Staatsolie Maatschappij Suriname N.V.

ENVIRONMENTAL SOCIAL MANAGEMENT PLAN FOR THE PROPOSED STAATSOLIE POWER PLANT IN SARAMACCA 2019

Report prepared in collaboration with:

srk consulting

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Abbreviations

CCU	Corporate Communications Upstream
DO	Drilling Operations Division
ELT	Ecological Land Type (see review study)
ERP	Emergency Response Plans
ESMP	Environmental Social Management Plan
GFI	General Field Instruction
HSE	Health, Safety and Environment
HSEQU	Health, Safety, Environment and Quality Upstream
MUMA	Multiple Use Management Area
PS & PS	Plant Security and Personnel Services
SOM	N.V. Staatsolie Maatschappij Suriname (Staatsolie)

1 INTRODUCTION

Staatsolie Maatschappij Suriname N.V. (Staatsolie) is the Surinamese State oil company founded in 1980 and wholly owned by the Republic of Suriname. The company explores, produces and refines crude oil. Staatsolie operates three oil fields in the Saramacca District of Suriname: Tambaredjo, Tambaredjo North-West and Calcutta, as well as two oil processing plants: TA-58 and Jossie. The Tambaredjo Oil Field is located 40 km west of Paramaribo and 8 km south of the Atlantic coast, north of the East-West Connection Road (*Oost-West Verbinding*) (see Figure 1-2).

Staatsolie's facilities and operations in Saramacca are supplied with power by N.V. Energie Bedrijven Suriname (EBS) through a transmission line to Saramacca. Power demand is expected to increase due to expansion of operations in the oil fields. While EBS will continue to supply power from other existing, distant sources, Staatsolie proposes to construct a new thermal (Heavy Fuel Oil [HFO]) power plant of up to 36 MW in phases at the Sarah Maria facility in the Tambaredjo Oil Field to provide backup power (the project).

The project site is situated in the northern portion of the Tambaredjo Oil Field, 120 m south-east of the TA-58 plant (see Figure 1-1). The site is vacant and covered with secondary marsh vegetation, which qualifies as modified habitat. Roadside drainage ditches run alongside access roads which border the site to the east, south and west.

The proposed power plant will be constructed on a ~2.5 ha site south-east of the TA-58 plant (see Figure 1-1).

Figure 1-1: Proposed power plant location relative to TA-58

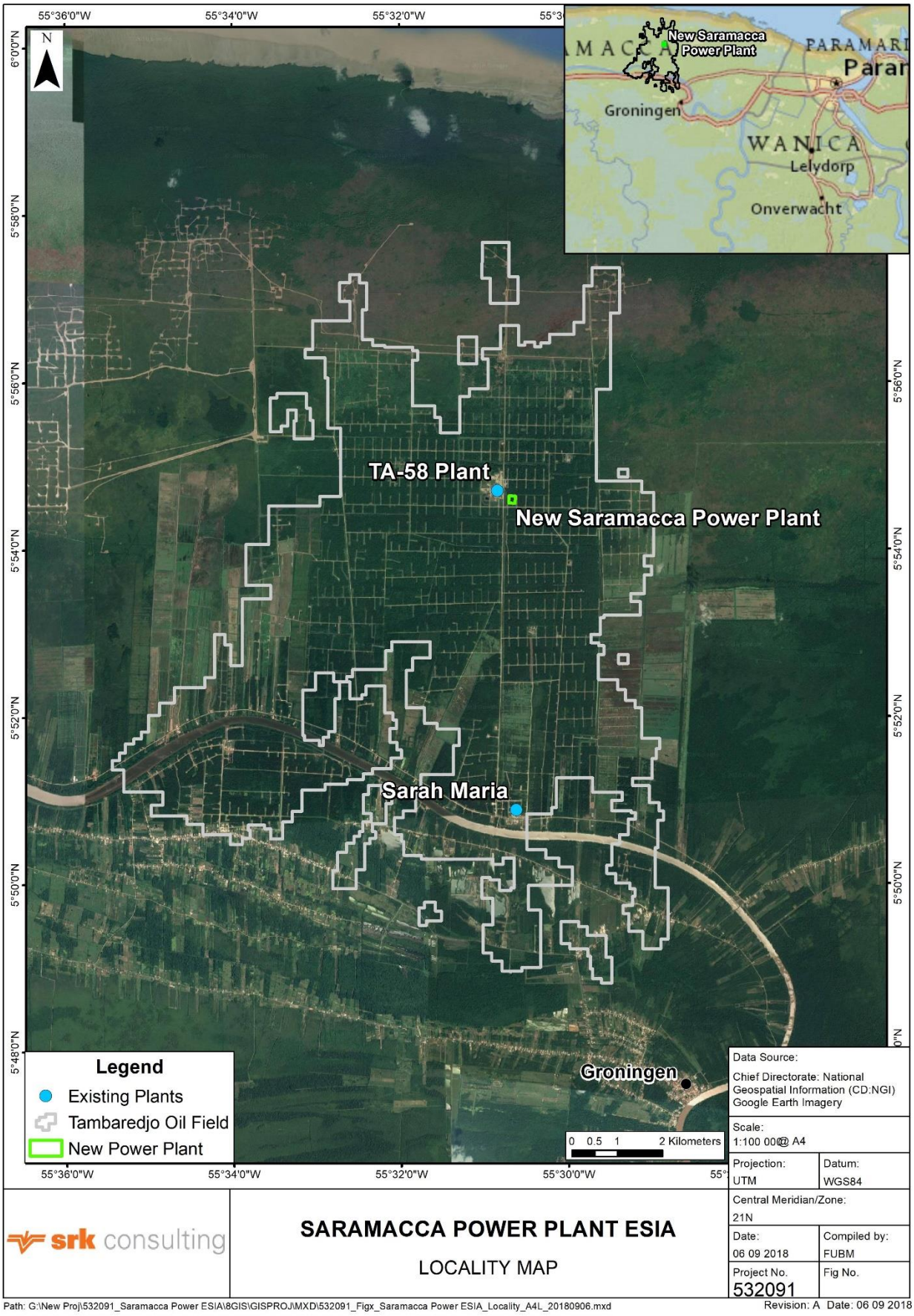

Figure 1-2: Locality map

The power plant will include the following key components:

- Powerhouse, internal combustion engines and additional equipment;
- Fuel treatment plant;
- Storage facilities for fuel and lubricant;
- Transformers; and
- Maintenance, storage and office areas.

The proposed power plant will consist of 6 MW engines, each with an individual 30 m-high exhaust stack. The number of engines is expected to reach a maximum of six engines, to allow for backup and redundancy requirements (i.e. not all engines will be operating at the same time).

Engines will be running mainly on Saramacca Crude, and occasionally on HFO (Staatsolie's own low-sulphur product with less than 3% sulphur) or Light Fuel Oil (LFO). Saramacca Crude will be transported through a pipeline from the existing TA-58 plant to the storage tanks at the power plant, while HFO and LFO will be trucked from the Staatsolie refinery at Tout Lui Faut. HFO is only required during special circumstances, e.g. pipeline maintenance or unplanned pipeline and/or TA-58 plant shutdowns. The use of LFO will be minimized and only required for start-up. The estimated maximum fuel consumption per generator is 28 000 litres per day.

The engines will be cooled by a closed-circuit cooling-water (radiator) system using treated water with possibly some anti-corrosion additives. The cooling pipes are typically run through concrete cable gutters; in the unlikely event of a leak cooling water will be contained and not discharged into the environment.

Efficiency improvement options for the power plant as well as the opportunity to use excess energy in the TA-58 plant will be considered.

The plant will be equipped with a fire-fighting system including tank, pipelines and pumps.

Construction will be phased. Phase 1 consists of three 6 MW generator units, which will not be operational simultaneously. The design will accommodate the possibility for further expansion to a maximum peak capacity of 36 MW, based on projected future needs.

The construction phase will consist of:

- Site clearance;
- Site preparations, including backfilling with sand;
- Concrete foundation piling;
- Construction of concrete foundations (buildings, tanks, generators and transformers);
- Installation of drainage and landscaping;
- Construction of buildings, support structures and tank farm;
- Transportation and installation of generator sets, including auxiliaries (stacks, cooling plant, piping etc);
- Electrical installations, including transformers and switchgear; and
- Commissioning and testing.

Most materials will be procured and delivered by the Engineering, Procurement and Construction (EPC) contractor and transported to site by dump truck (raw materials) and flatbed trucks (piling, containers, piping).

To satisfy the growing electricity demand of the Saramacca operations, the power plant should be operational in 2020. The (minimum) operational life of the plant is 20 years.

It is expected that the project construction phase will provide jobs for 215 people, while the operational phase generates employment for 10 people.

This document, the Environmental and Social Management Plan (ESMP), details the approach that will be followed during design, construction and operation of the Saramacca Power Plant Project to ensure that its negative impact on the environment is minimized.

Contractors that will be involved shall review and commit to the ESMP before starting the works.

This document is intended as a dynamic document that may be continually edited and updated by the HSEQ Upstream Division as new insights develop during the implementation of this ESMP.

1.1 ENVIRONMENTAL MANAGEMENT

Compliance with the provisions of a number of Staatsolie documents that address Health, Safety, and Environmental (HSE) issues are mandatory, principally:

- **Health, Safety & Environmental and Quality Policy**: is aimed at continually improving performance and aspires to prevent harm to the safety and health of its Employees, contractors, neighbors, and the environment.
- **GFI's**: general procedures to guide Staatsolie's operations so that it complies with the HSE policy. GFI's applicable to this project are listed in Appendix F.
- **Community Relation Policy**: is aimed at performing business activities in such a way that communities' interest and expectations with regard to socio-environmental aspects are properly considered.

1.2 DESCRIPTION OF THE ESMP

1.2.1 Purpose and scope of the ESMP

The purpose of this ESMP is to set out the management and monitoring measures required to minimize the environmental impacts of design, construction and operations of the Saramacca Power Plant Project, and to ensure that responsibilities and appropriate resources are efficiently allocated to the project. The ESMP addresses the design, construction and operational phases.

1.2.2 Structure of the ESMP

This ESMP is made up of three parts:

Part 1: Introduction
Provides brief background to the project and sets out the corporate environmental management requirements as well as a brief description of the purpose, scope and structure of the ESMP.

Part 2: Environmental Management Procedures
This section sets out the roles and responsibilities for implementation of the ESMP, environmental training requirements, emergency response planning, and monitoring requirements.

Part 3: Environmental Specifications
Explains the approach adopted to develop the environmental specifications and sets out the actual specifications in tabular form.

2 ENVIRONMENTAL PROCEDURES

2.1 ROLES AND RESPONSIBILITY

This paragraph is intended to ensure that an accountability process is defined and implemented to make certain that responsibilities are performed effectively. The general roles and responsibilities of various parties are outlined in the section below.

Position	HSE responsibility
Project Manager during construction	Overall responsibility for ESMP-related matters, for implementation and monitoring of HSE matters with regards to activities during the construction phase.
HSEQ Upstream Manager during project life cycle	Responsibility to support and monitor the performance with regards to HSE matters during project life cycle
HSE Site official during construction	Responsibility to inspect and monitor on site HSE performance and report on compliance against the ESMP to the Project Manager
Operations Manager	Overall responsibility for operations phase ESMP implementation, and HSE performance matters with regards to all activities during operations.
Corporate Communication Upstream Manager	Overall accountability of Community and Public Relations support for all Staatsolie operations and activities.
Community Relations Officer	Overall responsibility of Community Relations support for the Saramacca Power Plant Project
SOM Employees and contractors	Shall be aware of the ESMP requirements and adhere to the relevant mitigation measures.

2.1.1 Construction Phase Roles and Responsibilities

2.1.1.1 Project Manager

The Project Manager during Construction shall:

- Ensure that the key on-site staff are duly informed of the ESMP and associated responsibilities and implications of this ESMP prior to commencement of construction (in order to minimize incidents and undue delays);
- Ensure that a copy of the ESMP is available on site;
- Inform the HSE Site Manager **one week** before the date of the commencement of the project (this date being the day on which preparations activities will start);
- Ensure that Method Statements are submitted to the HSE Site Manager and HSEQ Upstream Manager for tasks requiring such; and
- Ensure that action items to rectify non-compliance are closed out in a timely and satisfactory manner.

2.1.1.2 HSEQ Upstream Manager

The HSEQ Upstream Manager shall:

- Undertake spot inspections to determine compliance with the ESMP and monitor the activities of the contractor on site with regard to the requirements outlined in this ESMP;
- Alert when action items intended to remedy non-compliance are not closed out in a timely and satisfactory manner;
- Compile compliance reports; and
- Submit reports on the implementation of the ESMP and non-compliance to NIMOS.

2.1.1.3 HSE Site Official

The HSE Site Official shall:

- Inform key on-site staff through initial environmental awareness training of their roles and responsibilities in terms of the ESMP;
- Perform daily HSE inspections based on the weekly ESMP checklist and submit compliance reports every 2 weeks to the HSEQ Upstream manager (based on reporting scheme in table 2 in paragraph 2.6.6 Reporting);
- Identify areas of non-compliance and propose action items to rectify them in consultation with the Project Manager; and
- Undertake a post-construction inspection upon completion of each location, which may result in recommendations for additional clean-up and rehabilitation measures;

2.1.1.4 EPC Contractor

Contractors delivering services to the project have a duty to demonstrate respect and care for the environment in which they are operating. Contractors shall comply with the specifications of the ESMP and abide by the instructions of the HSE Site Official and the Project Manager regarding the implementation of this ESMP. Contractors shall report to the Project Manager on all matters pertaining to the ESMP.

The EPC Contractor shall:

- Ensure that all personnel on site (including Sub-Contractors and their staff, and suppliers) are familiar with and understand the requirements of the ESMP;
- Ensure that all activities under their control are undertaken in accordance with the following:
    - o Health, Safety, Environment and Quality Policy,
    - o Risk Management Policy,
    - o Community Relations Policy,
    - o All applicable Staatsolie GFIs,
    - o The ESMP.
- Ensure that all employees and sub-contractors comply with this ESMP;
- Execute daily HSE inspections and any non-compliance with the specifications of the ESMP should be reported immediately;
- Compile Method Statements as listed hereunder;
- Ensure that any problems and non-conformances are remedied in a timely manner, to the satisfaction of the Project Manager.
- Ensure that all personnel are aware of emergency response plans and are adequately trained therein; and
- Compile the required reports (see Table 2-1 and Table 2-2, to be submitted to the Project Manager.

Figure 2-1 below depicts Staatsolie's HSE Organisational Structure during construction.

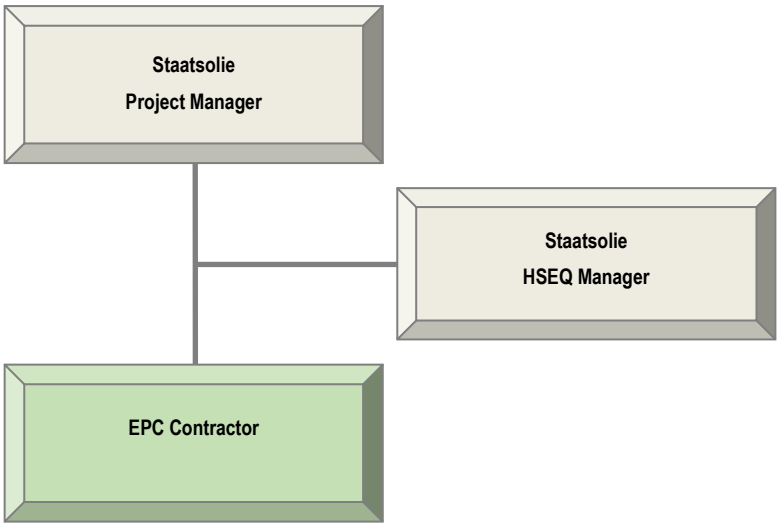

Figure 2-1: Expected Staatsolie HSE Organisational Structure (Construction)

2.1.1.5 Method Statements

Method Statements are to be compiled by Contractors for approval by the Project Manager, who reviews and endorses them. The HSEQ Upstream Manager must receive a copy of the Method Statement for review 2 weeks before commencement of the activity and if there are any issues regarding the environmental specifications these shall be made known to the Project Manager within a week. The Method Statement typically shall cover applicable details including, but not limited to:

- A reference to the ESMP;
- Description and frequency of the activities to be undertaken;
- Location where activities will be undertaken;
- Construction drawings;
- Map of the location;
- Materials and equipment requirements;
- How and where material will be transported and/or stored (transportation routes where relevant);
- The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur; and
- Timing of activities (start and end dates).

As a minimum, the following Method Statements for construction shall be submitted to the Project Manager not less than 14 days prior to the intended date of commencement of the activity:

- Environmental awareness course preparation;
- Material and equipment storage and delivery;
- Fuel consumption, storage, dispensing and prevention and management of fuel spills;
- Waste management;
- Management of contaminated water;
- Erosion and stormwater control; and
- Cement batching.

Contractors shall abide by these approved Method Statements. Appendix A provides a pro forma Method Statement sheet that must be completed by the Contractor for each activity requiring a Method Statement as specified in here above.

An ESMP checklist has been included in Appendix B to facilitate the random and weekly site inspection for the Saramacca Power Plant Project construction site. These completed checklists must

be discussed in the contractors project team(s) for corrective actions where relevant, and submitted through the Project Manager to the HSEQU department at the end of each week.

2.1.2 Operational Phase Roles and Responsibilities

2.1.2.1 Operations Manager

The Operations Manager shall:

- Ensure that the key on-site staff are duly informed of the ESMP and associated responsibilities and implications of this ESMP throughout operations;
- Ensure that a copy of the ESMP is available on site;
- Inform the HSEQ Upstream Manager **one week** before maintenance activities take place;
- Ensure that Method Statements are submitted to the HSEQ Upstream Manager for maintenance activities (as requested by the HSEQ Upstream Manager); and
- Ensure that action items to rectify non-compliance are closed out in a timely and satisfactory manner.

2.1.2.2 HSEQ Upstream Manager

The HSEQ Upstream Manager shall:

- Inform key on-site staff through environmental awareness training of their roles and responsibilities in terms of the ESMP during operations;
- Inspect and monitor on site HSE performance and report on compliance against the ESMP to the Operations Manager;
- Identify areas of non-compliance and propose action items to rectify them in consultation with the Operations Manager; and
- Alert when action items intended to remedy non-compliance are not closed out in a timely and satisfactory manner.

2.2 ENVIRONMENTAL TRAINING

Environmental awareness training courses shall be run for all personnel on site. It is incumbent upon the Project Manager to convey the objectives of the ESMP and the specific provisions of the ESMP to all personnel involved in the operation of the Saramacca Power Plant Project. Environmental training must cover the specific environmental management requirements as set out in the ESMP, but must also ensure that all on-site staff are aware of and familiar with the relevant requirements and principles/objectives of the HSEQ Policy, emergency response plans, applicable procedures (GFIs) and the ESMP. The HSE Site Manager will initialize the training sessions for all new or additional staff and the HSE department shall support with Environmental Awareness Courses (Integrated Health, Safety and Environmental Inductions). Contractors shall ensure that all staff attend the awareness courses to be held not less than one week before the Commencement Date. Where applicable, Contractors shall provide job-specific training on an ad hoc basis when workers are engaged in activities that require Method Statements. A copy of the ESMP shall be available on site, and the Contractors shall ensure that all the personnel on site (including Sub-Contractors and their staff) as well as suppliers are familiar with and understand the specifications contained in the ESMP.

Operation training will include information on:

- Current land and water use;
- Clearing, access and transportation;
- Waste minimization, handling and disposal methods;
- Fire and spill prevention and control;
- Emergency response procedure (Health, Safety and Environmental issues);
- Handling and storage of hazardous materials, fuels and oils; and
- Reclamation measures.

2.3 COMMUNITY ENGAGEMENT

2.3.1 Introduction

Community or stakeholder engagement describes the ongoing, interactive relationship between Staatsolie and the community. It is about building and maintaining constructive relationships over time. It is an ongoing process between the company and its project stakeholders that extends throughout the life of the project and encompasses a range of activities and approaches, from information sharing and consultation, to participation, negotiation, and partnerships. It enables people to be informed about local issues related to Staatsolie activities and to contribute ideas and help identify solutions. It strengthens community cooperation and builds the people's trust. Staatsolie recognizes the value of involving the community in its HSEQ policy which includes as one of the key-elements: *"Communication of the Health, Safety and Environmental policy, objectives and targets, and other relevant matters to all employees, contractors and stakeholders"*.
The nature and frequency of community engagement should reflect the level of project risks and impacts.
The current project does not encompass much stakeholder engagement, because there are very few stakeholders. Therefore no specific Community Engagement Plan (CEP) is thought to be required for the Saramacca Power Plant Project. It is, however, essential that Staatsolie implements its generic company CEP.

2.3.2 Purpose

Community engagement in the current context is seen as the way of interacting with residents / stakeholders. It is an ongoing process which allows a two-way communication. Stakeholders / residents and Staatsolie will both benefit from community engagement. The purpose is to help outline how Staatsolie will obtain a better understanding of the public's interest and perspective regarding their activities in the Saramacca area. It also helps people within the community feel involved in and be heard in the project.
In order for Staatsolie to understand the concerns, needs and aspirations of the community, Staatsolie needs to create this two-way communication. This can be achieved through:

- Keeping the community informed about issues that affect, or are important to the community
- Creating avenues for Staatsolie to listen to issues that affect, or are important to, the community

Meaningful community engagement usually results in minimization of vagueness, conflict and delays, and the establishment of relationships in the local community that can benefit current and future projects. It can limit the number of surprises that occur during a project because all parties share information openly and consistently.

2.4 IMPLEMENTATION OF ESMP

This section provides a description of the methods that will be used to monitor performance against ESMP commitments.

2.4.1 Monitoring

The HSE Site Manager together with the HSEQ Upstream Manager are responsible for monitoring the performance of on-site personnel against the commitments of the ESMP. Overall control for this function will lie with the HSEQ Upstream Manager, and responsibility for day-to-day monitoring will lie with the HSE Site Manager. The HSE Site Manager is obliged to, and will have the power to suspend activities if they do not comply with the performance standards specified in the ESMP. The following principal items will be monitored:

- Correct implementation of ESMP;
- Compliance with Method Statements; and

- Physical parameters and indicators, e.g. water quality.

A once-off ambient SO_2 and NO_2 air quality monitoring campaign during Operations is also recommended. Similarly, a once-off noise monitoring campaign is recommended during Operations.

2.4.2 Data and information management

Quantitative data should be stored in the Staatsolie Environmental Statistics database, which will allow systematic storage and manipulation of data, and will permit rapid retrieval for the purposes of internal and external reporting. The representatives of the HSEQ Upstream Manager will administer this database. In order to ensure a consistent and coherent system for documenting the implementation of the ESMP, all written records and other information will be stored in a filing system that is compatible with the requirements of the existing HSE Management System. This will comprise standardized forms, documents and reporting procedures.

2.4.3 Reporting

The frequency and nature of reporting of environmental management performance will depend upon the nature of the activity and aspect that is being managed. Reporting will consist of:

- Reports to the Project Manager/Project Leader and Deputy Director E&PC, on critical issues, as required;

Table 2-1 and Table 2-2 below give an overview of the other obligatory reporting lines during construction and operations, respectively.

