| <i>Contact Name</i> | |
| <i>Address of Site</i> | |
| <i>GRID Coordinates</i> | |
| <i>Town/City</i> | |
| <i>Phone Number</i> | |
| <i>Email</i> | |
| Date of Incident: | |
| Cause of Damage (wind): | |
| | |
| Equipment: | |
| <i>Type of Equipment</i> | |
| <i>Extent of Damage (item totaled, minor repairs, etc.)</i> | |
| <i>Value of Equipment Lost</i> | |
| <i>Photographs Attached? Before <u>and</u> after</i> | |
| | |
| Buildings/Structures: | |
| <i>Type (wood/steel frame, free stall, etc.)</i> | |
| <i>Total number of structures</i> | |
| <i>Dimension(s)</i> | |
| <i>What was the structure used for?</i> | |
| <i>Extent of Damage (complete or partial collapse)</i> | |
| <i>Estimated Loss</i> | |
| <i>Contents</i> | |
| <i>Photographs Attached? Before <u>and</u> after</i> | |
| | |
| Other Damages (List) | |
| | |
| | |
| | |
| Injuries and casualties | |
| | |
| | |
| Other Notes/Comments: | |
| | |
| | |

6.1.4 IV: 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 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 manoeuvre 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 clean-up company or the Fire Department (if arrangement has been made) to perform a large chemical spill clean-up.

Name of Spill Clean-up 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 clean-up procedures.

Date ___ / ___ / ___

6.2 TECHNICAL SPECIFICATIONS

Technical Specification Sheet of Solar PV Module

Harvest the Sunshine

630W





JAM66D45 LB

n-type Double Glass Bifacial Modules

Premium Cells

Hi-Efficiency+

16BB

MSB Half-Cell Technology

26%

Up To

Cell Conversion Efficiency

Premium Modules

Higher power generation better LCOE

Better Temperature Coefficient

25-year power warranty

n-type with very Lower LID

Better low irradiance response

30-year power output warranty

4-year return on investment

Lower Performance Ratio

Standard Module Loss Performance Warranty



Comprehensive Certificates

- IEC 61215, IEC 61730, UL 61215, UL 61730
- ISO 9001:2015 Quality management systems
- ISO 14001:2015 Environmental management systems
- ISO 45001:2018 Occupational health and safety management systems
- IEC 62941:2019 Terrestrial photovoltaic (PV) modules - Quality system for PV module manufacturing





6.3 QUALITY, ENVIRONMENT, AND OCCUPATIONAL HEALTH AND SAFETY MANUAL



GB/T19001-2016/ISO9001:2015 "Quality Management Systems Requirements"
GB/T24001-2016/ISO14001:2015 "Environmental Management Systems Requirements and Guidelines for Use"
GB/T45001-2020/ISO45001:2018 "Occupational Health and Safety Management Systems Requirements and Guidelines for Use"
GB/T50430-2017 "Engineering Construction Enterprises Quality Management Standards"
SJSMD/SC-2023

SUMEC Complete Equipment & Engineering Co., Ltd.

Quality, Environment, and Occupational Health & Safety

A/1

Management Manual

Compiled by: Compilation Team Reviewed by:  Approved by: 

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