Table 2-1: Regular reports and report lines during construction

Report Name	Description	Frequency	Responsibility of	Receiver
Water quality monitoring reports	Reports of (receiving environment) surface water quality monitoring done for the project	Fortnightly or when accidents happen.	Lifting, Gathering & Transport Manager	HSEQ Upstream Manager
Weekly report of safety talks	Reports of talks	Weekly	EPC Contractor/Project Manager	HSE Site Manager
Weekly HSE Inspection	Compliance with ESIA and ESMP	Weekly	HSE Site Manager	HSEQ Upstream Manager
Incidents	Report type and consequences for loss of days	When accidents happen	EPC Contractor/Project Manager	HSEQ Upstream Manager
Method Statement	Method Statements	Two weeks before commencement	EPC Contractor/Project Manager	HSEQ Upstream Manager

Table 2-2: Regular reports and report lines during operations

Report Name	Description	Frequency	Responsibility of	Receiver
Water quality	Reports of (receiving	Monthly for 6 months and	Operations Manager	HSEQ Upstream Manager

Report Name	Description	Frequency	Responsibility of	Receiver
monitoring reports	environment) surface water quality monitoring done for the project	thereafter when accidents happen.		
Weekly report of safety talks	Reports of talks	Weekly	Operations Manager	HSEQ Upstream Manager
HSE Inspection	Compliance with ESIA and ESMP	Weekly for three months, and thereafter monthly	HSEQ Upstream Manager	Operations Manager
Incidents	Report type and consequences for loss of days	When accidents happen	Operations Manager	HSEQ Upstream Manager
Method Statement	Method Statements	Two weeks before maintenance activity	Operations Manager	HSEQ Upstream Manager

2.4.4 Feedback

Feedback on performance will be communicated to the appropriate parties concerned. Any substandard performance will trigger a process that notifies the responsible party of the nature of the issue and indicates the actions that are required to rectify the situation. This will be followed up by further monitoring to ensure that the sub-standard performance has been corrected.

3 ENVIRONMENTAL SPECIFICATIONS

3.1 APPROACH TO THE ESMP AND ENVIRONMENTAL SPECIFICATIONS

The general principles contained within this section shall apply to all activities for the duration of the design, construction and operations phases of the Saramacca Power Plant Project. An environmental impact is defined as any change to the existing environment, either adverse or beneficial, that is directly or indirectly the result of the project and its associated activities. Impacts are generated by certain aspects of those activities. In the context of this document, an aspect is defined as *"an action, event, product or service, occurring as a component or result of an activity, which interacts with the existing environment"*. The fundamental approach adopted in the compilation of this ESMP is that management effort should be focused on environmental aspects to prevent impacts from occurring, i.e. a proactive approach. Proactive measures are then backed up with reactive measures, which serve to minimize the severity or significance of the impact, if it cannot be prevented at source. A series of tables incorporating management measures has been developed and grouped to cover the main activities that give rise to potential impacts during the design, construction and operations phases. Each table provides further detail on the following:

- Prescribed mitigation measure(s);
- Implementation timeframe;
- Monitoring and performance evaluation, including performance indicators and monitoring methods; and
- Identification of the person(s) responsible for implementation of the mitigation measure(s).

These tables are presented in the remainder of this section of the ESMP.

Table 3-1: Environmental management and mitigation measures that must be implemented during the *Design* Phase

Design Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
Authorisations	1.	Ensure that all required licences and permits have been obtained before the start of construction.	• Staatsolie	• Before construction commences	• Keep record of all permits, licences and authorisations	• Required licences/permits on file
Plant design	2.	Adopt appropriate technology to ensure power generating units meet the World Bank emission guidelines for reciprocating engines and turbines.	• EPC Contractor	• During design phase	• Review detailed layout plans	• Approval of final design
	3.	Design plant to allow for containment of contaminated stormwater runoff and all wastewater generated at the plant for treatment.				
	4.	Route stormwater around the plant as much as possible to minimize the potential for contaminating runoff.				
	5.	Bund fuel and hazardous material storage areas and install a roof if possible to prevent stormwater contamination from these areas.				

Table 3-2: Environmental management and mitigation measures that must be implemented during the *Construction* Phase

Construction Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
Site camp	1.	Submit a Method Statement for Site Camp establishment for acceptance by Staatsolie at least two weeks prior to the start of construction activities.	• EPC Contractor	• Start of construction	• Visual inspections • Method Statement	• Accepted Method Statement • Site boundaries demarcated • Signage in place
	2.	Establish a suitably fenced Site Camp at the start of the contract, which will allow for site offices, vehicle, equipment, material and waste storage areas to be consolidated as much as possible. Provide water and / or sanitary facilities at the Site Camp for personnel.				
	3.	Demarcate construction site boundaries upon establishment. Control security and access to the site. Fence off site boundaries and ensure that plant, labour and materials remain within site boundaries.				
	4.	Designate the area beyond the boundary of the site as No Go areas for all personnel on site. No vehicles, machinery, materials or people shall be permitted in the No Go area at any time.				
Safety and Security	5.	Ensure that emergency procedures (in relation to fire, spills, contamination of the ground, accidents to employees, use of hazardous substances, etc.) are established prior to commencing construction.	• EPC Contractor	• Throughout construction	• Visual inspection and approval by HSE Site Manager	• Number of safety/emergency incidents.

Construction Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
	6.	Make all emergency procedures, including responsible personnel, contact details of emergency services, etc. available to all the relevant personnel. Clearly display emergency procedures at the relevant locations around the site.				
	7.	Secure the Site Camp, particularly to restrict unauthorized access to fuels and any other hazardous substances.				
	8.	Store all construction material and equipment in locked containers within the Site Camp. Employ 24 hour security for the Site Camp if required.				
	9.	Provide suitable emergency and safety signage on site, and demarcate any areas which may pose a safety risk (including hazardous substances, deep excavations etc.).				
	10.	Advise NIMOS of any emergencies on site, together with a record of action taken.				
Environmental Awareness Training	11.	Provide environmental awareness training to all personnel on site at the start of their employment. Training should include discussion of: • Potential impact of construction waste and activities on the environment; • Suitable disposal of construction waste and litter; • Key measures in the ESMP relevant to worker's activities; • How incidents and suggestions for improvement can be reported. Ensure that all attendees remain for the duration of the training and on completion sign an attendance register that clearly indicates participants' names.	• EPC Contractor	• Before workers start working on-site • Before new activities are undertaken	• Check training attendance register • Observe whether activities are executed in line with ESMP requirements	• Proportion of workers that completed environmental training • Compliance of workers with ESMP
Complaints Register / Grievance Mechanism	12.	Continue to publicise and implement the existing Staatsolie grievance mechanism.	• HSEQU Manager • EPC Contractor • CCU	• Duration of construction activities	• Keep record of all complaints	• Register on site • Complaints followed up and closed out
Employment	13.	Procure and utilise local skills and resources wherever possible.	• Project Manager • EPC Contractor	• Duration of construction activities	• Keep record of local employees	• Percentage of local labour employed
	14.	Train local people to acquire skills required for the project.				
Hazardous materials	15.	Design and construct hazardous material storage facilities, especially fuel storage, with suitable impermeable materials and a minimum bund containment capacity equal to 110% of the largest container.	• Project Manager	• Throughout construction	• Visual inspection of hazardous materials handling and storage	• Number of incidents of non-compliance with safety procedures concerning hazardous

Construction Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
	16.	Ensure that contaminants (including cement) are not placed directly on the ground (e.g. mix cement on plastic sheeting) to prevent runoff reaching the environment.			areas	materials, including waste materials. • Number of spills of hazardous materials, including waste materials; • Cost of cleaning up spills. • Evidence of contamination and leaks.
	17.	Develop (or adapt and implement) procedures for the safe transport, handling and storage of potential pollutants.				
	18.	Avoid unnecessary use and transport of hazardous substances.				
	19.	Keep Material Safety Data Sheets for all hazardous materials on site and ensure that they are available for reference by staff responsible for handling and storage of materials.				
Vegetation clearing	20.	Limit the footprint area of the construction activity to what is absolutely essential.	• EPC Contractor	• Throughout construction	• Visual inspection	• Size of area cleared relative to development footprint • Size of area disturbed outside of construction site boundary
	21.	Designate areas outside the development footprint as No Go areas.				
	22.	Ensure that no vegetation is removed or disturbed outside the delineated construction site boundary.				
	23.	Do not harm, catch or kill birds or animals by any means, including poisoning, trapping, shooting or setting of snares.				
	24.	Safely remove and relocate any fauna that may be physically harmed by construction activities.				
Concrete/Cement Work	25.	Use pre-mixed concrete rather than batching where possible.	• EPC Contractor	• Throughout construction	• Visual inspection	• Number of incidents of batching outside works footprint • Contamination of water and soil • Visible litter / waste on site.
	26.	Ensure that no cement truck delivery chutes are cleaned on site. Cleaning operations are to take place off site at a location where wastewater can be disposed of in the correct manner. If this is not possible a suitable washing facility is to be developed on site.				
	27.	Batch cement in a bunded area within the boundaries of the development footprint only (where unavoidable).				
	28.	Ensure that cement is mixed on mortar boards and not directly on the ground (where unavoidable).				
	29.	Physically remove any remains of concrete, either solid, or liquid, immediately and dispose of as waste.				
	30.	Place cement bags in bins and dispose of bags as waste to a licensed waste disposal facility.				
	31.	Sweep / rake / stack excess aggregate / stone chip / gravel / pavers into piles and dispose at a licensed waste disposal facility.				

Construction Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
Waste management	32.	Submit a Method Statement for waste management (including hazardous waste).	• EPC Contractor	• Before start of activities on site • Throughout construction	• Availability of plan • Visual inspection of waste collection and disposal areas • Visual inspection of construction areas (litter) • Check waste disposal slips	• Monitor procedures to ensure the waste management plan is implemented. • Presence of litter • Availability of rubbish bins and skips • Degree to which rubbish bins and skips are filled • Total volume of general and hazardous waste storage capacity • Total volume of general and hazardous waste stored on site • Degree to which different waste is separated • Frequency of waste collection
	33.	Aim to minimise waste through reducing and re-using (packaging) material.				
	34.	Collect recyclables separately and deliver these to suitable facilities or arrange for collection.				
	35.	Collect all waste in bins and/or skips at the construction site.				
	36.	Prevent littering by construction staff at work sites by providing bins or waste bags in sufficient locations.				
	37.	Provide separate bins for hazardous / polluting materials and mark these clearly. Store hazardous / polluting materials on impermeable ground until it is disposed of / collected.				
	38.	Dispose of waste appropriately to prevent pollution of soil and groundwater.				
	39.	Do not allow any burning or burying of waste on site.				
Stormwater management	40.	Collect stormwater from bunded areas and treat or separate waste before disposing into surrounding drainage system.	• EPC Contractor	• Throughout construction	• Visual inspection	• Incidence of stormwater contamination • Visible leaks/ water wastage • Visible surface erosion.
	41.	Use berms and stormwater drainage systems to prevent surface run-off from entering site excavations.				
	42.	Implement measures to maximise the infiltration of stormwater on site.				
Erosion management	43.	Ensure that all roads and tracks used for construction have the appropriate water diversion / erosion control structures.	• EPC Contractor	• Throughout construction	• Visual inspection	• Visible surface erosion.
Dust management	44.	Limit vegetation clearance and the construction footprint to what is essential.	• EPC Contractor	• Throughout construction	• Visual assessment of dust plumes • Visual assessment of dust control measures	• Visibility of dust coming off construction site • Dust mitigation measures in place • Number of days that dust plumes are visible • Number of registered complaints • Size of disturbed areas
	45.	Regularly evaluate the effectiveness of all dust management measures. Amend how or which measures are used if necessary.				
	46.	Stabilise exposed surfaces as soon as is practically possible.				
	47.	Minimise dust generated on gravel sections of the Panday Gangaram Road: • Dampening dust-generating sections of the road; • Adhering to speed limits; and • Responding to complaints.				
	48.	Limit vehicle speeds to 40 km/h on unconsolidated and non-vegetated areas.				

Construction Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
	49.	Cover trucks transporting loose material to or from site with tarpaulins, plastic or canvas if necessary, to avoid dust.				
	50.	Ensure that any material spilled from trucks during transport to or from the site is cleaned up immediately.				
	51.	Limit the number of vehicles allowed on-site and restrict the movement of these vehicles over unsurfaced or unvegetated areas once they are on site to reduce dust problems.				
	52.	Reduce airborne dust at construction sites through dampening dust-generating areas, roads and stockpiles with water.				
	53.	Sweep roads at site entrance and exit points regularly, to prevent the spread of mud / dust by construction vehicles.				
Noise management	54.	Maintain all generators, vehicles and other equipment in good working order to minimise exhaust fumes and excess noise.	• EPC Contractor	• Throughout construction	• Random machinery checks	• Number of registered complaints
	55.	Enclose diesel generators used for power supply on site to reduce unnecessary noise.				
	56.	Investigate potential noise reduction measures, such as mufflers on equipment, if complaints regarding construction noise are received.				
Fire Management	57.	Ensure that no fires are permitted on or adjacent to site except in areas designated for this purpose. Any such designated areas should be situated as far as possible from flammable material stores any other high fire risk, or environmentally sensitive areas.	• EPC Contractor	• Throughout construction	• Inspect attendance register for training sessions; and • Inspect fire extinguishers and certificates.	• Number of fire incidents • Certified extinguishers in appropriate locations.
	58.	Ensure that no smoking is permitted on the site except for within a designated area in the Site Camp (to be included in the Site Camp Method Statement). Suitable firefighting equipment must be readily available in this area.				
	59.	Ensure that sufficient fire-fighting equipment is available on site.				
	60.	Equip all fuel stores and waste storage areas with fire extinguishers.				
	61.	Ensure that all personnel on site are aware of the location of firefighting equipment on the site and how the equipment is operated.				
	62.	Suitably maintain firefighting equipment.				
Transportation and refuelling	63.	Undertake regular maintenance of vehicles and machinery to identify and repair minor leaks and prevent equipment failures.	• EPC Contractor	• Throughout construction	• Visual inspection of vehicles, machinery	• Number of incidents of

Construction Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
	64.	Undertake any on-site refuelling and maintenance of vehicles/machinery in designated areas. Line these areas with an impermeable surface and install oil traps.			and refuelling/maintenance areas	non-compliance • Number of leaks and spills • Cost of cleaning up spills.
	65.	Use appropriately sized drip trays for all refuelling and/or repairs done on machinery – ensure these are strategically placed to capture any spillage of fuel, oil, etc.				
	66.	Clean up any spills immediately, through containment and removal of free product and appropriate disposal of contaminated soils				
	67.	Keep spill containment and clean-up equipment at all work sites and for all polluting materials used at the site.				
Fauna Management	68.	Do not harm, catch or kill birds or animals by any means, including poisoning, trapping, shooting or setting of snares.	• EPC Contractor	• Duration of construction activities	• Visual Inspection	• Number of animals harmed • Time period trenches are left open • Number of incidents of animals found in trenches.
	69.	Backfill trenches as soon as pipes have been laid to ensure that the time the trench is exposed is kept to a minimum.				
	70.	Open trenches must be inspected on a daily basis for animals which may have fallen or become trapped.				
	71.	Safely remove and relocate any fauna that may be physically harmed by construction activities.				
Protection of archaeological and paleontological resources	72.	Compile and implement a chance (archaeological) finds procedure.	• EPC Contractor	• Duration of construction activities	• Chance finds procedure compiled and implemented	• Number of chance finds
Ablution facilities	73.	Provide ablution facilities (i.e. chemical toilets) for all site staff at a ratio of 1 toilet per 15 workers (absolute minimum 1:25).	• EPC Contractor	• Throughout construction	• Visual inspections • Records of waste disposal	• Number of incidents of staff not using facilities • Number of pollution incidents
	74.	Secure all temporary / portable toilets to the ground to prevent them toppling due to wind or any other cause.				
	75.	Maintain toilets in a hygienic state (i.e. toilet dispensers to be provided, toilets to be cleaned and serviced regularly (at least "twice- monthly" by an appropriate waste contractor), and toilets to be emptied before long weekends and holidays).				
	76.	Instruct/ appoint an appropriate Sub-Contractor to remove accumulations of chemicals and treated sewage from the site and dispose of at an approved waste disposal site or sewage plant.				
	77.	Ensure that no spillages occur when the toilets are cleaned or emptied. Repeated incidents of spillage of chemicals and or waste (i.e. more than one incident), will require toilets to be placed on a solid base with a sump.				

Construction Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
Response to environmental pollution	78.	In the event of environmental pollution, e.g. through spillages, immediately stop the activity causing pollution	• EPC Contractor	• Throughout construction	• Maintain register of pollution events and response • Following resumption of activities, frequently inspect repaired equipment to ensure proper functioning	• Number of incidents • Time activities stopped • Number of recurring incidents • Availability and completeness of register
	79.	Only resume activity once the pollution has been halted or (in the case of spillages), captured without reaching the environment.				
	80.	Repair faulty equipment as soon as possible.				
	81.	Install additional bunding / containment structures around the equipment that was the source of the leak / spillage to prevent pollution.				
	82.	Treat hydrocarbon spills, e.g. during refuelling, with adequate absorbent material, which then needs to be disposed of at a suitable landfill.				
Construction site rehabilitation and closure	83.	Remove all construction equipment, vehicles, equipment, waste and surplus materials, including site offices, temporary fencing and other facilities, from the site.	• EPC Contractor	• Once construction is complete; or • Throughout construction if it takes place in phases / different areas sequentially	• Visual inspection of site • Keep record of rehabilitation measures	• Rehabilitation forms an integral part of operations from start-up • Construction sites fully rehabilitated within five years
	84.	Clean up and remove any spills and contaminated soil in the appropriate manner.				
	85.	Ensure that no discarded materials are buried on site or on any other land not designated for this purpose.				
	86.	Ensure that affected areas are rehabilitated following construction.				
	87.	Rehabilitate areas adjacent to the site (if disturbance is unavoidable) to at least the same condition as was present prior to construction.				
	88.	Rehabilitate any disturbed areas as soon as construction in the area is complete.				
	89.	Rehabilitate all project areas as soon as possible after completion of activities in each area, including removing and/or remediating any contaminated soils.				

Table 3-3: Environmental management and mitigation measures that must be implemented during the *Operational* Phase

Operational Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
Plant maintenance	1.	Implement a power plant maintenance programme in line with international standards and Staatsolie guidelines.	• Staatsolie Operations	• Throughout operations	• Regularly audit	• Compliance with relevant

Operational Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
	2.	Perform regular internal and external audits of the power plant maintenance programme to ensure it is implemented effectively, at least once every two years.	Manager		programmes	programmes • Regular audits
	3.	Regularly inspect all machinery and holding tanks for leaks or damages.			• Visually inspect areas inside and outside the plant for pollution	• Number of contaminations noted on site
	4.	Repair any defects as soon as possible. In the case of leaks, ensure that the leaking water or effluent is captured and not released into the environment.				
	5.	Operate the power generating units according to design specifications and manufacturer's instructions to meet the emission limits.			• Maintenance records • Records of exhaust emissions testing	• Meeting emission limits
	6.	Regularly maintain the power plant to minimise exhaust emissions.				
	7.	Test exhaust emissions on power generating units once they are fully operational, to confirm emission rates and compliance with equipment manufacturer emission specifications.				
	8.	Implement design measures as specified and intended (e.g. closed-circuit cooling water and lubrication system, treatment of used oil and appropriate bunding of the facility).				
Waste management	9.	Develop a waste management plan, laying out: • Expected type and amount of waste; • Measures to reduce waste; • Type and expected volume of recyclable waste; • Recycling facilities that will collect / receive waste; • Type of storage for different waste types; • Waste contractors that will collect waste; and • Monitoring procedures to ensure the waste management plan is implemented.	• Staatsolie Operations Manager	• Throughout operations	• Regular audits against plan	• Availability of plan • Extent to which plant is complied with
	10.	Aim to minimise waste through reducing and re-using (e.g. packaging) material.		• Throughout operations • Before start of operations	• Visual inspection of waste collection and disposal areas • Visual inspection of construction areas (litter) • Check waste disposal slips	• Presence of litter • Availability of rubbish bins and skips • Degree to which rubbish bins and skips are filled • Total volume of general and hazardous waste storage capacity • Total volume of general
	11.	Collect recyclables separately and deliver these to suitable facilities or arrange for collection.				
	12.	Collect all waste in bins and/or skips. Prevent littering by staff at work sites by providing bins or waste bags in sufficient locations.				
	13.	Provide separate bins for hazardous / polluting materials and mark these clearly.				

Operational Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
	14.	Store hazardous / polluting materials on impermeable ground until it is disposed of / collected.				and hazardous waste stored on site • Degree to which different waste is separated • Frequency of waste collection
	15.	Dispose of waste appropriately to prevent pollution of soil and groundwater.				
	16.	Do not allow any burning or burying of waste on site.				
Stormwater management	17.	Capture stormwater that might be contaminated separately and route to a settling pond where suspended matter can settle out. Dispose of such matter appropriately, e.g. to an approved landfill, and not into the environment.	• Staatsolie Operations Manager	• Throughout operations	• Visually inspect stormwater runoff and drains	• Extent to which stormwater is captured in drains • Extent to which stormwater avoids polluting areas
	18.	Keep outside areas clean to minimise the potential of polluting stormwater.				
Hazardous materials	19.	Utilise hazardous material storage facilities, especially fuel storage, with suitable impermeable materials and a minimum bund containment capacity equal to 110% of the largest container.	• Staatsolie Operations Manager	• Throughout operation	• Visual inspection of hazardous materials handling and storage areas	• Number of incidents of non-compliance with safety procedures concerning hazardous materials, including waste materials • Number of spills of hazardous materials, including waste materials • Cost of cleaning up spills • Evidence of contamination and leaks
	20.	Ensure that contaminants (including cement) are not placed directly on the ground (e.g. mix cement on plastic sheeting) to prevent runoff reaching the marine environment.				
	21.	Develop (or adapt and implement) procedures for the safe transport, handling and storage of potential pollutants.				
	22.	Avoid unnecessary use and transport of hazardous substances.				
	23.	Keep Material Safety Data Sheets for all hazardous materials on site and ensure that they are available for reference by staff responsible for handling and storage of materials.				
Transportation and refuelling	24.	Undertake regular maintenance of vehicles and machinery to identify and repair minor leaks and prevent equipment failures.	• EPC Contractor	• Throughout operation	• Visual inspection of vehicles	• Number of incidents of non-compliance • Number of leaks and spills • Cost of cleaning up spills
	25.	Undertake any on-site refuelling and maintenance of vehicles/machinery in designated areas with an impermeable surface.				
	26.	Clean up any spills immediately, through containment and removal of free product and appropriate disposal of contaminated soils.				
	27.	Keep spill containment and clean-up equipment at all work sites and for all polluting materials used at the site.				
Employment	28.	Consider maximising the employment of local workers.	• HR manager	• Throughout operation • Before new workers start for the first time • Before new activities are	• Keep record of staff by origin • Attendance registers of training sessions	• Number of Suriname nationals employed
	29.	Work closely with the local community to identify and communicate required skills and resources that the local community could provide.				

Operational Phase Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
	30.	Consider purchasing resources from Surinamese sources wherever feasible.		undertaken	• Keep record that measure was considered and why it was (not) implemented	
Response to environmental pollution	31.	In the event of environmental pollution, e.g. through spillages, immediately stop the activity causing the pollution.	• Staatsolie Operations Manager	• Throughout operations	• Maintain register of pollution events and response • Following resumption of activities, frequently inspect repaired equipment to ensure proper functioning	• Number of incidents • Time activities stopped • Number of recurring incidents • Availability and completeness of register
	32.	Only resume activity once the pollution has been halted or (in the case of spillages), captured without reaching the environment.				
	33.	Repair faulty equipment as soon as possible.				
	34.	Install additional bunding / containment structures around the equipment that was the source of the leak / spillage to prevent pollution from reaching the environment in future.				
	35.	Treat hydrocarbon spills, e.g. during refuelling, with adequate absorbent material, which then needs to be disposed of at a suitable landfill.				
	36.	Notify NIMOS within one day of an environmental pollution event.				

3.2 PHYSICAL MONITORING FRAMEWORK

The key focus of the monitoring program will be the impacts from the various project activities on the environment at representative sites and at any sites where problems have arisen or are suspected. This will provide information on the accuracy of the impact predictions that were made and on the effectiveness of the ESMP. It will also provide important input information for any future development activities in similar areas.

The primary variables to be addressed in the monitoring program will be air quality (recommended once-of off campaign), noise (recommended once-of off campaign) and surface water quality. The monitoring framework program is presented in Table 3-2. Based on this framework the HSEQ Upstream Manager should set up a documented sampling program.

Table 3-4: Monitoring framework programme for the Saramacca Power Plant Project

Aspect	Parameters	Frequency	Monitoring locations
Air quality	Ambient SO_2 and NO_2	Once off during Operations	To be decided with HSEQ Upstream Manager
Noise	Ambient Noise Levels	Once off Operations	To be decided with HSEQ Upstream Manager
Water quality	EC (field meter) or chlorides, TSS or turbidity, or Secchi Colour and clarity	Monthly for 6 months and thereafter in case of accidents.	To be decided with HSEQ Upstream Manager

Appendices

Appendix A: Method Statement

METHOD STATEMENT

SOM DEPARTMENT:……. **DATE:**……

PROPOSED ACTIVITY (give title of Method Statement and reference to Environmental specification):

WHAT WORK IS TO BE UNDERTAKEN (give a brief description of the works):

WHERE ARE THE WORKS TO BE UNDERTAKEN (where possible, provide an annotated plan and a full description of the extent of the works):

START AND END DATE OF WORKS FOR WHICH METHOD STATEMENT IS REQUIRED:

Start Date:	End Date:

HOW ARE THE WORKS TO BE UNDERTAKEN (provide as much detail as possible, including annotated maps and plans where possible):

In case on private land: include signature of owner/user to show that he/she is aware

Please attach extra pages if more space is required

Appendix B: ESMP Checklist

Weekly Checklist

To be submitted to the HSEQU Division

Location:

Mitigation measure	Yes/No	Comments
All personnel on site are aware of the contents of the ESMP and were made aware of environmental issues.		
All personnel on site are aware of the ERPs		
All personnel on site are aware of the drugs and alcohol policy		
MSDS's are available for all hazardous substances on site.		
Drip trays are being used where there is a risk of spillage (i.e. fuelling of equipment).		
Fuel is stored in a bunded area (with 110% of the stored fuel volume) and no leaks are visible.		
All containers and storage tanks are leak proof		
There are no spills and leakages		
The clearing width of new trails is as specified		

Mitigation measure	Yes/No	Comments
No animal kills have been reported		
Waste is collected in appropriate bins/areas and removed to a suitable landfill regularly.		
Firefighting equipment is functional and accessible.		
Spill response equipment and materials is functional and accessible.		
There is no trespassing by project personnel		
There is no trespassing by unauthorized persons		
There are no complaints from the community		
Any other observations or comments.		

Department delegate

Completed by: ……

Date: …….

Sign: ……..

Environmental Engineer

Received and checked by: ……

Date: …….

Sign: ……..

Appendix C: Water quality monitoring form

Area	
Date	
Monitored by	
Weather conditions	

Sample name	Eco-system	Coordinates (UTM/WGS84)		Sampling time	Water level (cm)	pH	EC µS/cm	chlorides (mg/L)	TESMP gr C	Color	Clarity	Turbidity NTU	Oil & Grease (mg/L)
		Easting	Northing										
	Standard				N/A	N/A	<1,765	<600	N/A				<10

T = Typha (Langagrasi)
FO = Freshwater Open Swamp
SW = Swampwood

Environmental Engineer/ HSE technician

Received and checked by: ……

Date: …….

Sign: ……..

Appendix D: Weekly Waste Report

Contractor's name :
Project :
Location :
Period :
Reported by :

Waste type	Quantity	Unit: m3 or kg	Disposal destination
Waste paper			
Packaging material			
PET/ HDPE			
Food waste			
Ink cartridges			
Waste metal			
Waste concrete			
Waste oil			
Oil contaminated sorbents			
Oil contaminated pails			
Oil contaminated barrels			
Waste oil filters			
Mud waste water			
General/ miscellaneous waste			

Appendix E: Overeenkomst inzake mijnbouwwerkzaamheden.

OVEREENKOMST

TOEGANG TERREINEN VOOR HET VERRICHTEN VAN MIJNBOUWWERKZAAMHEDEN

De ondergetekenden:

Staatsolie Maatschappij Suriname N.V., gevestigd aan de Dr. Ir. H.S. Adhinstraat 21 te Paramaribo, ten deze vertegenwoordigd door haar Algemeen Directeur dhr. M.C.H. Waaldijk, hierna te noemen **"Staatsolie"**

en

, houder van ID kaart nummer en wonende aan de te , hierna te noemen **"Gerechtigde"**

In overweging nemende:

- dat bij Decreet E-8B (S.B. 1980 nr. 128) aan Staatsolie concessie is verleend tot het verrichten van werkzaamheden verbandhoudende met de opsporing en ontginning van koolwaterstoffen,

- dat in gevolge het Decreet Mijnbouw (S.B. 1986 no. 28), Gerechtigde en derdebelanghebbenden werkzaamheden die hiermee verband houden moeten gedogen,

Verklaren het volgende overeen te komen:

Artikel 1

Gerechtigde is de .....van het perceelland, gelegen in het district ..... en nader omschreven op de kaart van landmeter d.d. (bijlage 1). Bijlage 1 maakt integraal deel uit van de overeenkomst. Gerechtigde zal een deel van dit perceelland, groot .....ter beschikking stellen aan Staatsolie voor het verrichten of doen verrichten van werkzaamheden voortvloeiende uit het recht verkregen door Staatsolie vanwege Decreet E-8B, gedurende de periode ..... tot .....

Artikel 2

Staatsolie zal Gerechtigde vergoeden de schade onmiddellijk veroorzaakt door de bovengenoemde werkzaamheden. Deze vergoeding is, afhankelijk van het geval, gebaseerd op taxatie van LVV of andersoortige uit te voeren taxaties, en zal indien van toepassing in een nadere overeenkomst vastgelegd worden.

Artikel 3

Partijen zullen indien nodig tijdens de uitvoering van de werkzaamheden met elkaar in overleg treden voor nadere afspraken met betrekking tot de utvoering van bovengenoemde werkzaamheden

Artikel 4

Visuele oriëntatie van de staat van bovengenoemd perceelland vóór de aanvang van de werkzaamheden heeft het navolgende doen constateren:

-
-
-

Artikel 5

Staatsolie zal ten behoeve van de mijnbouwwerkzaamheden de volgende aanpassingen plegen op bovengenoemd perceelland:

-

-

-

Artikel 6

Deze overeenkomst is van kracht jegens Gerechtigde, zijn rechtsverkrijgers en rechtsopvolgers. Gerechtigde is gehouden bij de verkoop en overdracht in eigendom van het geheel of een gedeelte van het in de considerans omschreven perceel, alsmede bij verlening daarop van enig zakelijk genotsrecht, aan de nieuwe eigenaar of zakelijk gerechtigde ten behoeve van Staatsolie, alle de in deze overeenkomst opgenomen verplichtingen, over te dragen.

Artikel 7

Staatsolie is gehouden om conform het door het Nationaal Instituut voor Milieu en Ontwikkeling in Suriname (NIMOS) goedgekeurde Environmental Management Plan bij beëindiging van de mijnbouwwerkzaamheden het perceelland te rehabiliteren, zulks in overleg met Gerechtigde.

Artikel 8

Na het verrichten van de mijnbouwwerkzaamheden door Staatsolie zal het perceel als volgt worden overgedragen:

-

-

-

Aldus overeengekomen en in tweevoud opgemaakt en ondertekend te Paramaribo op …… .....

Staatsolie Maatschappij Suriname N.V. Gerechtigde

_____ _____

R. Elias
Managing Director

Appendix F: List of applicable GFIs

GFI no	Subject	Scope
	Section 1 **ADMINISTRATIVE**	
104N	**Security Rules for Saramacca Operations** Dutch	This instruction outlines the security rules and regulations applicable to the Saramacca Operations for the different groups concerned.
105(N)	**Routine Safety Talks.** English/Dutch	This instruction formalizes the dissemination of information through regular meetings, approximately ten minutes long, commonly called "Toolbox Meetings" or "Safety Talks".
106	**HSE and Security Induction for New Arrivals.** English	This instruction describes the management of the system that controls HSE and Security Induction through which every new arrival is made familiar with the company's health, safety, environmental and security requirements as they relate to the activity that they are about to undertake.
109(N)	**Code of dress for industrial areas.** English/Dutch	This General Field Instruction outlines the type of clothing and minimum personal protective equipment (PPE) for the ESMPloyees and visitors present at Staatsolie industrial workplaces.
110	**Incident Reporting.** English	This instruction details the process for the reporting of incidents, which initiate the investigation of these incidents. Incidents are reported and recorded for, Mitigating of consequences; Preventing recurrence; Monitoring performance; Satisfying statutory requirements and for Insurance claims.
119C	**Personal Protective Equipment and Dress Code.** English/Dutch	This GFI identifies the most common types of personal protective equipment for the various locations on the Saramacca Field.
120C	**General traffic rules.** English/Dutch	This GFI defines the general traffic rules to guide the performance of company ESMPloyees, contractor's ESMPloyees and visitors while on company roads. It also defines rules for the behavior of drivers of company owned and rented vehicles on public roads.
126	**Safe Use of Mobile Communication Devices.** English	This instruction provides guidance to the safe use of mobile Communication Devices in order to minimize hazards that are introduced with it.
130(N)	**Formatting of Work instructions.** English/Dutch	This GFI guides the process of selecting activities for which Work Instructions must be written and the formatting of the instructions.

GFI no	Subject	Scope
131	**Guidelines for Departmental HSE Teams.** English	This GFI outlines the terms of reference and composition of the Departmental HSE Teams which are intended to assist the departmental head in the execution of the departmental HSE program and to achieve workers participation.
132	**Contractor Health, Safety and Environmental Management** English	This GFI provides guidance to Staatsolie staff in promoting and managing HSE performance of Contractors.
Section 2 JOB SAFETY INSTRUCTIONS		
200(N)	**Permit to work system - General.** English/Dutch	This GFI provide guidelines to the process of "the Permit to Work system" that is in force at the Saramacca Operations, so designed: That one central authority knows all activities that are intended to take place at any location and, To ensure that adequate precaution is taken and that the condition of the equipment on which the work was done is safe for returning it to service.
201(N)	**Permit to work system - Hot work.** English/Dutch	This GFI covers the aspect of the Permit to Work System that deals with the permitting of Hot Work.
202(N)	**Permit to work system - Confined space entry.** English/Dutch	This GFI covers the aspect of the Permit to Work that covers the special precautions that must be taken to protect workers, required to enter vessels and other confined spaces, from the risks associated with this type of work.
203(N)	**Permit to work system - Excavation.** English/Dutch	The Excavation Certificate controls the special precautions that must be taken when excavating is requested.
210(N)	**Handling of Hazardous Chemicals.** English/Dutch	This instruction describes the management system for the selection, handling and disposal of all hazardous chemicals used by Staatsolie.
214(N)	**Isolation, Lockout and Warning Tags.** English/Dutch	This procedure establishes guidelines to prevent personal injury and property damage due to an unexpected release of energy or hazardous materials.
215	**Management of Change Procedure** English	This General Field Instruction provides guidelines in how to manage division cross-bordering changes at the Saramacca Operations that might create safety hazards for others than the originating division of the intended change.

GFI no	Subject	Scope
225(N)	**Storage, Transportation and handling of Compressed, liquefied and pressurized gasses.** English/Dutch	This GFI handles the general guidelines for safe storage, transportation and the handling of gas bottles. The most common industrial gasses, which are used by Staatsolie, are oxygen, acetylene, nitrogen, propane (LPG), butane and carbon dioxide.
228(N)	**Abrasive Blasting.** English/Dutch	This instruction provides guidelines for the protection of personnel engaged in abrasive blasting and others who may be in the surrounding areas where abrasive blasting is conducted.
229(N)	**Spray painting.** English/Dutch	This instruction provides guidance for the safe use of spray painting whereby care must be taken to protect the workers involved, other personnel in the vicinity, nearby equipment and the environment.
230	**Housekeeping** English	This document provides guidance to ESMPloyee's to ensure that proper housekeeping is maintained.
232	**Job Safety Analysis** English	Job Safety Analysis is a proven method that evaluates a sequence of job steps or tasks to identify and document potential hazards and to take countermeasures to protect workers' health and safety against those hazards. This instruction provides guidance for conducting a Job Safety Analysis.
233	**Safety Color Codes**	This instruction establishes the requirements for a uniform visual system for marking potential hazards, and provides an effective means of communicating hazard information to the ESMPloyees & contractors, in order to reduce the likelihood of injury from potential hazards in the work environment. It defines the color codes of signs, tags and barricades to be used in controlling exposure to potential hazards, and specifies requirements for design uniformity to promote ESMPloyee recognition and avoidance of hazards.
Section 3 EMERGENCY RESPONSE		
305(N)	**Emergency Response - Injury / Illness**. English/Dutch	This instruction describes the procedure that needs to be followed when an emergency situation at the Staatsolie Saramacca Location turns up.

GFI no	Subject	Scope
	Section 4 **EQUIPMENT STANDARDS AND SPECIFICATIONS**	
400	**Inspection of Fire Protection and Emergency Equipment.** English	This GFI provides departments and divisions of the Saramacca Operations with procedures for the inspection of Fire protection and Emergency Equipment, which must be in good condition at all time.
405	**Scaffolding Rules** English	This GFI provides the guidelines of erecting tubular scaffolding.
408(N)	**Protection from lead in lead-based paints.** English/Dutch	This instruction is intended to curtail the use of and provide protection when there is a possibility of exposure to lead-based paint.
410(N)	**Care of Gas Detection Instruments.** English/Dutch	This instruction provides guidelines for care of gas detection instruments.
	Section 6 **ENVIRONMENT PROTECTION**	
611(N)	**Solid waste handling and disposal.** English/Dutch	This instruction provides guidance for solid waste handling and disposal requirements for waste listed in the appendix of this field instruction.
612	**Handling and Disposal of spent dry cell batteries and used toner cartridges.** English	This instruction provides guidance for the reduction and the disposal of spent dry cell batteries and toner cartridges in an effective and responsible manner. This is a way to manage waste, generated in oil exploration, production and refining related activities and processes, properly in order to minimize its potential to cause harm to health and the environment and to minimize the risk of potential liabilities.

Appendix G: Project Waste Management Plan

Table of Contents

1.0 Introduction

In order to manage the waste generated during the project this Waste Management Plan has been prepared. All employees, including Staatsolie and contractors, shall manage waste generation through implementation of the waste hierarchy, where avoidance and minimization of waste are the mostly preferred.

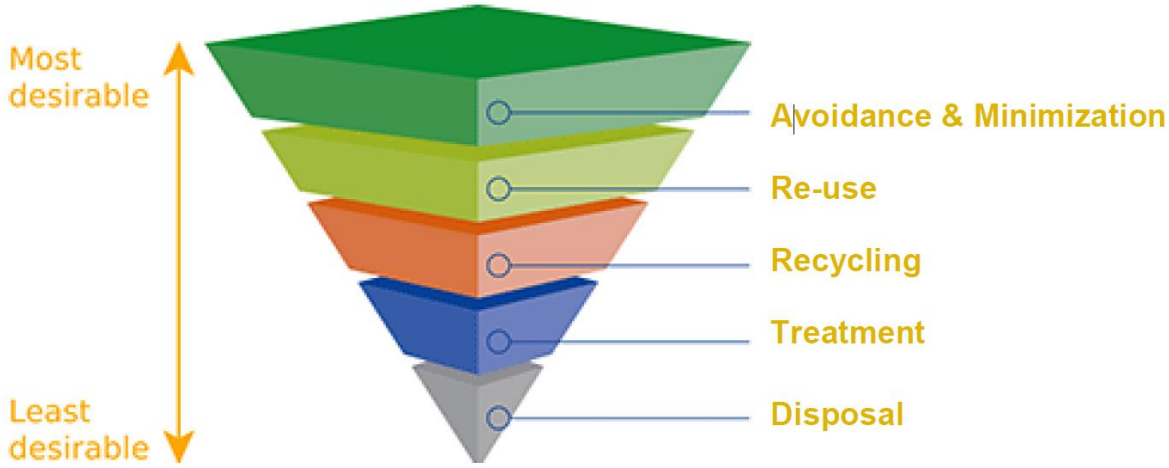

Figure I-1: Waste Management Hierarchy

2.0 Scope

This waste management plan applies to the activities carried out for the Power Plant Project in Saramacca.

3.0 Terms and Definitions

Waste Generator	The department/employee carrying out the activity, which results in the material becoming surplus and being designated for discarding.
Hazardous waste	Any wastes, which because of its quantity, physical, chemical or infectious characteristics have the potential to cause harm to human health or the environment.
Waste Avoidance and minimization	Waste avoidance and minimization are at the top of the waste hierarchy. Avoidance is mostly preferred in the list of waste hierarchy where zero waste is generated. Slight modifications in activities can improve efficiencies in utilizing to reduce waste generation e.g. reducing paper waste by printing double sided.
Reuse	The action or practice of using something again, whether for its original purpose (conventional reuse) or to fulfill a different function (creative reuse or repurposing).
Recycling	Involves processing used waste materials into new products.
Treatment	Waste treatment refers to the activities required to ensure that waste has the least practicable impact on the environment.
Disposal	Wastes that cannot be reused, recycled or treated will be segregated and stored in

	designated waste storage areas for incineration, disposal in a landfill or for collection by a waste transporter.
Landfill	Site for the disposal of waste materials by burial.

4.0 Responsibilities

Functionary	**Responsibility**
Employees/Departments Staatsolie (Waste Generator)	• Ensure that practices are conducted to avoid unnecessary waste generation by prevention, minimization and reuse of waste. • Separate reusable, recyclable and other waste by placing them in therefore labeled waste bins. • Remove all waste from the Uitkijk North Area.
Manager Lifting, Gathering & Transport Drilling operations Manager	• Implementation of mitigation measures as provided in chapter 3 of the ESMP.
HSEQ Upstream Manager	• Advice on the management of waste that are not covered by this plan. • Manage and analyze waste data and provide advice on improvements of waste management within the company. • Monitor and report on the implementation of this plan.

5.0 Waste management

Waste segregation

To effectively implement the waste management hierarchy, segregation of waste streams at the source is essential. Therefore the appropriate and clearly labeled waste bins have to be provided at strategic locations.

Waste collection, transport, storage and handling

The waste will be stored temporarily on site and then collected and transported to the waste handling facilities of Staatsolie, including the Sarah Maria dumpsite and the landfarm.

Waste Management (disposal/treatment)

Waste category	**Waste Type**	**Waste Management**
Office	PET bottles	Recycling (AMRECO)
	Paper	Open burning; Staatsolie is in the process to separate paper waste for recycling by AMRECO
	Copy/print cartridges	Export (BAP)
Industrial	Packaging material	Open burning; Staatsolie is in the process to construct a landfill, including an incinerator
	Metal scrap	Recycling (COBO)

	Batteries	Export (BAP)
	Waste oil (lubricating oil, hydraulic oil)	Oil is currently stored in portafeeds at the Landfarm of Staatsolie. Staatsolie is in the process to check if the waste can be send to EQ Recycling. On the other hand Staatsolie plans to construct a treatment system (centrifuge + decanter) to treat the oil at the landfarm.
	Rags/gloves contaminated with oil	Open burning; Staatsolie is in the process to construct a landfill, including an incinerator

Special waste:

- Sewage waste from the portable toilets is collected and dumped in a septic tank on dry land. This waste is handled by a contractor of Staatsolie (Uitzendbureau Sarah Maria).

Appendix H: Handling of spills and leakage

1.0 Introduction and scope

Oil / hydrocarbon spills can occur due to human errors, equipment failures and bypassing maintenance procedures.

This plan is applicable for the Saramacca Power Plant Project and is based on the existing procedures and plans of Staatsolie with regards to oil spill preparedness and response.

2.0 Prevention of oil spills

Prevention of spills has a lot to do with operational procedures. Following the maintenance procedures and operations protocols ensures a safe operation. The latter aids in the goal to prevent occurrence of oil spills within the implementation process of the company's HSEQ policy and core values.

3.0 Minimize impact on the environment

In order to minimize the impact on the environment, in case of an oil spill, the following measures will be implemented:

- Daily monitoring by operators.
- Markings and signs will be placed to indicate the locations of the pipelines. Guards will be placed for the protection of the manifolds.
- Maintenance activities as required.

4.0 Response

In case of an accidental spill or leak, the response will be as follows:

- Notification
    - Notify relevant parties (in accordance with the "Melding procedure" – Figure J-1).

- Containment activities
    - Place sorbents for later removal.

- Reclaiming and clean-up activities
    - Recover contaminated soil.
    - Transport contaminated soil to the Landfarm facility of Staatsolie, for treatment.
- Monitoring
    - n/a.

MELDINGSPROCEDURE

Staatsolie Oil Spill Response Team

t.b.v.

Upstream

1. Indien U melding krijgt van een oil spill, handel dan als volgt:

Vraag de melder naar:

- Locatie en omvang van de olievlek
- Naam, adres en telefoonnummer van de melder in geval van een buitenstaander
- Naam en afdeling in geval van een Staatsolie employee
- Overige bijzonderheden zoals: eventuele schade of persoonlijke ongelukken, de richting waar de olie naartoe gaat en of de spill toeneemt

2. Indien het een spill betreft op Saramacca, bel of meld de Head Guard van Saramacca en geef de informatie door:

Head Guard:

- Internelijn: 444#
- Buitenlijn: 375222 tst 444#

3. De Head Guard meldt vervolgens de desbetreffende afdeling en vraagt voor verificatie van de informatie:

- Gedurende werktijd, via het kantoor van de desbetreffende afdeling
- Na werktijd en in het weekend, de desbetreffende afdelings standby operator (zie lopende roosters)

OPERATIONELE AFDELINGEN

Locatie	Telefoon Kantoor
CS	68847, 63217, 63217
JS	67870, 67871, 67874, 67877
SM & LP	65840, 65846
CT TA-58	65870, 65873, 65876
FP TA-58/45	65840, 65844, 65843
Calcutta/ Huwz	68840, 68844, 68856, 68857
TNW	68848, 68849, 68872, 68873

4. Na verificatie wordt in geval van:

- Een kleine spill, deze door de operationele afdeling direct aangepakt
  Actie: Afdelingsleiding of Shift Foreman

- Een grote spill in openbaar water of op de openbare weg, door een Strike Team lid , of de afdelingsleiding aan de Guard gevraagd om het SORT lid conform het wachtdienstrooster te melden. Bij geen response van dit lid, moet steeds het volgend SORT-lid op het wachtdienstrooster worden gebeld.
  Actie: SORT leden

SORT-LEDEN

Functionaris	Telefoon Kantoor	Thuis
P. Brunings	66502	08515353
H. Chin A Lien	66480	08583122
R. Parran	68844	08923766
S. Gopal	65843	0374072 / 08683973
A. Schuitemaker	66850	431974 / 08660070
S. Cheuk A Lam	65873	400275 / 08749000
D. Riedewald	65840	08814953
C. Monsels	65220	08727224
S. Oedit	66553	08854311
A. Entingh	68847	328998 / 08591345
S. Mangalsing	66714	08710554

5. Indien het een spill betreft op TLF of bij de pipeline TLF-Paranam wordt de Guard van TLF door de Head Guard van Saramacca hiervan op de hoogte gebracht.

Head Guard TLF: - Telefoon: 480501 tst 62235
- Telefoon: 486294 tst 62235

Figure J-1

Environmental and Social Impact Assessment for Proposed Staatsolie Power Plant in Saramacca, Suriname

Environmental and Social Impact Assessment Report

Report Prepared for

Staatsolie Maatschappij Suriname N.V.

SRK Report Number 532091/3

Report Prepared by

srk consulting

February 2019

Environmental and Social Impact Assessment for Proposed Staatsolie Power Plant in Saramacca, Suriname

Environmental and Social Impact Assessment Report

Staatsolie Maatschappij Suriname N.V.

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SRK Project Number 532091

February 2019

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Profile and Expertise of Consultant

SRK Consulting (South Africa) Pty Ltd (SRK) has been appointed by Staatsolie Maatschappij Suriname N.V. (Staatsolie) to undertake the Environmental and Social Impact Assessment (ESIA) process required for the proposed new 36MW thermal power plant in Saramacca, Suriname.

SRK Consulting was established in 1974 and comprises over 1 300 professional staff worldwide, offering wide-ranging expertise in the natural resources and environmental sectors. SRK's Cape Town environmental department has a proven track record of managing large, complex environmental and engineering projects in the Western Cape, Africa and internationally, including in Suriname, amongst others for the SPCS Power Plant Expansion, EBS Power Plant, Staatsolie Refinery Expansion and Bakhuis Mining and Transportation Projects. SRK has rigorous quality assurance standards and is ISO 9001 certified.

The qualifications and experience of the key independent environmental consultants undertaking the ESIA are detailed below.

Project Director and Reviewer: Christopher Dalgliesh, BBusSc (Hons); MPhil (EnvSci)
Chris Dalgliesh is a Partner and Principal Environmental Consultant with over 25 years' experience, primarily in South Africa, Southern Africa, West Africa and South America (Suriname). Chris has worked on a wide range of projects, notably in the natural resources, Oil & Gas, energy generation, infrastructure and industrial sectors. He has directed and managed numerous Environmental and Social Impact Assessments (ESIAs) and associated management plans, in accordance with international standards. He regularly provides high level review of ESIAs, frequently directs Environmental and Social Due Diligence studies for lenders, and also has a depth of experience in Strategic Environmental Assessment (SEA). He holds a BBusSci (Hons) and MPhil (Environmental Management).

Project Manager: Sue Reuther, BSc Hons (Econ); MPhil (EnvMgt)
Sue Reuther is a Principal Environmental Consultant and Associate Partner with more than 15 years of experience researching and working on issues in the environmental assessment sector. She has been involved in a variety of ESIAs, as well as due diligence reviews against IFC and World Bank Standards.
Sue has managed projects across South Africa and sub-Saharan Africa, in Israel and Suriname for a range of sectors, including mining, infrastructure, industrial and coastal developments, power generation, aquaculture and oil and gas. Sue has two years of previous experience in strategy and financial research and assessment (London). She holds a BSc (Hons) in Economics and MPhil (Environmental Management).

Statement of SRK Independence

Neither SRK nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK.

SRK has no beneficial interest in the outcome of the assessment which is capable of affecting its independence.

Disclaimer

The opinions expressed in this report have been based on the information supplied to SRK by Staatsolie. SRK has exercised all due care in reviewing the supplied information, but conclusions from the review are reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

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Acronyms and Abbreviations

AoI	Area of Influence
AQSRs	Air Quality Sensitive Receptors
CIA	Cumulative Impact Assessment
CO_2-e	CO_2-equivalent
DO	Dissolved Oxygen
EBS	N.V. Energiebedrijven Suriname
EHS	Environmental, Health and Safety
EMP	Environmental Management Programme
EPC	Engineering, Procurement and Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EC	European Community
GLC	Ground Level Concentration
GIIP	Good International Industry Practice
HFO	Heavy Fuel Oil
HSEQ	Health, Safety, Environment and Quality
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
L_{Aeq}	Equivalent A-weighted sound level
LFO	Light Fuel Oil
MW	Megawatt
NIMOS	Nationaal Instituut voor Milieu en Ontwikkeling in Suriname
NTU	Nephelometric Turbidity Unit
OECD	Organisation for Economic Co-ordination and Development
PS	Performance Standard
QRA	Quantitative Risk Assessment
SIA	Social Impact Assessment
SLM	Sound level meter
SPCS	Staatsolie Power Company Suriname
SRK	SRK Consulting (South Africa) (Pty) Ltd
Staatsolie	Staatsolie Maatschappij Suriname N.V.
TSS	Total Suspended Solids
NAAQS	US National Ambient Air Quality Standards
VECs	Valued Environmental and Social Components
WHO	World Health Organisation

Units:

°C	Degrees Celsius
dB(A)	Decibels (weighted)
ha	Hectare
km	Kilometre
km^2	Square kilometre
km/h	Kilometres per hour
µg/m³	Microgram per cubic metre

m	Metre
mm	Millimetre
m/s	Metres per second

Chemical compounds:

CO	Carbon monoxide
CO_2	Carbon dioxide
NO_X	Oxides of nitrogen
NO_2	Nitrogen dioxide
PM	Particulate matter
SO_2	Sulphur dioxide
VOC	Volatile Organic Compounds

Glossary

Aquifer	An underground body of permeable rock or unconsolidated materials (gravel, sand or silt) which can contain or transmit groundwater.
Avifauna	The collective birds of a given region.
Baseline	Information gathered at the beginning of a study which describes the environment prior to development of a project and against which predicted changes (impacts) are measured.
Biodiversity	The diversity, or variety, of plants, animals and other living things in a particular area or region. It encompasses habitat diversity, species diversity and genetic diversity.
Construction Phase	The stage of project development comprising site preparation as well as all construction activities associated with the development.
Consultation	A process for the exchange of views, concerns and proposals about a project through meaningful discussions and the open sharing of information.
Cumulative Impacts	Direct and indirect impacts that act together with current or future potential impacts of other activities or proposed activities in the area/region that affect the same resources and/or receptors.
dB(A)	A unit of sound level - a weighted sound pressure level with the use of the A metering characteristic and weighting specified in ANSI Specifications for Sound Level Meter.
Electrical Conductivity (in water)	Reflects the capacity of water to conduct electrical current and is directly related to the concentration of salts dissolved in water.
Ecology	The study of the interrelationships of organisms with and within their physical surroundings.
Ecosystem	The interconnected assemblage of all living organisms that occupy a given area and the physical environment with which they interact.
Endemic / Endemism	Species unique (native or restricted) to a defined geographic location, i.e. ecological state of a species being unique to a defined geographic location.
Environment	The external circumstances, conditions and objects that affect the existence of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Environmental and Social Impact Assessment	A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project.
Environmental Impact Assessment Report	The report produced to relay the information gathered and assessments undertaken during the Environmental Impact Assessment.
Environmental and Social Management Plan	A description of the means (the environmental specification) to achieve environmental objectives and targets during all stages of a specific proposed activity.
Fauna	The collective animals of a particular region, habitat or geological period.
Feasibility study	The determination of the technical and financial viability of a proposed project.
Flora	The collective plants of a particular region, habitat or geological period.
Geohydrology	The study of the character, source and mode of occurrence of groundwater

Heritage Resources	Refers to something tangible or intangible, e.g. a building, an area, a ritual, etc. that forms part of a community's cultural legacy or tradition and is passed down from preceding generations and has cultural significance.
Herpetofauna	Amphibians and reptiles of a particular region, habitat or geological period.
Hydrology	(The study of) surface water flow.
Impact	A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.
Integrated Environmental Management	The practice of incorporating environmental management into all stages of a project's life cycle, namely planning, design, implementation, management and review and closure.
Mitigation measures	Design or management measures that are intended to avoid and / or minimise or enhance an impact, depending on the desired effect. These measures are ideally incorporated into a design at an early stage.
Operational Phase	The stage of the works following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation.
Polder	A low-lying tract of land enclosed by dikes that form an artificial hydrological entity: it has no connection with outside water other than through canals and manually operated devices (e.g. pumps and sluices).
Scoping	A procedure to consult with stakeholders to determine issues and concerns and for determining the extent of and approach to an ESIA (one of the phases in an ESIA). This process results in the development of a scope of work (or Plan of Study) for the ESIA and specialist studies.
Specialist study	A study into a particular aspect of the environment, undertaken by an expert in that discipline.
Stakeholders	All parties affected by and/or able to influence a project, often those in a position of authority and/or representing others.
Sustainable development	Sustainable development is generally defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

1 Introduction

1.1 Background and Introduction

Staatsolie Maatschappij Suriname N.V. (Staatsolie) is the Surinamese State oil company founded in 1980 and wholly owned by the Republic of Suriname. The company explores, produces and refines crude oil. Staatsolie operates three oil fields in the Saramacca District of Suriname: Tambaredjo, Tambaredjo North-West and Calcutta, as well as two oil processing plants: TA-58 and Jossie. The Tambaredjo Oil Field is located 40 km west of Paramaribo and 8 km south of the Atlantic coast, north of the East-West Connection Road (*Oost-West Verbinding*) (see Figure 1-1).

Staatsolie's facilities and operations in Saramacca are supplied with power by N.V. Energie Bedrijven Suriname (EBS) through a transmission line to Saramacca. Power demand is expected to increase due to expansion of operations in the oil fields. While EBS will continue to supply power from other existing, distant sources, Staatsolie proposes to construct a new thermal (Heavy Fuel Oil [HFO]) power plant of up to 36 MW in phases at the Sarah Maria facility in the Tambaredjo Oil Field to provide backup power (the project).

Staatsolie has appointed SRK Consulting (South Africa) (Pty) Ltd (SRK), an international consultancy with extensive experience in Suriname, as independent consultants to undertake the Environmental and Social Impact Assessment (ESIA) process for the project.

1.2 Purpose of the Report

This ESIA Report documents the steps undertaken during the Impact Assessment Phase to assess the significance of potential impacts and determine measures to mitigate the negative impacts and enhance the benefits (or positive impacts) of the proposed Saramacca power plant project. The report presents the findings of the Impact Assessment Phase and the public participation that forms part of the process.

The EIA Report is accompanied by an Environmental Management Programme (EMP), which documents the management and monitoring measures that need to be implemented during the design, construction and operational phases of the project to ensure that impacts are appropriately mitigated and benefits enhanced.

More specifically, the objectives of this ESIA Report are to:

- Inform the stakeholders about the proposed project and the ESIA process followed;
- Obtain contributions from stakeholders and ensure that all issues, concerns and queries raised are fully documented and addressed;
- Assess in detail the potential environmental and socio-economic impacts of the project; and
- Identify environmental and social mitigation measures to address the impacts assessed.

This report will be submitted to the Nationaal Instituut voor Milieu en Ontwikkeling in Suriname (NIMOS) for their comment and acceptance.

1.3 Structure of this Report

This report discusses relevant environmental legislation and its application to this project, outlines the ESIA process, presents a detailed project description and environmental baseline, details the stakeholder engagement process followed and assesses the potential impacts of the project before concluding the report with a set of pertinent findings and key recommendations. The report consists of the following sections:

Section 1: Introduction

Provides an introduction and background to the proposed project and outlines the purpose of this document and the assumptions and limitation applicable to the study.

Section 2: Governance Framework and Environmental Process

Provides a brief summary and interpretation of the relevant legislation as well as pertinent strategic planning documents, and outlines the approach to the environmental process.

Section 3: Project Description

Describes the location and current status of the site and provides a brief summary of the surrounding land uses as well as background to, motivation, and description of, the proposed project.

Section 4: Description of the Affected Environment

Describes the biophysical and socio-economic characteristics of the affected environment against which potential project impacts are assessed.

Section 5: Stakeholder Engagement

Details the stakeholder engagement approach and summarises stakeholder comments that informed the impact assessment.

Section 6: Environmental Impact Assessment

Describes the specialist studies undertaken and assesses the potential impacts of the project utilising SRK's proven impact assessment methodology.

Section 7: Conclusions and Recommendations

Provides the key findings and conclusions of the ESIA Report.

Section 8: Way Forward

Concludes the document with an outline of the remaining steps in the ESIA process

1.4 Assumptions and Limitations

As is standard practice, the report is based on a number of assumptions and is subject to certain limitations. These are as follows:

- Information provided by Staatsolie, other consultants and specialists is assumed to be accurate and correct;
- SRK's assessment of the significance of impacts of the proposed development on the affected environment has been based on the assumption that the activities will be confined to those described in Section 3. If there are any substantial changes to the project description, impacts may need to be reassessed;
- Where detailed design information is not available, the precautionary principle, i.e. a conservative approach that overstates negative impacts and understates benefits, has been adopted;
- It is assumed that the stakeholder engagement process undertaken during the ESIA process has identified all relevant concerns of stakeholders; and
- Staatsolie will in good faith implement the agreed mitigation measures identified in this report. To this end it is assumed that Staatsolie will commit sufficient resources and employ suitably qualified personnel.

Notwithstanding the above, SRK is confident that these assumptions and limitations do not compromise the overall findings of the report.

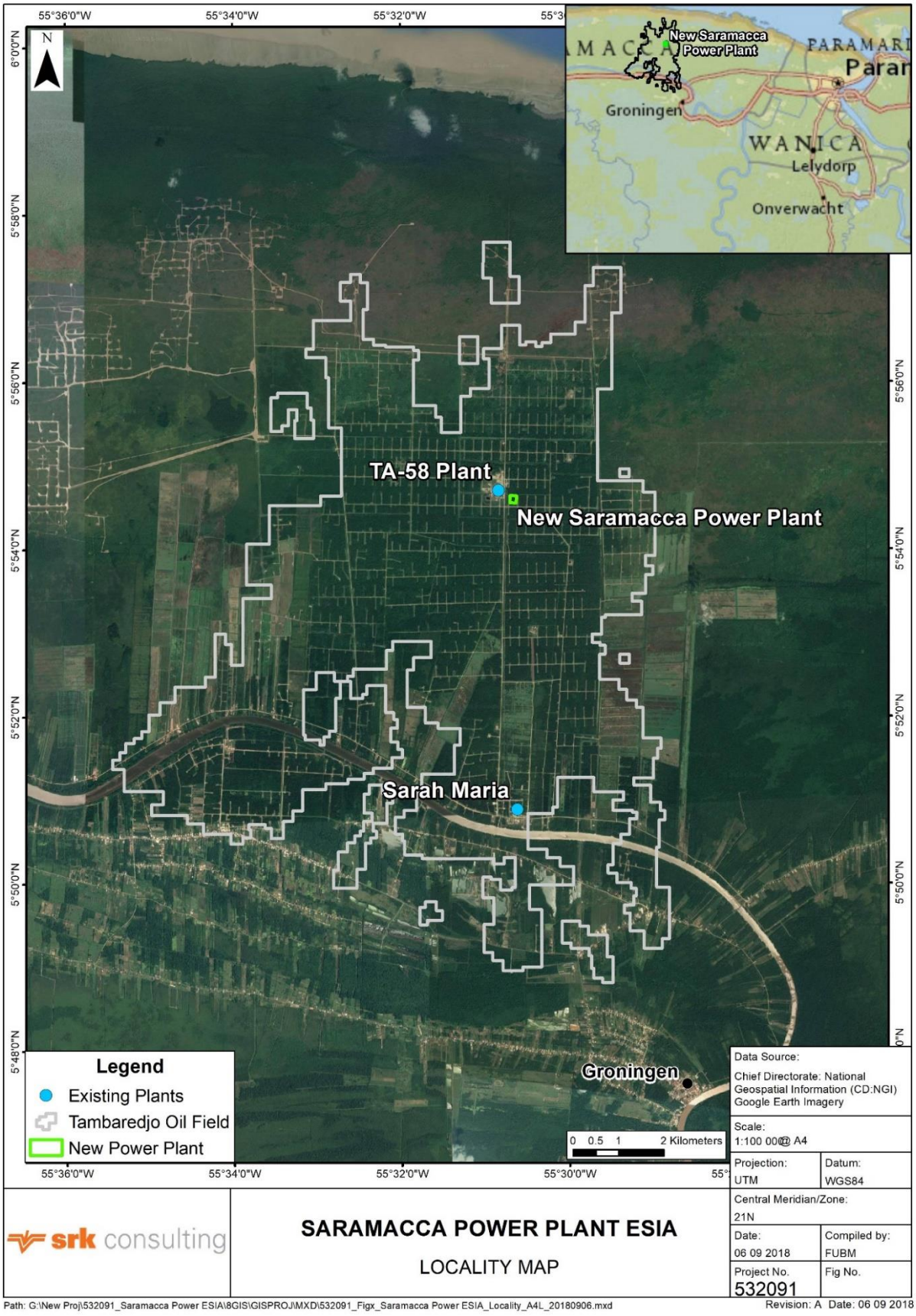


Figure 1-1: Locality map

2 Governance Framework and Environmental Process

2.1 Introduction

Suriname is governed in terms of the 1987 Constitution of the Republic of Suriname, reformed in 1992, which provides for a legal basis for the country's environmental policies. Article 6g states that "the social objective of the State is directed towards the creation and stimulation of conditions necessary for the protection of nature and the maintenance of ecological balance".

Suriname does not have an approved national environmental policy and there is no promulgated legislation dealing specifically with environmental management. However, environmental legislation is under development and various guidelines for environmental assessment have been released. The ESIA process for the proposed power plant will comply with the guidelines and other relevant legislation.

In addition to national regulatory requirements, the ESIA process will be guided by international best practice, notably standards and guidelines such as those prescribed by the World Bank Group for Bank-funded private sector development projects[1]. The World Bank Group standards and guidelines include environmental and social guidelines and standards that relate to the implementation and scope of the ESIA process. Where applicable, the application of the standards and guidelines will be modified to reflect the scale of the project and other relevant factors.

The legislative, regulatory and institutional requirements guiding the proposed ESIA process as described above are discussed in more detail below. Note that other requirements may pertain to the proposed project, but identification and interpretation of these is beyond the brief of this study. As such, the list provided below is not intended to be definitive or exhaustive and serves to highlight key environmental legislation and obligations only.

The key regulatory requirements pertaining to the proposed expansion project and the environmental assessment thereof include the following:

- Suriname legislation, regulations and guidelines; and
- International best practice standards, such as the guidelines of the World Bank Group.

2.2 Suriname Legal Requirements

2.2.1 Legal Requirements Regarding Environmental Assessment

NIMOS was established in 1998 as an autonomous Government Foundation and currently reports on its activities to the Environmental Coordination Department in the Cabinet of the President. The Office of Environmental and Social Assessments, a division of NIMOS, is responsible for the administration of ESIA processes in Suriname.

A **draft Environmental Act**, most recently amended in 2016, has been developed as an environmental framework law in response to the 1992 Rio declaration. The draft Act lays down rules for the conservation, management and protection of a sound environment within the framework of sustainable development. The draft Act has been under consideration by the Council of Ministers for some time and has not yet been promulgated. Nevertheless, the principles in the draft Act provide guidance for EIA in Suriname.

[1] The World Bank Group standards are applied as best practice guidelines and not as an investment requirement.

Draft EIA Regulations, to be promulgated under the Environmental Act once in force, have also been developed since 2003 and contain requirements for EIA processes and public participation. The draft EIA Regulations are still being amended and are not yet in force.

NIMOS has published **Guidelines for Environmental Assessment** (EA) in Suriname. The Guidelines stipulate the EA process that should be undertaken if the environmental framework law and EIA Regulations were in place (NIMOS, 2017). The EA Guidelines are being applied by NIMOS as part of the project assessment process and project developers are expected to comply with the guidelines.

The EA Guidelines series consists of the following volumes:

- **Volume I: Generic (2009)** – This volume contains general guidelines for determining whether an EA is required, the nature and extent of the analysis required and the procedure that should be followed in the conduct of an EA. The guidelines cover aspects such as project screening, classification of projects, scoping guidelines, public consultation, structure of EA reports and the EA report review process, including criteria for review and a compliance checklist. Project screening is required to determine if EA is required and the appropriate level (category) of EA. Projects are classified into one of three categories, namely Category A (EA is mandatory), Category B (some form of EA is required) or Category C (no EA is required).

  The construction and operation of a new power plant is classified as a Category A project under the listing: "*power plants (regardless of source of energy used) above 10 MW*", for which a full ESIA is required. NIMOS confirmed classification during the screening phase for the project, undertaken by Staatsolie.

- **Volume II: Mining (2005)** – *These guidelines are not relevant to this project.*

- **Volume III: Forestry (2005)** – *These guidelines are not relevant to this project.*

- **Volume IV: Social Impact Assessment (2005)** – These guidelines provide an outline of the requirements for conducting Social Impact Assessment, whether as part of an EA process or required independently for projects that have potential impacts on the social environment.

- **Volume V**: **Power Generation and Transmission Projects (2005)** – These guidelines are applicable to this project, but do not have specific requirements for power generation. More guidance is provided for transmission, which is excluded from the scope of this ESIA.

- **Volume VI: Aquaculture Projects (2011)** – *These guidelines are not relevant to this project.*

- **Volume VII: Agriculture Project (2013)** – *These guidelines are not relevant to this project.*

As a supplement to the more comprehensive Environmental Assessment Guidelines (Volume I), NIMOS released a **Guidance Note NIMOS Environmental Assessment Process (2017)**, which highlights the EA process that is implemented in the current legislative environment (prior to the promulgation of the Environmental Act and EIA Regulations). It defines five EIA process phases, *viz.* Screening, Scoping, Assessment, Review and Decision-making phases, and associated reporting requirements, as well as NIMOS decision-making timeframes. The process flow diagram is shown in Figure 2-2.

At the conclusion of an EA process, NIMOS provides environmental advice regarding approval or denial of the project to the agency authorized to issue a permit to undertake the development or activity.

2.2.2 Other Environmental Legal Requirements

Selected legal instruments governing environmental management in Suriname are included in Table 2-1 below. Note the table only lists key instruments and is not necessarily comprehensive, and not all of the listed instruments necessarily apply to this project.

Table 2-1: Selected relevant national environmental legislation

Title	Objective	Implementing agency	Remarks
Hindrance Law G.B. 1930 no. 64 as amended	Controls industrial pollution (noise, air and waste).	District Commissioners are responsible for enforcement and issue permits in consultation with Ministries of Health, Labour and NIMOS	Permits are required for industrial development projects. Outdated regulations concerning *inter alia* pollution standards and waste management have impacted negatively on the effectiveness of the Hindrance Act (Buursink, 2005, cited in SRK, 2008)
Law on Ecological Circumstances in Residential Areas S.B. 1980 no. 68	To improve the ecological circumstances in residential areas	District Commissioners	
Police Criminal Law G.B. 1915 no. 77 as amended by S.B. 1990 no. 24	Contains many general environmental provisions with respect to public places, including waste disposal, noise, control of pests, hunting and fishing, water pollution, etc.	Ministry of Justice and Police	Article 39a penalizes the disposal of waste in public places. Article 51 penalizes the contamination of a water resource.
Law No. 44 of 30 March 2015, amending Criminal Law G.B.1911 no.1, as amended by S.B. 2012 no. 70	Stipulates penalties for a range of offenses	Ministry of Prosecution	Articles 225a and 225b stipulates penalties for environmental pollution

A **draft Waste Act** (2004) has been compiled but has not been promulgated. The draft Act sets out regulations for the treatment of waste materials to protect the environment, based on the "polluter pays" principle. Different types of waste materials are identified, and rules prescribed for adequate storage, transportation and treatment (including recycling, composting and disposal) of each waste type. The Act makes provision for the prosecution of transgressors.

Agencies which will or may be involved in various approval or consultation processes applicable to this project are expected to include the:

- Ministry of Labour (*Ministerie van Arbeid)* – which is responsible for the supervision of compliance with employment protection and health and safety inspection regulations;
- *NIMOS* – which is an autonomous Government Foundation. The Office of Environmental and Social Assessments, a division of NIMOS, is responsible for the administration of EIA processes in Suriname;
- Ministry of Public Works, Transport and Communication (*Ministerie van Openbare Werken, Transport en Communicatie)* – which is responsible for transportation, infrastructure, town planning, waste management and surface water control;

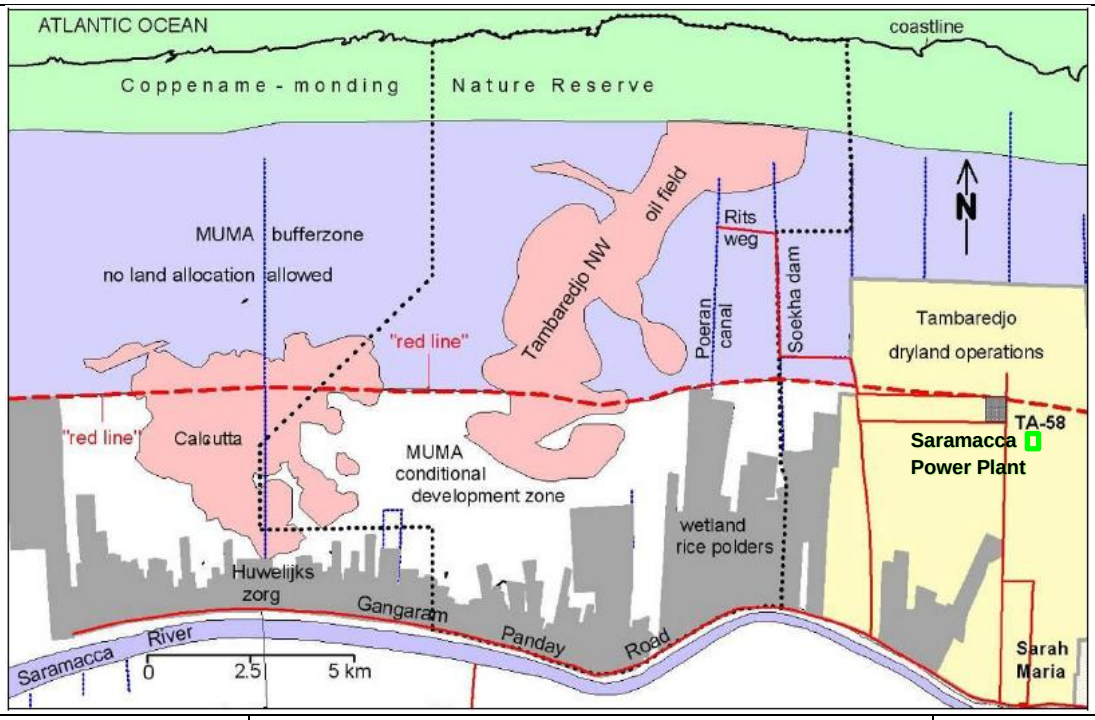
- Ministry of Regional Development (*Ministerie van Regionale Ontwikkeling)* – which is responsible for the development of rural areas and the provision of services outside Paramaribo through the District Commissioners;
- Ministry of Public Health (*Ministerie van Volksgezondheid*) – which is responsible for general public health management; and
- Ministry of Spatial Planning, Land and Forest Management (*Ministerie van Ruimtelijke Ordening, Grond- en Bosbeheer)* – which is responsible for city and land use planning and forest, flora and fauna resource management.

2.2.3 Planning Framework

According to the Resolution on Land Allocation in Coastal Zone Management Areas (2005), in the area between the Atlantic Ocean and the Saramacca River, land to the north of the red line shown in Figure 2-1 acts as a buffer zone to the Coppename-monding Nature Reserve and is reserved for coastal protection and sustainable production. No land can be allocated for other use in this area.

Land can be allocated for other uses south of the red line. Restrictions in this area stipulate that no water extraction from the seaside drainage basin is allowed and that excess water should be drained into the Saramacca River.

Staatsolie's proposed Saramacca Power Plant lies just south of the red line, and the use is thus expected to be compatible with the Resolution on Land Allocation in Coastal Zone Management Areas.



srk consulting	**SARAMACCA POWER PLANT** Land Allocation in Coastal Zone Management Area Zones	Project No. 532091

Figure 2-1: Land Allocation in Coastal Zone Management Area Zones

Source: Noordam Environmental Consultancy, 2014

2.2.4 International Agreements

Suriname is signatory to a nu mber of international agreements and conventions relating to environmental management. The international conventions are not always translated into national

legislation. An overview of selected agreements relevant to this project is provided in Table 2-2 below.

Table 2-2: Overview of international agreements relevant to the project

Agreement / Convention	Purpose	Relevance
Biodiversity		
Convention on Wetlands of International Importance (RAMSAR Convention), 1971 *Suriname ratified in 1985*	Intergovernmental treaty for the conservation and sustainable use of wetlands.	The Coppename-monding Nature Reserve, located ~7 km north of the project site, is a Ramsar wetland.
Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, 1940	Provides for the establishment of protected areas, research co-operation between governments, listing of species for special protection and control of trade in protected fauna and flora.	The Coppename-monding Nature Reserve, located ~7 km north of the project site, is a Western Hemisphere Shorebird Reserve.
Convention on Biological Diversity, 1992 *Suriname ratified in 1996*	Development of national strategies for the conservation and sustainable use of biological diversity	Suriname has a National Biodiversity Strategy that aims to value and protect biological diversity, including natural and cultural resources, through equitable and sustainable use for present and future generations.
Air quality and climate change		
Vienna Convention for the Protection of the Ozone Layer, 1985 *Suriname acceded in 1997*	Protection of the ozone layer, came into force in 1988.	The power plant may emit ozone-depleting substances.
Montreal Protocol on Substances that Deplete the Ozone Layer, 1989 *Suriname acceded in 1997 and ratified all amendments in 2006.*	Protection of the ozone layer.	The power plant may emit ozone-depleting substances.
United Nations Framework Convention on Climate Change (UNFCC), 1994 *Suriname ratified in 1997*	Control of and limiting greenhouse gas emissions.	The power plant will emit greenhouse gases. Suriname has prepared a Climate Change Action Plan 2008-2013.
Kyoto Protocol, 1997 *Suriname ratified in 2006*	Provides for greenhouse gas emissions targets.	The power plant will emit greenhouse gases. Suriname has prepared a Climate Change Action Plan 2008-2013.
Minamata Convention on Mercury, 2013 *Suriname ratified in 2018*	Control of anthropogenic emissions and release of mercury and mercury compounds from *inter alia* artisanal and small-scale gold mining and point sources, such as power plants.	The power plant may emit mercury compounds.
Paris Agreement, 2015 *Suriname signed in 2016* *Suriname has not yet ratified*	Limit the global average temperature increase above pre-industrial levels to well below 2°C. The Nationally Determined Contribution (NDC) of Suriname included commitments to improve sustainable forest management to enhance the country's carbon sink potential, but no targets in terms of absolute or relative Greenhouse Gas (GHG) emissions by 2030.	The power plant will emit greenhouse gases.

Source: SRK (2010), Noordam (2014)

2.3 International Standards, Requirements and Guidelines

2.3.1 Environmental Assessment

- SRK will be *guided* by international standards and best practice in conducting the ESIA and associated public consultation and information disclosure process, primarily the Performance Standards (PS) of the International Finance Corporation (IFC – the private sector arm of the World Bank Group), which contain guidelines on how to undertake ESIAs and various specialist studies (see Table 2-3).

Table 2-3: IFC Performance Standards

Performance Standard	Aims and objectives	Applicability to this project
PS 1: Assessment and Management of Environmental and Social Risks and Impacts	Requires the proponent to conduct a process of environmental and social assessment and to establish and maintain an Environmental and Social Management System (ESMS), appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts. PS1 aims to: • Identify and evaluate environmental and social risks and impacts of the project; • Adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment; • Promote improved environmental and social performance of clients through the effective use of management systems; • Ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately; • Promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them; and • Ensure that relevant environmental and social information is disclosed and disseminated.	PS1 is relevant to the project. PS1 has guided the ESIA process, specifically the: • Conducting of a Scoping Phase; • Engagement of stakeholders during the Scoping and Impact Assessment Phases; • Identification and assessment of project impacts, as well as the identification of strategies to avoid, minimise or offset these impacts; • Development of an ESMP for the construction and operation of the power plant.
PS 2: Labor and Working Conditions	Recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. PS2 aims to: • Promote fair treatment, non-discrimination and equal opportunity of workers; • Establish, maintain and improve the worker-management relationship; • Promote compliance with national employment and labour laws; • Protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties and workers in the client's supply chain; and • Promote safe and healthy working conditions and the health of workers; and avoid the use of forced labour.	As the power plant will employ a (limited) number of workers, PS2 is relevant to the project. However, employment will follow established procedures at Staatsolie.

Performance Standard	Aims and objectives	Applicability to this project
PS 3: Resource Efficiency and Pollution Prevention	Recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. Thus, PS3 aims to: • Avoid or minimise pollution from project activities; • Promote more sustainable use of resources (including energy and water); and • Reduce project-related Greenhouse Gas (GHG) emissions.	As the power plant will generate noise and gaseous emissions (including GHG), PS3 is applicable to the project. PS3 has guided the ESIA process, specifically the: • Identification of potential impacts on human health and the environment from the release of emissions and noise, as well as strategies to avoid, minimise or offset these impacts; and • Compilation of an ESMP which includes strategies to avoid, minimise or offset these impacts.
PS 4: Community Health, Safety and Security	Recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. PS4 aims to: • Anticipate and avoid adverse impacts on the health and safety of affected communities during the project life from both routine and non-routine circumstances; and • Ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected communities.	As the power plant will generate noise and gaseous emissions (including GHG) and generate heavy vehicle traffic during construction, PS4 is applicable to the project. PS4 has guided the ESIA process, specifically the: • Identification of potential impacts on human health from the release of emissions and noise and traffic; • Engagement of community members about the project; • Compilation of an ESMP which includes measures to address risks that have been identified.
PS 5: Land Acquisition and Involuntary Resettlement	Recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. PS5 thus aims to: • Avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs; • Avoid forced eviction; • Anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected; and • Improve, or restore, the livelihoods and standards of living of displaced persons.	As the site is not inhabited, is not used for any income generating activities, and is leased by the applicant, PS5 is not applicable to the project.

Performance Standard	Aims and objectives	Applicability to this project
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. PS6 aims to: • Protect and conserve biodiversity; • Maintain the benefits from ecosystem services; and • Promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.	As the power plant is located in an area with secondary vegetation and is located near more pristine areas and a nature reserve, PS6 is applicable to the project. PS6 has guided the ESIA process, specifically the: • Compilation of an ecology baseline based on primary and secondary data; • Assessment of ecological impacts; • Compilation of an ESMP which includes measures to address impacts that have been identified.
PS 7: Indigenous Peoples	Recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. PS7 thus aims to: • Ensure that the development process fosters full respect for human rights, dignity, aspirations, culture and natural resource-based livelihoods of Indigenous Peoples; • Anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts; • Promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner; • Establish and maintain an ongoing relationship based on informed consultation and participation with the Indigenous Peoples affected by a project throughout the project's life-cycle; • Ensure the Free, Prior and Informed Consent of the affected communities of Indigenous Peoples when the circumstances described in this Performance Standard are present; and • Respect and preserve the culture, knowledge and practices of Indigenous Peoples.	As the site is not inhabited or used by Indigenous People, PS7 is not applicable to the project.
PS 8: Cultural Heritage	Recognizes the importance of cultural heritage for current and future generations. As such, PS8 aims to: • Protect cultural heritage from the adverse impacts of project activities and support its preservation; and • Promote the equitable sharing of benefits from the use of cultural heritage.	Archaeological sites, such as graves and remnants of previous activities, are distributed throughout Suriname and not well documented. As such, PS8 could be applicable to the project. However, the polder on which the project is located has significantly transformed the natural swamp and would have impacted on any artefacts. The ESIA process recommends a chance finds procedure for use during construction.

Note: **Bold text** indicates standards that may be relevant to the ESIA.

Where applicable, the standards and guidelines will be modified to reflect the scale of the project and other relevant factors (e.g. time constraints). Other selected relevant international guidelines will be taken into account where appropriate.

2.3.2 Emission Guidelines

SRK will be guided by international guidelines and standards where Suriname emission standards do not exist or are deemed inappropriate. Guidelines and standards that may be considered include the following:

- Relevant Environmental, Health and Safety (EHS) Guidelines of the IFC, which are technical reference documents with general and sector-specific examples of Good International Industry Practice (GIIP) – in this case the EHS Guidelines for Thermal Power Plants (2008)[2]. These guidelines contain performance levels and measures that are generally considered to be achievable in new facilities by using existing technology at reasonable cost. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent; and
- World Health Organisation (WHO), which has developed a range of guidelines and accepts guidelines from a range of other organisations.

2.3.2.1 Air Quality Guidelines

The World Bank accepts a range of guidelines, including the WHO Air Quality Guidelines, European Community (EC) and US National Ambient Air Quality Standards (NAAQS). These air quality standards and guidelines set pollution limits to prevent health impacts on the general population, which also consider particularly sensitive individuals such as children, the elderly or ill persons[3]. These guidelines are thus considered conservative. Guidelines for the key pollutants of interest (NO_2, SO_2, PM_{10} and CO) are presented in Table 2-4. Volatile Organic Compounds (VOC) refers to a group of pollutants that are not typically generated in power plant emissions, but limited emissions may arise from fuel storage.

These best practice standards are usually developed and implemented by developed countries, which often have very different environmental, social and economic characteristics. In general, adopted standards should be politically feasible and economically viable, but meet the ultimate objective of improving ambient air quality and management throughout the various phases of the project.

Table 2-4: International ambient air quality guidelines accepted by the World Bank

Pollutant	Averaging Period	WHO Guideline Value (µg/m³)[4]	EC Directive Limits (µg/m³)	US NAAQS (µg/m³)
Sulphur Dioxide (SO_2)	1-year	20	20	-
	24-hour	-	125 (3 permitted exceedences per year)	-
	1-hour	-	350 (24 permitted	196

[2] The Draft for Second Public Consultation of the EHS Guidelines for Thermal Power Plants dated May/June 2017 were also reviewed.

[3] Occupational guidelines and limits are typically much higher as people in a workforce are exposed to pollution for shorter periods of time and are deemed to be relatively healthy adults.

[4] While the WHO also provides interim targets for each pollutant, these are proposed as incremental steps in a progressive reduction of air pollution in areas where pollution is high. As this is not applicable to the project area, the interim targets are not included in this table.

Pollutant	Averaging Period	WHO Guideline Value (µg/m³)[4]	EC Directive Limits (µg/m³)	US NAAQS (µg/m³)
			exceedences per year)	(99th Percentile of 1-hour daily maximum concentrations, averaged over 3 years)
	10-minute	500	-	-
Nitrogen Dioxide (NO_2)	1-year	40	40	100
	1-hour	200	200 (18 permitted exceedences per year)	188 (99th Percentile of 1-hour daily maximum concentrations, averaged over 3 years)
Particulate Matter (PM_{10})	1-year	20	40	-
	24-hour	50	50 (35 permitted exceedences per year)	150 (Not to be exceeded more than once per year on average over 3 years)
Carbon Monoxide	1 hour	30 000	-	40 000 (Not to be exceeded more than once per year)
	8 hour	10 000	10 000	10 000 (Not to be exceeded more than once per year)

2.3.2.2 Noise Guidelines

In general, noise standards applied by the international community are similar and vary according to land use. International guidelines take into consideration the following adverse effects of noise:

- Annoyance;
- Speech intelligibility and communication interference;
- Disturbance of information extraction;
- Sleep disturbance; and
- Hearing impairment.

World Health Organisation

The World Health Organisation (WHO) and the Organisation for Economic Co-ordination and Development (OECD) have developed guidelines based on the effects of exposure to environmental noise. These guidelines provide recommended noise levels for different area types and time periods.

The WHO has recommended that a standard guideline value for average outdoor noise levels of 55 dB(A) be applied during normal day time to prevent significant interference with the normal activities of local communities. The relevant night time noise level is 45 dB(A). The WHO further recommends that, during the night, the maximum level of any single event should not exceed 60 dB(A). This limit is to protect humans against sleep disruption. Specified ambient noise levels for various environments are presented in Table 2-5.

Table 2-5: WHO guidelines for ambient sound levels

Environment	Ambient Sound Level (L_{Aeq}) (dB(A))			
	Day Time		Night Time	
	Indoor	Outdoor	Indoor	Outdoor
Dwellings	50	55	-	-
Bedrooms	-	-	30	45
Schools	35	55	-	-

The WHO specifies that an environmental noise impact analysis is required before implementing any project that would significantly increase the level of environmental noise in a community (WHO, 1999). '*Significant increase*' is considered a noise level increase greater than 5 dB.

World Bank / IFC Guidelines

The IFC recommends similar guideline values for average outdoor noise levels of 55 dB(A) during normal day time and 45 dB(A) during night time in residential areas. In industrial and commercial areas noise should not exceed 70 dB(A) (see Table 2-6).

The IFC specifies that noise levels generated by a development should not exceed background noise levels by more than 3 dB(A), or exceed the guideline levels.

Table 2-6: IFC ambient noise guidelines

Receptor	Maximum Allowable Ambient Noise Levels	
	1-hour L_{Aeq} (dB(A))	
	Day Time	Night Time
	07:00 – 22:00	22:00 – 07:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70
Note: No L_{Aeq} values are stipulated for rural areas.		

2.4 Corporate Requirements

Staatsolie has adopted procedures for protecting the environment which comply with international standards. An integrated Health, Safety, Environment and Quality (HSEQ) Policy and Management System is implemented across Staatsolie operations to monitor its effects on the health and safety of its employees, contractors and affected communities, as well as impacts on the environment.

Box 1. Staatsolie HSEQ Policy

Staatsolie demonstrates a firm commitment to Health, Safety, Environment & Quality (HSEQ) by effectively using an integrated management system, through which we continuously:

- Comply with relevant laws and legislation, and Staatsolie's requirements, while taking the needs of our stakeholders into account;
- Identify risks, determine mitigating measures, and apply these measures to our work in order to prevent incidents and damage to the environment;
- Hold all employees and contractors accountable to follow Staatsolie's HSEQ requirements, in order to achieve excellent performance with zero harm;
- Continually improve our management system by enhancing processes, services, and our product quality through the setting of explicit performance objectives;

- Involve all employees and contractors in the decision-making processes of our HSEQ management system.

2.5 ESIA Process

An ESIA is a systematic process to identify, predict and evaluate the environmental[5] effects of a proposed project. The purpose of an ESIA is to:

- Provide information for decision-making on the environmental consequences of proposed actions by identifying the potentially significant environmental effects and risks of a proposed project (i.e. ensure that environmental factors are considered in decision-making processes along with economic and technical factors). This means that the outcome of an ESIA process provides advice to the decision-makers, and is not a final decision in itself; and
- Promote environmentally sound and sustainable development through the identification of appropriate enhancement and mitigation measures.

Sustainable development has been defined in many ways, but the most frequently quoted definition is that of the Brundtland Commission (WCED, 1987): *Sustainable development is 'development that meets the needs of today's generation without compromising those of future generations'.*

It is widely accepted that adverse environmental impacts of projects and development need to be prevented or minimised, and ESIA has become an important tool in achieving this through the integration of environmental considerations into proposed projects. Recommendations made by an ESIA may necessitate the redesign of some project components, require further studies, identify changes which alter the economic viability of the project or cause a delay in project implementation. An ESIA should also lead to a mechanism whereby adequate monitoring is undertaken to achieve effective environmental management of the project during implementation.

The general approach to the ESIA will be guided by the requirements of NIMOS, as stipulated in the EA Guidelines (2009) and Guidance Note Environmental Assessment Process (2017), and international best practice.

Relevant principles underpinning the ESIA are:

- Assessment based on appropriate information;
- Accountability for information on which decisions are made;
- Broad interpretation of the term "environment" (inclusion of social and biophysical environment);
- An open and transparent participatory approach;
- Consultation with stakeholders;
- Due consideration of alternatives;
- Attempt to mitigate negative impacts and enhance positive impacts;
- Attempt to understand the social costs and benefits of the proposed project;
- Regard for individual and community rights and obligations; and
- Opportunity for public and specialist input in the ESIA process.

[5] 'Environment' is used in the broadest sense (including social and cultural aspects of the environment).

The main objectives of the ESIA are to:

- Document and contextualise the ecological baseline conditions of the study area and the socio-economic conditions of affected communities;
- Assess in detail the environmental and socio-economic impacts that may result from the project;
- Inform and obtain contributions from stakeholders, including relevant authorities and the public, and address their relevant issues and concerns;
- Identify environmental and social mitigation measures to address the impacts assessed; and
- Develop an Environmental and Social Management Plan (ESMP), based in part on the mitigation measures developed in the ESIA Report.

The EA process as prescribed by NIMOS is shown in Figure 2-2. Staatsolie completed the screening phase of the EA process prior to SRK's appointment. Based on NIMOS' EA Guidelines, the project falls within Category A, for which a full EA is required.

The dashed red box in Figure 2-2 indicates the EA aspects covered by SRK in the ESIA process, which includes the Scoping Phase and Impact Assessment Phase. The Scoping Phase is currently underway.

A more detailed overview of SRK's proposed ESIA process is provided in Figure 2-3.

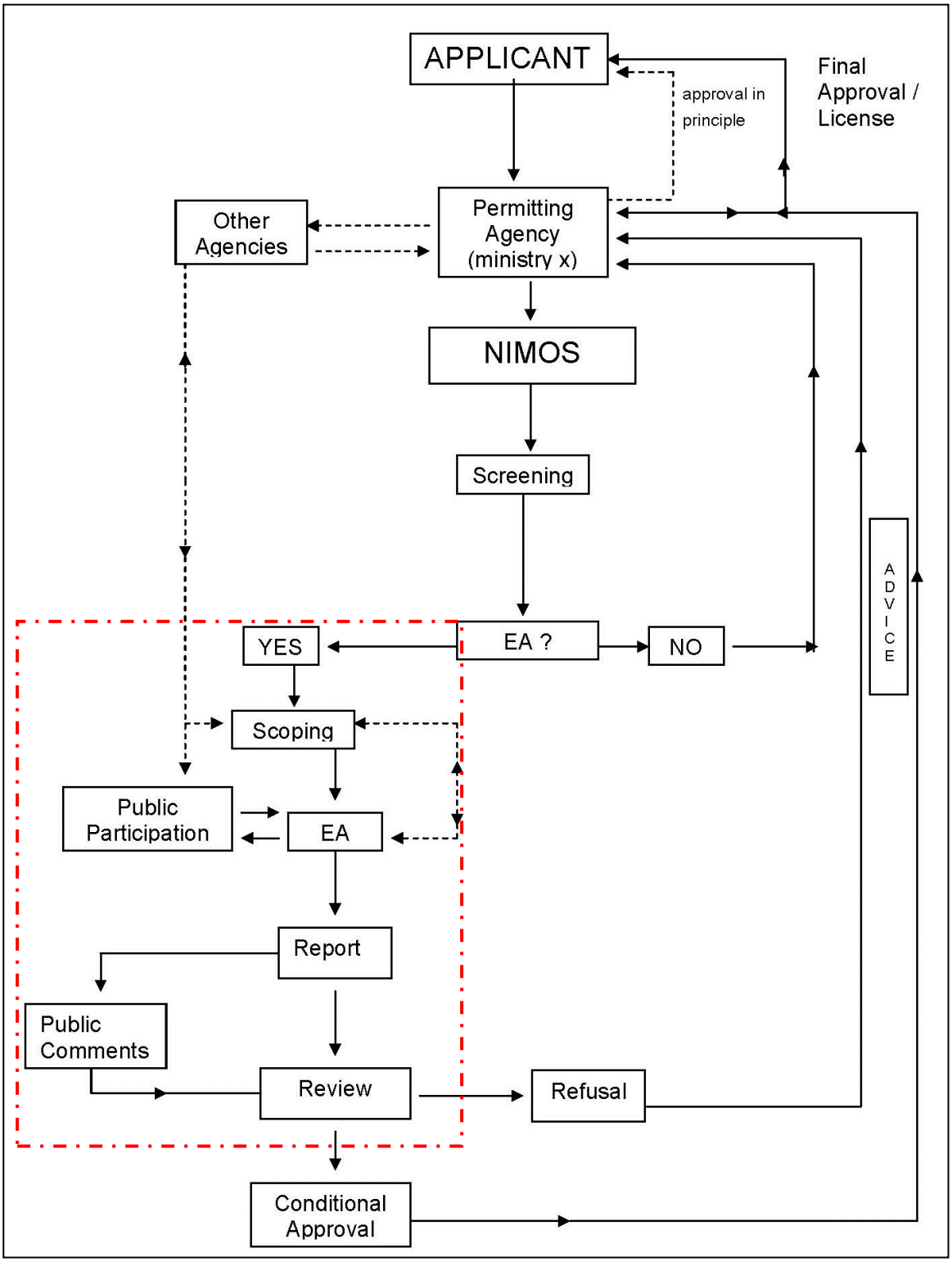


Figure 2-2: NIMOS Environmental Assessment flow diagram.

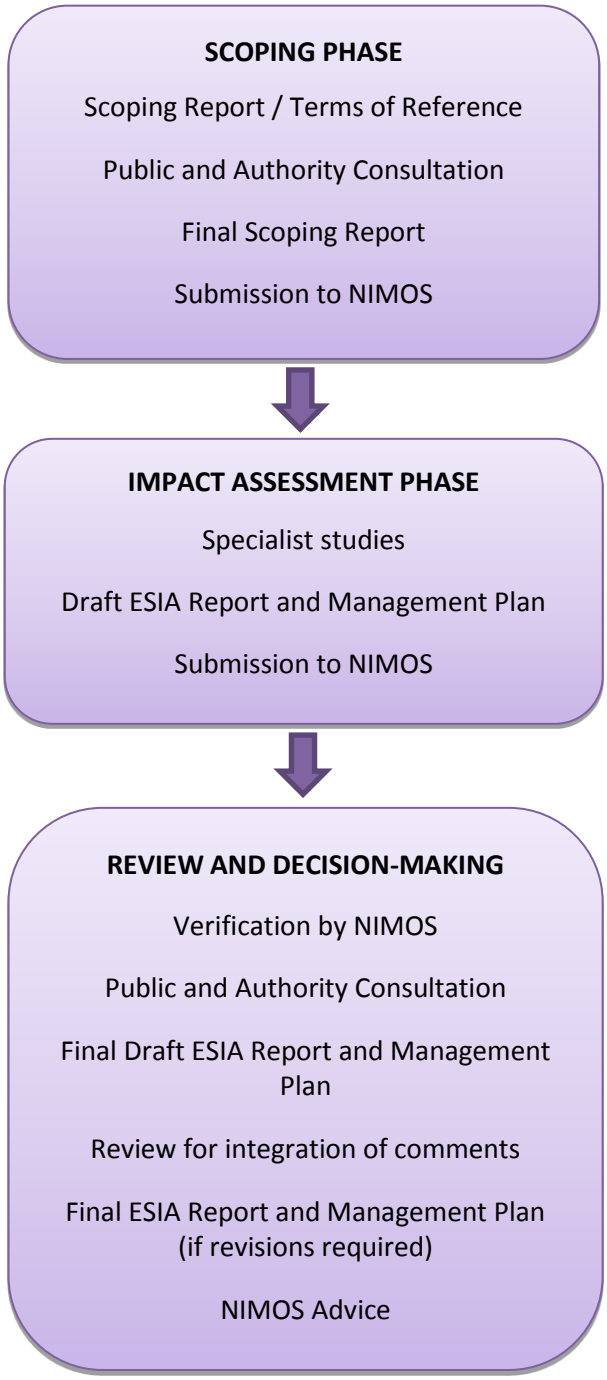


Figure 2-3: Overview of the ESIA process

3 Project Description

3.1 Description of the Project Area

3.1.1 Site Description

The proposed new power plant site is located in the Tambaredjo Oil Field, 40 km west of Paramaribo and 8 km south of the coast, in the Saramacca District of Suriname. The Tambaredjo field is located between the East-West Connection Road and the coast, and mostly north of the Saramacca River (see Figure 1-1).

The project site is situated in the northern portion of the Tambaredjo Oil Field, 120 m south-east of the TA-58 plant (see Figure 1-1). The site is vacant and covered with secondary marsh vegetation, which qualifies as modified habitat. Roadside drainage ditches run alongside access roads which border the site to the east, south and west (see Figure 3-1).

srk consulting	SARAMACCA POWER PLANT PROJECT Project site viewed from the south-western corner	Project No. 532091

Figure 3-1: Project site viewed from the south-western corner

Source: S. Reuther (1 August 2018)

The site is embedded in amongst the oil wells on the Tambaredjo Polder, at an elevation of 2 m above mean sea level (see Figure 3-2).

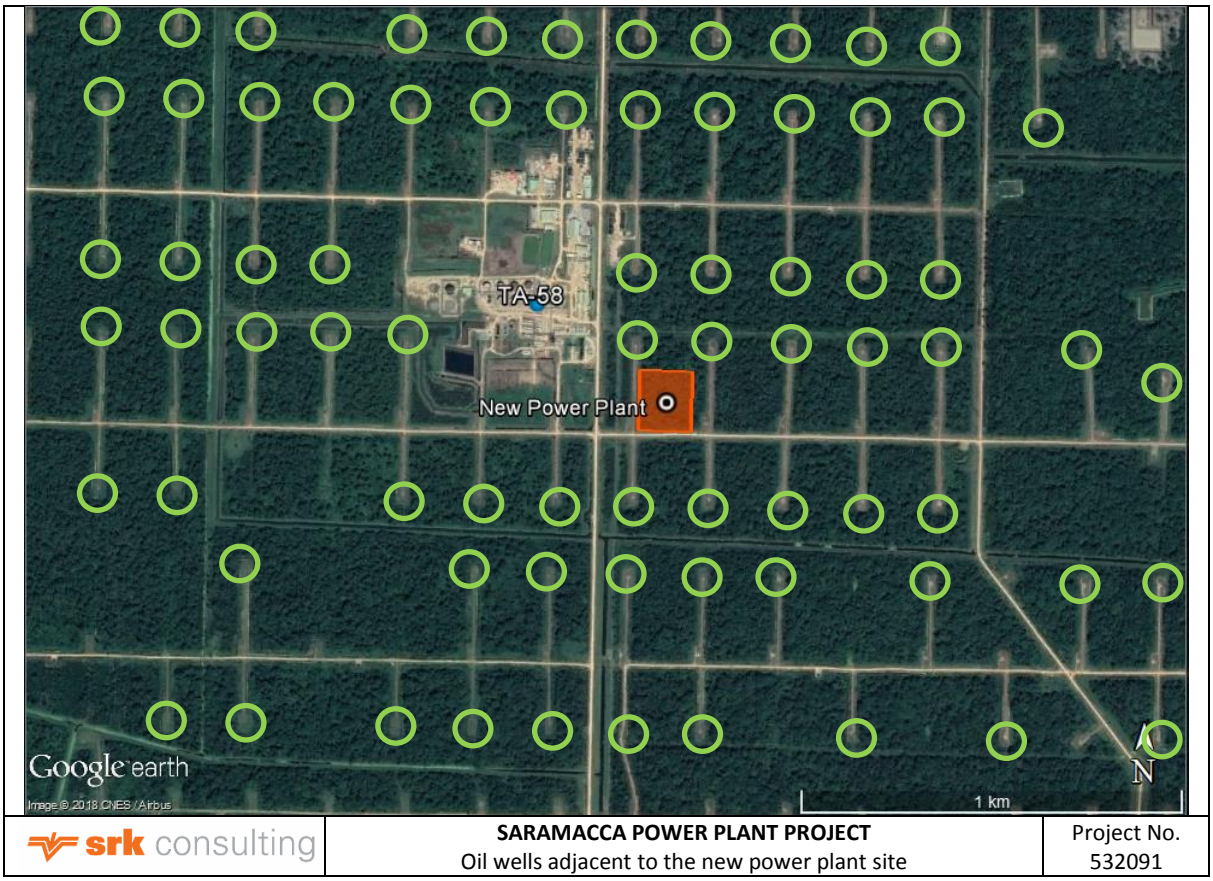


Figure 3-2: Oil wells surrounding the proposed power plant site

Note: Oil wells are shown in green circles.

3.1.2 Surrounding Land Use

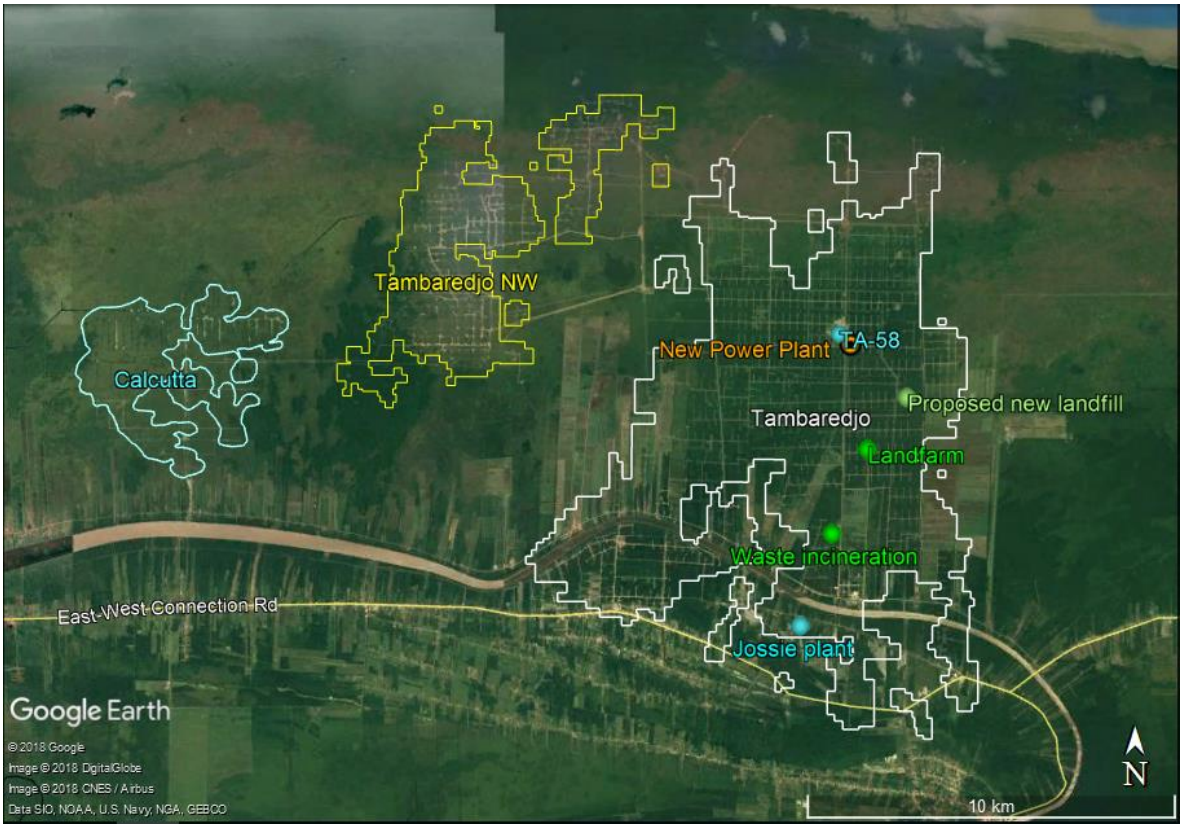
Staatsolie explores, produces and refines crude oil in Suriname. In the Saramacca District, Staatsolie operates three oil fields: Tambaredjo, Tambaredjo North-West and Calcutta. The proposed new power plant is located in the Tambaredjo Oil Field, 40 km west of Paramaribo and 8 km south of the Atlantic coast, north of the East-West Connection Road (see Figure 1-1).

Staatsolie commenced construction of the Tambaredjo Polder in the 1990s, to facilitate dryland oil production. The polder covers approximately 10 000 ha and is drained by a system of roadside ditches that are connected to north-south aligned canals which drain into the Saramacca River to the south. Oil is extracted from a large number of wells in 200 x 200-metre grids across the polder. The wells are connected by unpaved (shell sand) roads to a series of secondary access roads which ultimately connect to the Panday Gangaram Way.

Staatsolie has constructed the TA-58 and Jossie oil-water separation plants, to separate the water and crude oil that are jointly extracted from the well, in the Tambaredjo Polder. The oil-water separation plants comprise pumps, processing facilities and oil storage tanks. The TA-58 plant is located 120 m north-west of the proposed new power plant (see Figure 3-3). Backup generators for the Sarah Maria facility are also located at TA-58.

Waste incineration pits and a landfarm on the Tambaredjo Polder provide for waste disposal. Domestic and industrial waste from upstream operations is disposed at an open dumpsite and incinerated in two open pits. A new ~10 ha landfill and incinerator south-east of the proposed power plant site are proposed to improve waste management (see Figure 3-3). The 7 ha landfarm serves for bioremediation of oil-contaminated soil, sludge from oil spills and waste from storage tank cleaning. The landfarm is bunded and designed to contain contaminated water, including runoff.

Processed crude oil from the TA-58 and Jossie plants is conveyed by pipeline to the refinery and export terminals at Tout Lui Faut, south of Paramaribo.



srk consulting	SARAMACCA POWER PLANT PROJECT Location of Staatsolie oil fields in the Saramacca District	Project No. 532091

Figure 3-3: Location of Staatsolie oil fields in the Saramacca District

3.2 Proponent's Project Motivation

Electrical power is required for production activities in the Staatsolie's Saramacca oil fields of Tambaredjo, Tambaredjo North-West and Calcutta and the TA-58 and Jossie oil treatment plants. To ensure optimal production, electrical power supply must be guaranteed, stable and avoid outages. Currently, EBS provides electricity to Staatsolie's Saramacca operations through a high voltage transmission line originating from the power grid in Paramaribo. This high voltage line is currently limited in its maximum capacity and is sensitive to power outages and power fluctuations. Due to the expansion of Staatsolie's activities in the area, electrical power demand will soon exceed the supply capabilities of the line.

Staatsolie therefore wants to build a thermal power plant:

- As back-up to minimize production loss due to power failures; and
- To guarantee sufficient electrical power for growing energy demand.

3.3 Project Alternatives

An ESIA process should identify and describe alternatives to the proposed activity that were considered, or, failing that, provide adequate motivation for not considering alternatives. Different types or categories of alternatives can be identified, e.g. location alternatives, type of activity, design or layout alternatives, technology alternatives and operational alternatives.

Not all categories of alternatives are applicable to all projects. However, the consideration of alternatives is inherent in the detailed design and the identification of mitigation measures, and therefore, although not specifically assessed, alternatives have been and will be taken into account in the design and ESIA processes.

As reported in the Scoping Report, Staatsolie considered and evaluated a number of alternatives to increase the power supply to the Sarah Maria facility during the Concept and Feasibility phases of the project. This included three location alternatives at the Sarah Maria facility, which were considered in more detail (see Figure 3-4):

L1. Near the Sarah Maria offices, next to the existing EBS substation;

L2. Near the TA-58 oil-water separation plant; and

L3. Approximately 5 km south of the TA-58 plant.

A site (screening) selection matrix is included as Table 3-1. The site selection matrix considered relevant technical/design, financial and environmental criteria as identified by the Staatsolie project team. Alternatives shaded in grey are no longer considered viable options and are not further assessed in the ESIA.

The site selection matrix indicates that Location Alternative (Option) 2 was identified as the preferred location within the Sarah Maria facility, since it:

- Is located further away from residential areas;
- Requires lower capital expenditure;
- Requires shorter pipelines from the TA-58 as the main source of fuel; and
- Provides sufficient space for the new power plant without impacting on existing structures.

No other location alternatives will be assessed in the impact assessment.

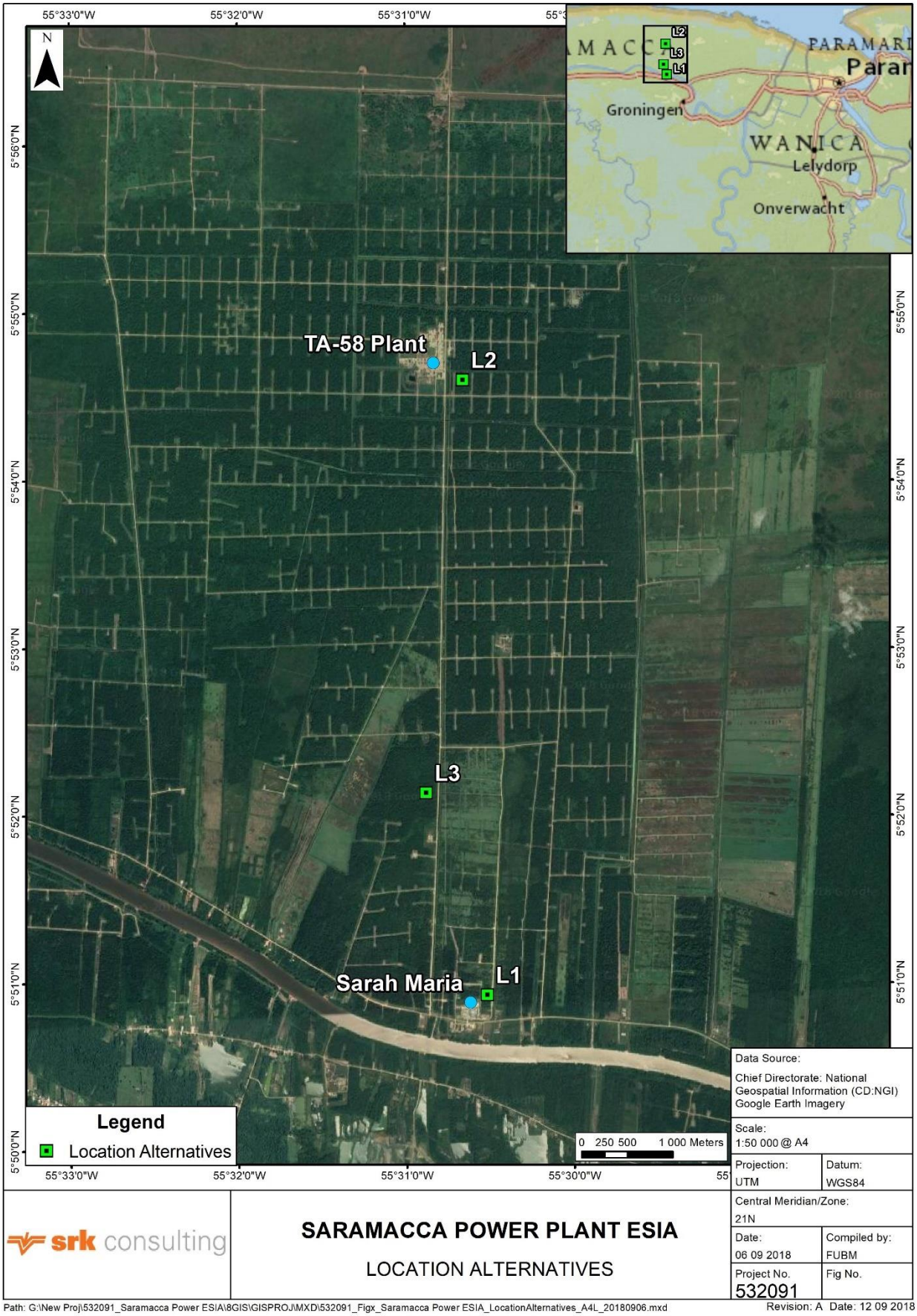


Figure 3-4: Location alternatives

Table 3-1: Site location alternatives matrix

Note: green shading indicates a favourable aspect, red shading an unfavourable aspect

Criteria	Option 1	Option 2	Option 3
Alternative Descriptor			
Location	Near the Sarah Maria offices, next to the existing EBS substation	Approximately 120 m east of the TA-58 oil-water separation plant	Approximately 5 km south of the TA-58 plant
Coordinates	05°51'1.06"N 55°30'31.16"W	05°54'35.75"N 55°30'39.61"W	05°52'13.45"N 55°30'53.59"W
Property control	Staatsolie	Staatsolie	Staatsolie
Technical Criteria			
Site size	New power plant may impact on existing structures at Sarah Maria offices	Sufficient space for the new power plant without impacting on existing structures	Sufficient space for the new power plant without impacting on existing structures
Proximity to TA-58 / required pipeline length	7 km	120 m	5 km
Proximity to transmission network tie-in	120 m	120 m	5 km
Technical Status	***Acceptable but not preferred***	***Acceptable and most preferred***	***Acceptable but not preferred***
Financial Criteria			
CAPEX	Highest CAPEX due to longest pipelines to TA-58	Lowest CAPEX due to shortest pipelines to TA-58 and connection to power transmission network	Higher costs than Option 2 due to longer pipelines to TA-58 and larger distance to power transmission network
Financial Status	***Acceptable but not preferred***	***Acceptable and most preferred***	***Acceptable but not preferred***
Environmental and Social Criteria			
Biodiversity	Clearing of low-sensitivity secondary marsh vegetation, which appears to be in poorer condition than on site 2	Clearing of low-sensitivity secondary marsh vegetation, which appears to be in slightly better condition than on sites 1 and 3	Clearing of low-sensitivity secondary marsh vegetation, which appears to be in poorer condition than on site 2
Distance to nearest residence	350 m Noise and air quality impacts on residents expected	7 km No noise and air quality impacts on residents expected	2.5 km No noise and no/few air quality impacts on residents expected
Environmental and Social Status	***Unacceptable***	***Acceptable and most preferred***	***Potentially acceptable but not preferred***
INTEGRATED SITE SELECTION STATUS	***ELIMINATED***	***PREFERRED SITE ASSESSED IN ESIA***	***ELIMINATED***

3.4 Project Description

The proposed power plant will be constructed on a ~2.5 ha site south-east of the TA-58 plant (see Figure 3-5).

srk consulting	SARAMACCA POWER PLANT PROJECT Proposed project location relative to TA-58	Project No. 532091

Figure 3-5: Proposed power plant location relative to TA-58

The power plant will include the following key components:

- Powerhouse, internal combustion engines and additional equipment;
- Fuel treatment plant;
- Storage facilities for fuel and lubricant;
- Transformers; and
- Maintenance, storage and office areas.

The proposed power plant will consist of 6 MW engines, each with an individual 30 m-high exhaust stack. The number of engines is expected to reach a maximum of six engines, to allow for backup and redundancy requirements (i.e. not all engines will be operating at the same time).

Engines will be running mainly on Saramacca Crude, and occasionally on HFO (Staatsolie's own low-sulphur product with less than 3% sulphur) or Light Fuel Oil (LFO). Saramacca Crude will be transported through a pipeline from the existing TA-58 plant to the storage tanks at the power plant, while HFO and LFO will be trucked from the Staatsolie refinery at Tout Lui Faut. HFO is only required during special circumstances, e.g. pipeline maintenance or unplanned pipeline and/or TA-58 plant shutdowns. The use of LFO will be minimized and only required for start-up. The estimated maximum fuel consumption per generator is 28 000 litres per day.

The engines will be cooled by a closed-circuit cooling-water (radiator) system using demi water with possibly some anti-corrosion additives. The cooling pipes are typically run through concrete cable gutters; in the unlikely event of a leak cooling water will be contained and not discharged into the environment.

Efficiency improvement options for the power plant as well as the opportunity to use excess energy in the TA-58 plant will be considered.

The plant will be equipped with a fire-fighting system including tank, pipelines and pumps.

Construction will be phased. Phase 1 consists of three 6 MW generator units, which will not become operational simultaneously. The design will accommodate the possibility for further expansion to a maximum peak capacity of 36 MW, based on projected future needs.

The construction phase will consist of:

- Site clearance;
- Site preparations, including backfilling with sand;
- Concrete foundation piling;
- Construction of concrete foundations (buildings, tanks, generators and transformers);
- Installation of drainage and landscaping;
- Construction of buildings, support structures and tank farm;
- Transportation and installation of generator sets, including auxiliaries (stacks, cooling plant, piping etc);
- Electrical installations, including transformers and switchgear; and
- Commissioning and testing.

Most materials will be procured and delivered by the Engineering, Procurement and Construction (EPC) contractor and transported to site by dump truck (raw materials) and flatbed trucks (piling, containers, piping).

To satisfy the growing electricity demand of the Saramacca operations, the power plant should be operational in 2020. The (minimum) operational life of the plant is 20 years.

It is expected that the project construction phase will provide jobs for 215 people, while the operational phase generates employment for 10 people.

4 Description of the Affected Environment

The following chapter presents an overview of the biophysical and socio-economic environment in which the proposed project is located to:

- Understand the general sensitivity of and pressures on the affected environment;
- Inform the identification of potential issues and impacts associated with the proposed project, which were assessed in the Impact Assessment section; and
- Start conceptualising practical mitigation measures.

The description of the affected environment is based on existing information and preliminary specialist input. The chapter draws extensively on information provided in previous studies by Noordam Environmental Consultancy for developments located just west of the project area, notably the 2010 Tambaredjo North-West Oil Field Development ESIA, 2014 Farmersland Production Development ESIA and 2018 Calcutta-North Appraisal Drilling ESIA. Where information has been obtained from different sources, those are referenced.

Where appropriate, baseline information has been supplemented or generated by specialists appointed to undertake baseline and impact assessments for the proposed Project.

The specialist baseline and impact studies undertaken for the ESIA process are listed in Table 4-1.

Table 4-1: Specialist baseline studies undertaken for the ESIA

Specialist Study	Specialist
Air Quality Impact Assessment	Airshed Planning Professionals
Noise Impact Assessment	Airshed Planning Professionals
Surface Water Quality Study	Noordam Environmental Consultancy
Terrestrial Ecology Impact Assessment	Noordam Environmental Consultancy
Social Impact Assessment.	Social Solutions

Specialist baseline and impact assessment reports are attached as Appendix E to Appendix I.

4.1 Biophysical Environment

4.1.1 Geology and Geomorphology

The study area is located in the Young Coastal Plain of the Guiana Basin, on Holocene deposits of the Coronie Formation. The area is situated on predominantly marine clay sediments of the Comowine Phase, deposited less than 1 000 years ago (Brinkman and Pons, 1968). Considerable accretion has occurred along the coast north of the project area during the last decades. The Young Coastal Plain is dominated by flat and low-lying swamps and marshes with clay soils at 1 - 1.5 m above mean sea level, on which a peat layer has developed.

In the Tambaredjo Oil Field, the swamp has been drained and infilled to facilitate “dryland” oil exploitation (in contrast to the more recently developed Tambaredjo North-West and Calcutta North fields, where “wetland” drilling is practiced).

4.1.2 Climate

4.1.2.1 General Description of Regional Climate

Suriname has a typical tropical climate with high rainfall and high temperatures. Most rainfall in the region falls in two rainy seasons, interspersed with two 'dry' seasons as follows (Webster & Roebuck, 2001):

- Short rainy season – early December until early February;
- Short dry season – early February until mid-April;
- Long rainy season – mid-April until mid-August; and
- Long dry season – mid-August until early December.

4.1.2.2 Rainfall

Rainfall data acquired over a period of 39 years (see Figure 4-1) indicates a long-term average of approximately 2 200 mm per annum in Paramaribo.

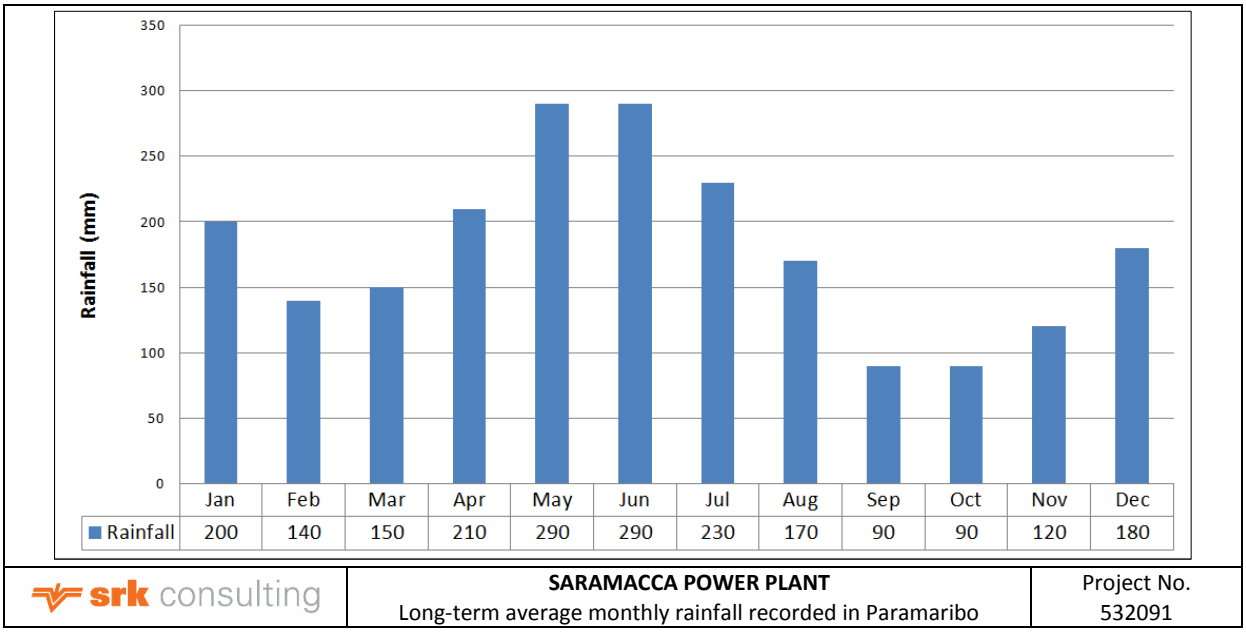
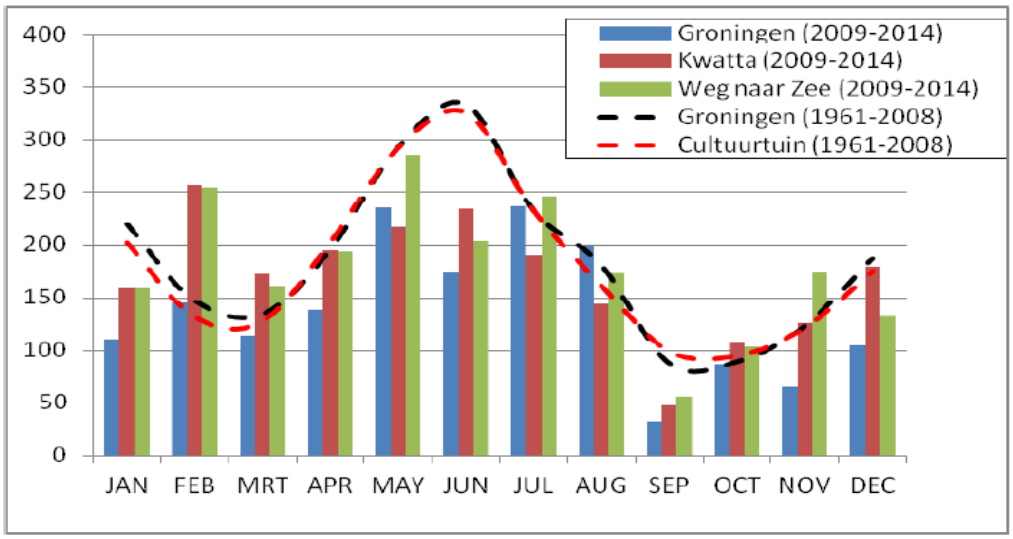


Figure 4-1: Long-term average monthly rainfall recorded in Paramaribo

Source: Weatherbase, 2013

Measurements of rainfall in the study area between 2009 and 2014 indicate similar annual rainfall and trends (Noordam, 2014). Average annual rainfall was 2018 mm at Kwatta and 2186 mm at Groningen in the period, compared to a long-term annual average of 2 233 mm at Groningen and 2 248 mm at Cultuurtuin, with a peak in May to July.



srk consulting	**SARAMACCA POWER PLANT** Average rainfall for 2009 – 2014 (Groningen, Kwatta, Weg naar Zee) and 1961 – 2008 (Groningen, Cultuurtuin)	Project No. 532091

Figure 4-2: Average monthly rainfall for 2009 – 2014 (Groningen, Kwatta, Weg naar Zee) and 1961 – 2008 (Groningen, Cultuurtuin)

Source: Noordam Environmental Consultancy (2014)

Rainfall is an important parameter with respect to air quality, which deteriorates during dry conditions and improves during the wet season. However, in Suriname even during the dry season(s) rainfall is relatively high. During wet periods, rain suppresses dust particles in the atmosphere and alleviates air pollution. Dust emissions are further reduced by damp soil conditions. During dry periods, dust emissions generally increase as the soils become desiccated.

Humidity is generally high throughout the year, varying between 80% and 90% on the Coastal Plain and 75% in the Interior. The highest humidity values are recorded from May to July and the lowest from September to November.

4.1.2.3 Ambient Temperature

In Suriname, the period between July and October tends to be warmest, with daily temperatures reaching (average) highs of more than 31°C. The period from December to March is coolest, with daily temperatures in the coolest month, January, reaching a high of approximately 30°C. Minimum temperatures throughout the year are between approximately 22°C and 24°C. Monthly average, maximum and minimum temperatures obtained for the period January 2015 to December 2017 are shown in Table 4-2

Table 4-2: Minimum, maximum and mean temperature 2009 – 2011, Suriname

	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum	29.5	29.7	30.4	30.8	31.7	31.1	31.5	31.7	32.3	31.7	30.9	30.7
Minimum	22.5	22.8	22.8	22.1	23.8	23.8	22.9	22.5	23.1	22.8	22.3	23.5
Average	26.0	26.0	26.4	26.6	27.1	27.1	27.2	27.1	27.3	27.1	26.8	26.6

Source: MM5 Data January 2015 – December 2017, cited in Airshed Planning Professionals (2018)

Daily and monthly temperature trends are presented in Figure 4-3.

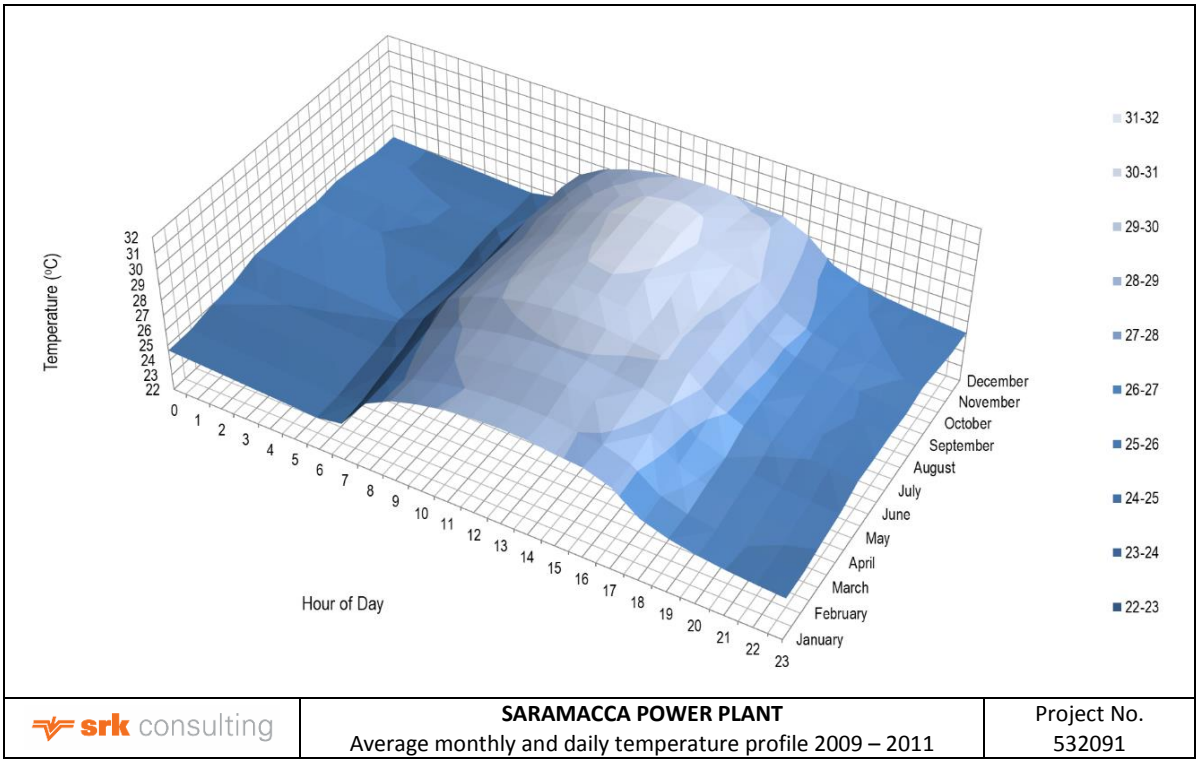


Figure 4-3: Average monthly and daily temperature profile 2015 – 2017, Saramacca

Source: MM5 Data January 2015 – December 2017, cited in Airshed Planning Professionals (2018)

Ambient air temperature is important, both for determining the effect of plume buoyancy (the greater the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing depth and inversion layers.

The atmospheric boundary layer is normally unstable during the day as a result of the turbulence due to the sun's heating effect on the earth's surface. The depth of this mixing layer depends predominantly on the extent of solar radiation, growing gradually from sunrise to reach a maximum at about 5-6 hours after sunrise. During night-time conditions a stable layer with limited vertical mixing exists. During windy and/or cloudy conditions the atmosphere is normally neutral (Airshed Planning Professionals, 2012).

4.1.2.4 Wind

Suriname does not experience hurricanes like the rest of the Caribbean region, but powerful winds do blow during strong storms. The dominant wind direction is easterly and north-easterly, with little variation between day and night-time wind directions.

Winds speeds are generally lower during the night, with a high frequency of 3 - 4 m/s winds evident at night, with no winds in excess of 5 m/s. During the day, wind speeds tend to be higher and occasionally exceed 6 m/s. Calmer conditions are more frequent at night than during the day (see Figure 4-4). The period average wind speed was calculated as 3.2 m/s (Airshed Planning Professionals, 2018).

Seasonal wind patterns show an increase in the occurrence of high wind speeds from March – May, and to a lesser extent from December – February. From June – August, calm conditions and south-easterly winds increase.

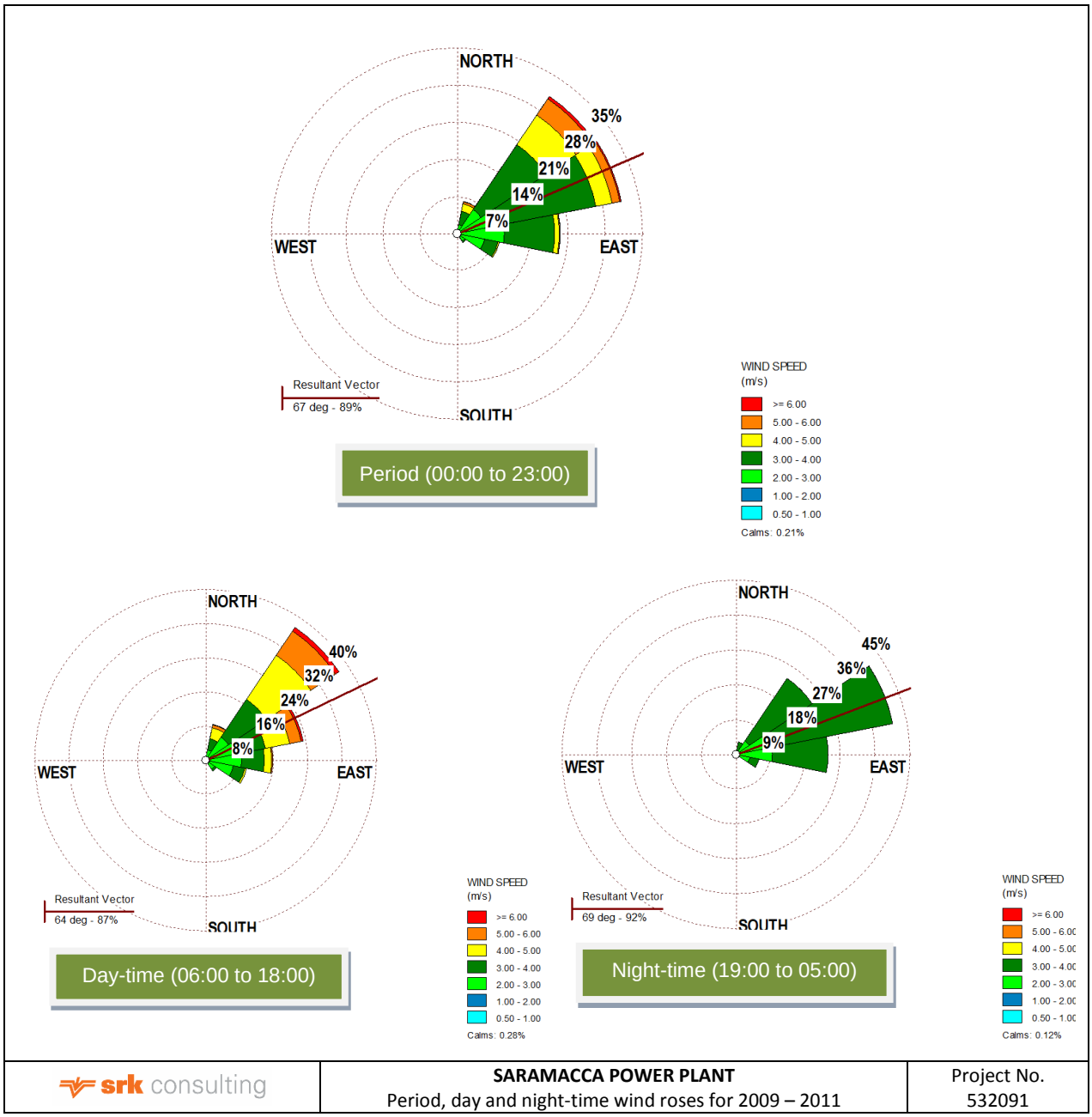


Figure 4-4: Period, day and night-time wind roses for 2015– 2017, Paramaribo

Source: MM5 Data January 2015 – December 2017, cited in Airshed Planning Professionals (2018)

Note: Wind roses comprise 16 spokes that represent the directions from which winds blow during a specific period. The colours in the wind roses reflect the different wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction. The frequency with which calms occur, i.e. periods during which the wind speed is below 0.5 m/s, is indicated above each wind rose.

4.1.3 Air Quality

There are few significant sources of air pollution in the area. The TA-58 plant, located ~150 m north-west of the proposed power plant, releases some atmospheric emissions and is the main (continuous) contributor to localised air pollution. Backup generators for the Sarah Maria facility are also located at TA-58 and emit exhaust fumes when operational. Emissions, and ambient pollution levels, are expected to be relatively low and localised (Airshed, personal communication 2018).

Other potential sources of air pollution include vehicles entraining dust on unpaved roads and farming activities generating mainly airborne particulates during harvesting, burning of surplus biomass and spraying of fields.

Traffic volume in the Tambaredjo Oil Field is very low, and stringent speed limits apply. Staatsolie vehicles are thus not expected to generate significant dust in the concession area. Public roads, notably Gangaram Pandayweg, and the nearest rice farms are located ~7 km to the south and not expected to impact air quality at the project site.

Passive samplers were placed around the project site (locations A – D in Figure 4-5) to determine the ambient baseline concentration of key pollutants. Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2), Hydrogen Fluoride (HF) and Volatile Organic Compounds (VOCs - benzene, toluene, ethyl benzene and xylene) concentrations were sampled using Radiello passive samplers within the Sarah Maria facility. NO_2, SO_2 and HF passive sampling was carried out from the 10 - 17 August 2018, while VOCs sampling occurred from 17 - 24 August 2018.

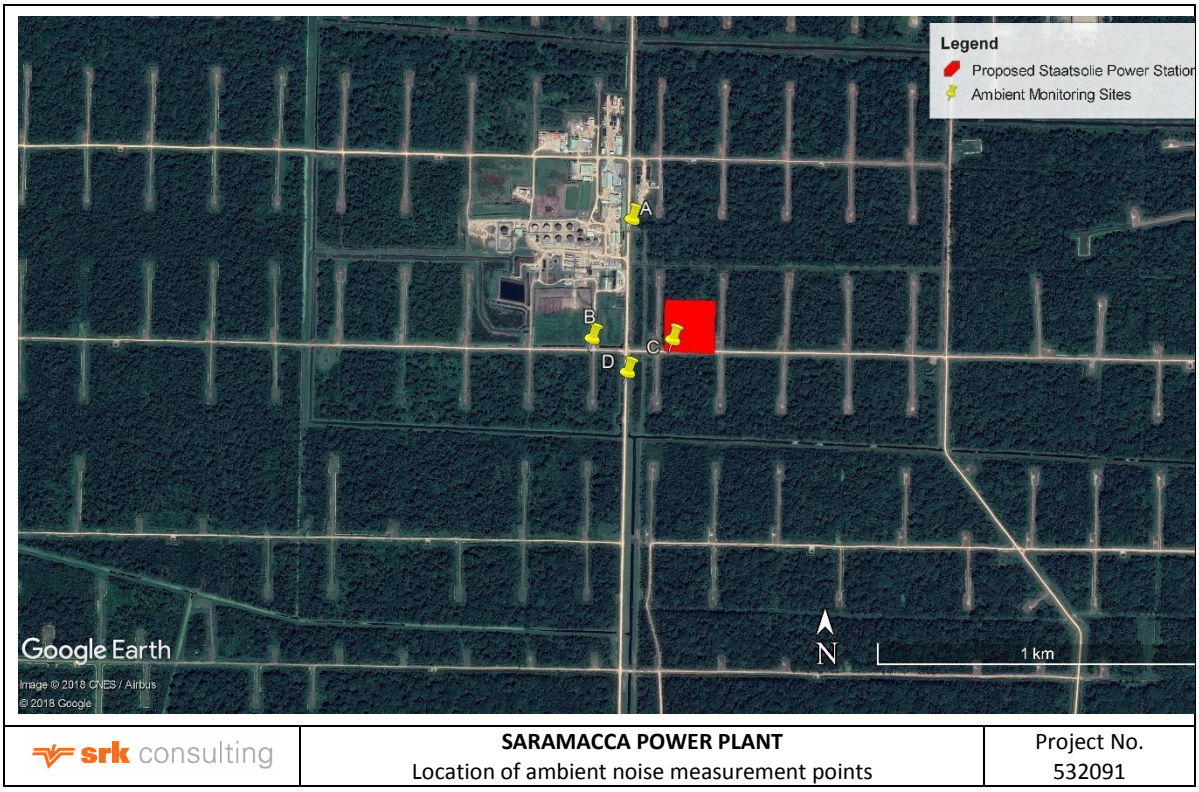


Figure 4-5: Location of passive sampling points

The adopted hourly average ambient concentration limits for NO_2, SO_2, HF, toluene, ethyl benzene and xylene are 200 µg/m³, 350 µg/m³, 18 µg/m³, 640 µg/m³, 2 560 µg/m³ and 350 µg/m³ respectively, while the adopted annual average screening limit for benzene is 5 µg/m³ (see Table 6-6). Limits were extrapolated for the seven-day period for which sampling was conducted for NO_2, SO_2, HF, benzene, toluene, ethyl benzene and xylene as 13.8 µg/m³, 24.1 µg/m³, 39.1 µg/m³, 44.6 µg/m³, 178 µg/m³, 24.4µg/m³ and 1.24 µg/m³ respectively. Sampling results that exceed these limits will potentially exceed their short-term (or long-term, for benzene) limit.

Measured passive sampling results are presented in Table 4-3. All measured pollutants are low, and well below their respective extrapolated seven-day screening limits, indicating that baseline air quality is good. Measured pollutant concentrations represent between 0.5% and 15.6% of their respective seven-day screening limits.

Table 4-3: NO_2, SO_2, HF (10th to 17th August 2018) and VOCs (17th to 24th August 2018) passive sampling results

Pollutant	Passive sampling results				Extrapolated 7-day screening limit (µg/m³)	Measured result as % of 7-day limit
	Site A (µg/m³)	Site B (µg/m³)	Site C (µg/m³)	Site D (µg/m³)		
NO_2	2.15	2.05	1.54	2.12	13.8	11.2% to 15.6%
SO_2	0.39	0.67	0.39	0.39	24.1	1.6% to 2.8%
HF	0.19	0.19	0.19	0.19	1.24	15%
VOC (Benzene)	0.74	0.74	0.74	0.74	39.1	1.9%
VOC (Toluene)	0.8	0.8	0.8	0.8	44.6	1.9%
VOC (Ethyl Benzene)	0.88	0.88	0.88	0.88	178	0.5%
VOC (Xylene)	1.77	1.77	1.77	1.77	24.4	7.3%

4.1.4 Noise

Measurements were taken at seven locations around the project site to determine the ambient baseline noise levels (see Figure 4-6). Sites A – D are located in close proximity to the proposed power plant, while sites E, G and I are located near possible access routes to the Sarah Maria facility.

Baseline noise levels are typical of rural areas, with daytime sound pressure levels ranging from 46 dBA at location B (west of TA-58, where there is little traffic) to 66 dBA at Location I (10 km south-east of the project site, characterised by significant light and heavy vehicle traffic) (Airshed, personal communication 2018).

srk consulting	SARAMACCA POWER PLANT Location of ambient noise measurement points	Project No. 532091

Figure 4-6: Location of ambient noise measurement points

Table 4-4 provides a qualitative description of noise at sampling locations. Key sources of environmental noise include the TA-58 plant, which generates a low frequency hum, local fauna, such as birds, insects, primates and dogs, and vehicle traffic within the Sarah Maria facility and on public roads adjacent to the concession.

Table 4-4: Survey site descriptions and acoustic observations

Site Photo	Site Details and Observations
	**Site**: A **Coordinates**: 5°54'44.88"N; 55°30'45.49"W
	Description: North of proposed power plant location, east of TA-58, along main north-south access road
	Day-time acoustic environment: Low frequency humming from TA-58, vehicle traffic on north-south road, birds and insects
	Night-time acoustic environment: Low frequency humming from TA-58, very occasional vehicle traffic on north-south road, birds and insects
	**Site**: B **Coordinates**: 5°54'32.80"N; 55°30'56.60"W
	Description: West of proposed power plant location, south of TA-58, along east-west road south of the power plant location
	Day-time acoustic environment: Light and heavy traffic on TA-58 approach road, birds, insects
	Night-time acoustic environment: Low frequency noise from TA-58, very occasional light road traffic on TA-58 approach road
	**Site**: C **Coordinates**: 5°54'32.61"N; 55°30'27.34"W
	Description: East of proposed power plant location along east-west road south of the power plant location
	Day-time acoustic environment: Light and heavy traffic on TA-58 approach road, birds, insects
	Night-time acoustic environment: Low frequency noise from TA-58, very occasional light road traffic on TA-58 approach road

	**Site**: D **Coordinates**: 5°54'20.48"N; 55°30'45.92"W
	Description: South of proposed power plant location, south of TA-58, along main north-south access road
	Day-time acoustic environment: Low frequency humming from TA-58, light and heavy vehicle traffic on north-south road, birds and insects
	Night-time acoustic environment: Low frequency humming from TA-58, very occasional vehicle traffic on north-south road, birds and insects
	**Site**: E **Coordinates**: 5°52'39.14"N; 55°34'8.18"W
	Description: South west of the study area, north of Saramacca river
	Day-time acoustic environment: Birds, insects and frogs with a single vehicle passing (noted by the sampler to not be normal for this location). Oil well pumps
	Night-time acoustic environment: Birds, insects, wildlife, baboons (or other primates). Oil well pumps
	**Site**: G **Coordinates**: 5°50'51.93"N; 55°30'51.78"W
	Description: At the entrance of the approach road from Sarah Maria emplacement to TA-58
	Day-time acoustic environment: Heavy and light vehicle traffic on Gangaram Pandayweg and the road to TA-58, birds, insects
	Night-time acoustic environment: Occasional light vehicles passing, birds, and insects.

Site: I
Coordinates: 5°49'52.67"N; 55°27'52.28"W

Description: Corner Wayamboweg and Gangaram Pandayweg

Day-time acoustic environment: Heavy and light vehicle traffic, idling busses, birds, insects

Night-time acoustic environment: Occasional light and heavy vehicles on both roads, birds, insects

Sampled daytime L_{Aeq} (Figure 4-7) were highest at sampling locations D, G and I where traffic volumes are highest. A large discrepancy between L_{AFmin} and L_{AFmax} (Figure 4-9) recorded at these sampling locations close to the major roadways indicates that in the absence of the vehicle traffic, environmental noise at these locations is quite low. Because of the high frequency noise from the TA-58 facility, L_{AFmin} at the locations close to the TA-58 plant (A, B, C & D) is higher than L_{AFMin} levels recorded at other locations (E, G & I).

Of the four sampling locations in the vicinity of the proposed power plant location, sampled daytime L_{Aeq} was highest at sampling locations A and D, which were located next to the north-south TA-58 access road. Sampled L_{Aeq} at sampling locations B and C, which are located to the east and west of the access road, were typical of daytime levels in rural locations. Due to a large number of insects as well as increased propagation potential for the low frequency noise from TA-58, night-time L_{Aeq} at these two locations was actually higher than daytime L_{Aeq} levels.

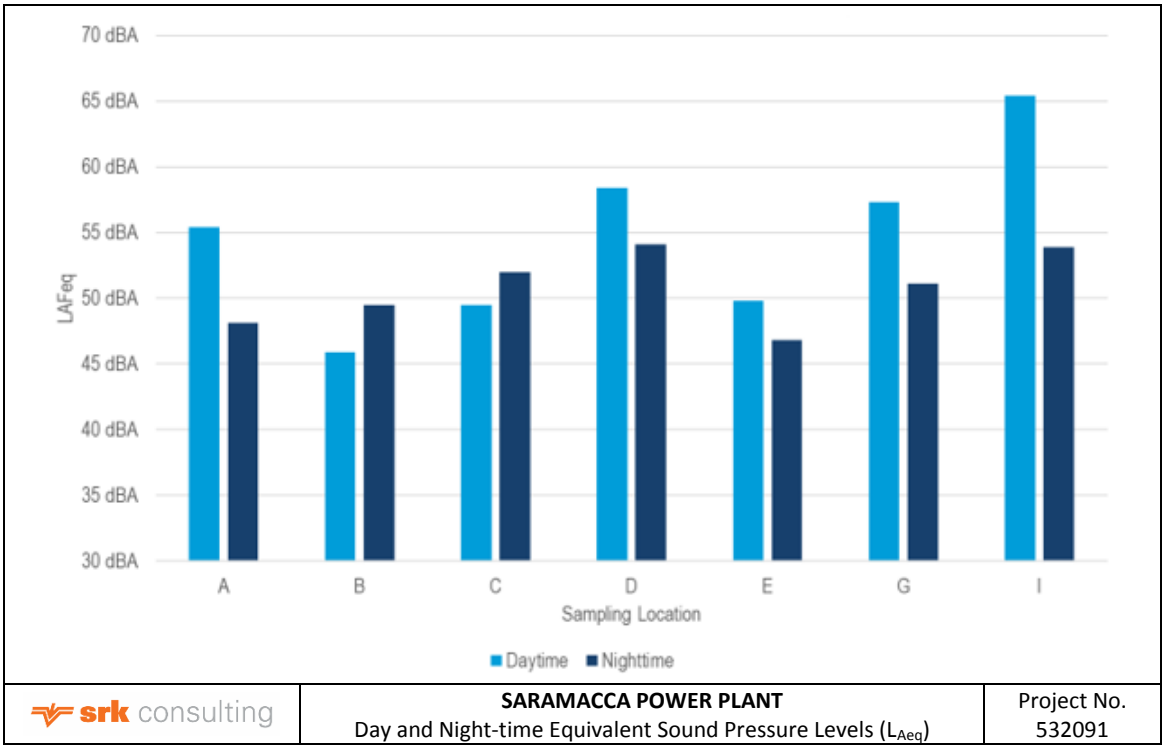
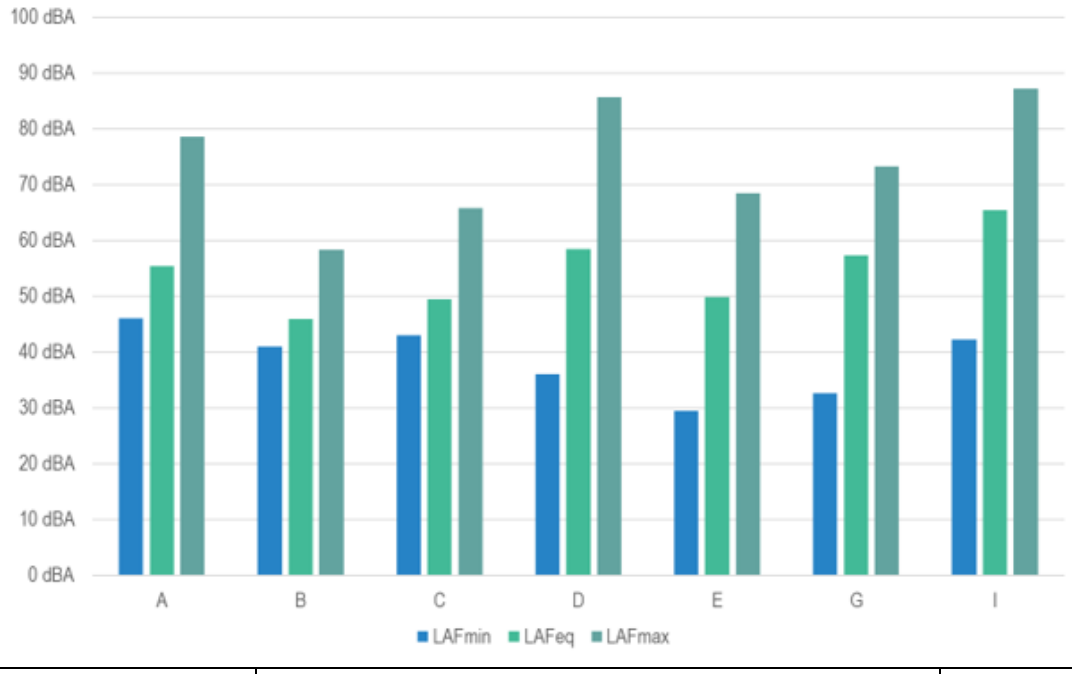


Figure 4-7: Sampled day and night-time $L_{Aeq\ (1hour)}$ levels



srk consulting	SARAMACCA POWER PLANT Logges daytime LAFmin, LAFeq and LAFmax sound pressure levels	Project No. 532091

Figure 4-8: Sampled LAFMin, LAeq LAFMax and levels recorded at each of the sampling locations

4.1.5 Hydrology

The Saramacca District has approximately 3 320 km^2 of coastal wetlands, of which 370 km^2 support mangrove forest. Most wetlands consist of swamplands with poorly to very poorly drained soils, which are inundated either permanently or at least during the greater part of the year. Areas along the coast or tidal river sections are inundated twice a day during high tide. Water quality in the Coastal Plain varies from saline to brackish near the coast to freshwater further south.

Historically, the northern part of the swamp drained north towards the sea, while the southern part drained south towards the Saramacca River. The approximate catchment boundary is indicated by the red line in Figure 4-9. The area draining northwards is considered to support important ecosystem goods and services that are particularly sensitive to the hydrology and water quality, and includes the Coppename Monding Nature Reserve (see Figure 4-10). The proposed Saramacca Power plant lies just south of this approximate historic watershed.

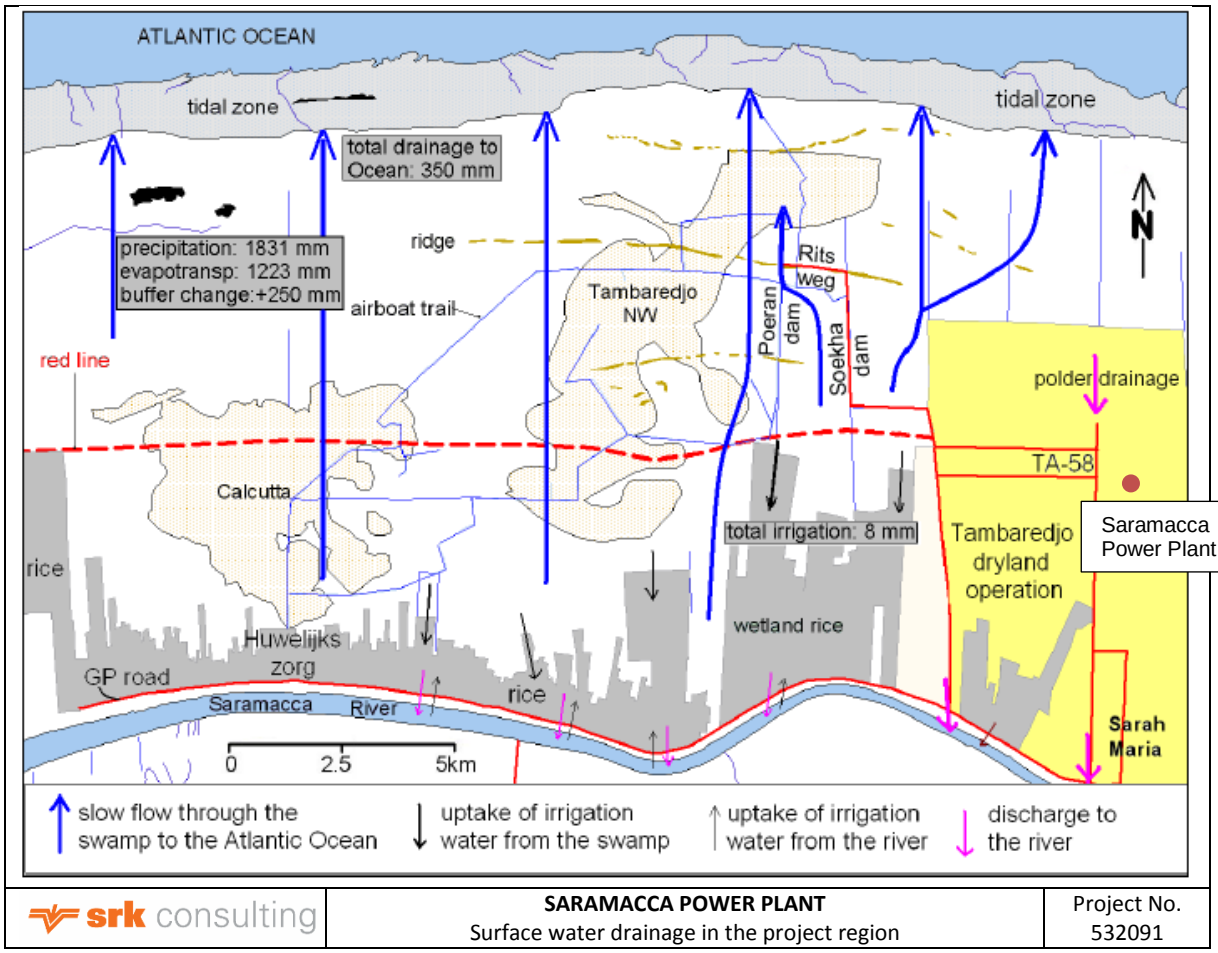


Figure 4-9: Surface water drainage in the project region

Source: Noordam Environmental Consultancy (2010)

The natural hydrological conditions of the area draining southwards have been affected over time by dryland cropping, road construction, development of rice polders, abstraction and discharge of irrigation water and the development of the Tambaredjo oil polder. As a result, water levels have changed, flow of swamp water to the Saramacca River has been obstructed in certain areas, and drainage patterns have changed as indicated in Figure 4-9, i.e. more water drains northwards than previously, while the entire Tambaredjo Polder drains southwards.

The Tambaredjo Oil Field (outlined in white in Figure 4-10) was developed in a former wetland area located between the Buru and Wayambo swamps. The polder is characterised by south-north aligned dams and canals that obstruct the natural water flow in the swamp. The entire polder area now drains via two main canals towards the Saramacca River.

srk consulting	SARAMACCA POWER PLANT Location of Tambaredjo oil polder relative to other features	Project No. 532091

Figure 4-10: Location of Tambaredjo oil polder relative to other hydrological features

The project site is located the Tambaredjo Polder, for which excess water is discharged into the Saramacca River by a number of large N-S canals. In addition to these N-S canals there are also a number of E-W canals that connect the N-S canals. The N-S canals drain into the Saramacca River through culverts. The project site drains through the Kisoensing-west Canal that runs along the main access road of the polder. The culverts along the Saramacca River are operated by Staatsolie, so the company has full control on the water management of the polder

Key sources of potential water pollution include the TA-58 plant, the Sarah Maria facility the waste incineration area and the landfarm in the Tambaredjo Polder (see Figure 3-3).

4.1.5.1 Tambaredjo Polder Water Quality

Historic water quality data (1999) for the Tambaredjo polder recorded elevated chloride (salinity) > 250 ppm chloride at the outlet of the TA-58 oil-water separator, where effluent is released into the canal. It is, however, expected that salinity will be considerably reduced downstream at the outfall into the Saramacca River due to dilution of the effluent by stormwater.

Very low pH was measured near TA-58, but in the remainder of the locations pH is much higher. Overall pH during the dry season is higher than during the rainy season. Dissolved oxygen (DO) levels vary from low to medium, with overall higher DO in the dry season.

Very high turbidity was measured at one location, but typically varies between 35 and 66 Nephelometric Turbidity Unit (NTU), consistent with data for a 2016-17 sampling campaign (Staatsolie), for which 90% of the results are between 41 and 114 FTU. These turbidity values correspond with Total Suspended Solids (TSS) values between 31 and 82 mg/L (Staatsolie data 2015-16, sampling Kisoensingh-west Canal).

Nitrate and ammonia are very low, which is normal for unpolluted natural waters. The phosphate levels are very low to medium. The measured nutrient levels do not point to organic pollution.

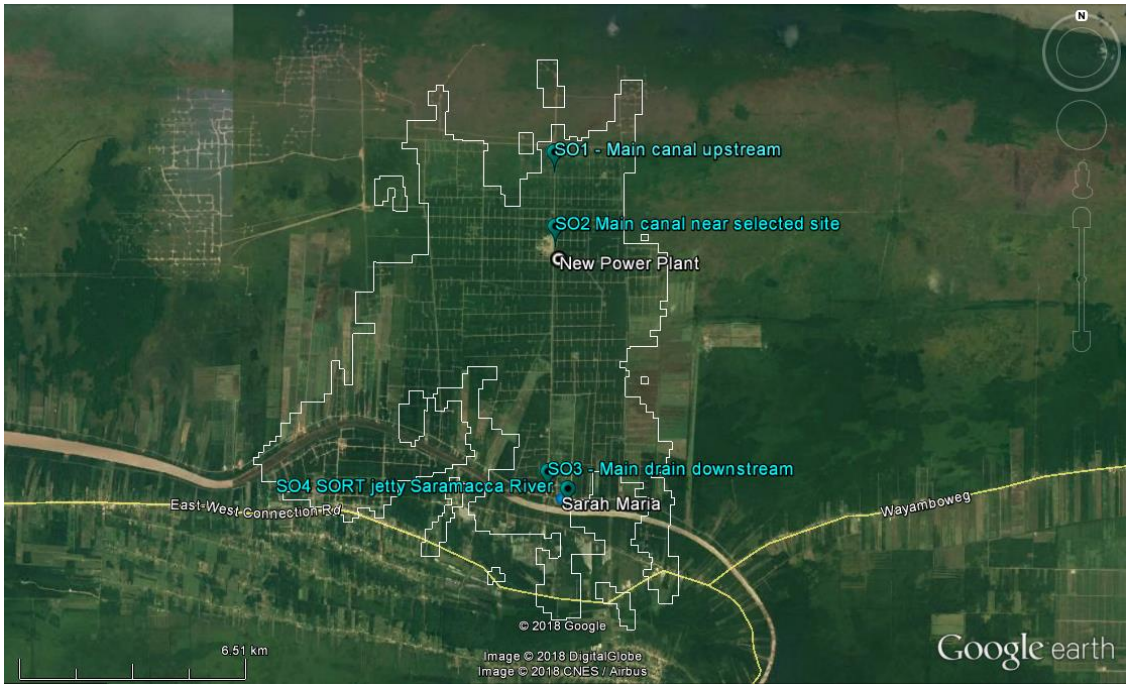
For the **current study**, surface water samples were taken in the Kisoensingh-west Canal at locations SO1-SO3 (and the Saramacca River at location SO4), upstream and downstream of the

proposed new power plant (see Figure 4-11), during the rainy (11 July 2018) and dry seasons (3 October 2018), to determine the baseline water characteristics and concentration of key pollutants. Aside from higher pH, all other parameters are more or less within the same range as in 1999.

A number of metals are found in the water, of which barium, arsenic and zinc are encountered in at least 50% of the samples. Arsenic exceeds the guideline value for consumption of organisms by humans, but it is below the value for aquatic life. The elevated barium levels could be related to spills of barite or disposal of spent drilling mud. The SO3 dry season sample exceeds the USEPA guideline for consumption of organisms.

Furthermore, there are a number of chemical compounds, of which toluene and diazinon are found in all rainy season samples and phenols in both rainy and dry season samples. These findings could possibly be related to release during processing of crude oil (toluene), spills or leakages of certain chemicals like wood preservatives (phenols) and the use of insecticides (diazinon).

Of interest is the presence of PCB's in sample SO2 during the rainy season sampling. The sample is taken near TA-58 and most likely points to pollution from that source. The level is well above the USEPA guideline level for human consumption. Minor diesel and gasoline spills can be observed in samples SO1 (rainy season) and SO2 (dry season).



srk consulting	**SARAMACCA POWER PLANT** Location of surface water sampling points	Project No. 532091

Figure 4-11: Location of surface water sampling points

4.1.5.2 Saramacca River Water Quality

The current study found that pH is slightly acidic, while salinity is very low. There is, however, a slight increase in pH and EC for the Long Dry Season, but there is no indication of salt intrusion from the ocean, which would be indicated by EC values > 1 mS. Dissolved Oxygen is moderate with values of 5.5 mg/L.

Total Suspended Solids (TSS) is higher than the TSS in the Kisoensingh-west canal (except for sample SO2 - LDS), probably under influence of the tidal movement. Phosphorus is lower than in the canal, because the canal water has more exchange with soil and organic debris.

Rainy and dry season samples from the Saramacca River (SO4) adjacent to the Tambaredjo Polder, showed elevated levels for barium, zinc and diazinon in both seasons. Similar levels of barium and diazinon have also been recorded in the Suriname and Coppename Rivers (NEC & ILACO 2016), with 6-12 µg/L barium and 0.3-0.7 µg/L diazinon. It should be noted that the Coppename River is considered an unpolluted river. The elevated concentrations of these compounds are thought to be the result of natural processes and therefore represent natural background levels in these rivers.

The diazinon levels in the canal are also considered to represent natural background levels, as they are in the same range as found in the rivers. However, the barium level in the canal is above the natural river levels and points to pollution.

Elevated levels for toluene and Total Petroleum Hydrocarbon were measured in the rainy season sample. These are likely the result of an oil spill or leakage.

Apart from the latter, the river water can be characterised as unpolluted.

4.1.6 Geohydrology

The coastal plain of Suriname is underlain by three major aquifers within the Corantijn Group (SRK, 2013):

- The A-sand aquifer (in the Burnside Formation) contains freshwater in many locations, including Paramaribo, where it is found at an approximate depth of 150 m. The aquifer thickness varies from 10-60 m. The A-Sand aquifer is not directly recharged by rainwater, and it is suspected that upward leakage of groundwater from the older, underlying formation is likely;
- The Coesewijne aquifer contains freshwater in many locations of the coastal plain, including Paramaribo. The top of the aquifer is found at a depth of 70 m at Paramaribo. The Coesewijne sands are in hydraulic contact with the overlying Zanderij Formation, with groundwater flow in the southern Young Coastal Plain (Helena Christina road – Lelydorp) and diffusion in the northern Young Coastal Plain; and
- The Zanderij aquifer contains mostly brackish water in the Young Coastal Plain. The Formation crops out in the Savanna Belt and dips to the north. At Paramaribo it is found at depths of about 30-50 m. The Zanderij Formation is in hydraulic contact with the sandy deposits of the Coropina Formation (Lelydorp Deposits) south of Lelydorp. In the study area the aquifer does not have hydraulic contact with surface deposits due to the heavy clay in overlying layers.

The oil-bearing sand is found below these aquifers and forms the basal unit of the Saramacca Formation, which was deposited on top of an erosional surface that marks the transition from the Cretaceous to the Tertiary (Palaeocene).

Groundwater is abstracted at Sarah Maria from the Zanderij Formation at a depth of ~160 m to obtain process water for primary oil processing. Potable (drinking) water is not abstracted from aquifers north of the Saramacca River, as the groundwater is brackish and/or has an objectionable oily taste. Drinking water is abstracted from the Coesewijne aquifer south of the Saramacca River, e.g. in Tijgerkreek, Tambaredjo and Groningen.

Potable water for the Staatsolie operations at Saramacca is transported from the Tijgerkreek plant by means of a separate piping network through Josikreek to Sarah Maria and TA-58. The community at large (Calcutta/Tambaredjo) receives potable water from the plant at Tijgerkreek, through a separate public distribution network.

4.1.7 Flora

Fieldwork was undertaken on 9th October 2018 by Pieter Teunissen and Dirk Noordam, and included observations made at 12 locations to groundtruth desktop data.

The coastal region is characterised by vegetation succession from saline mangroves to freshwater habitats. Along the coast, young Black Mangrove (*Avicennia germinans*) develops where mudflats silt up above mean sea level. With the prevailing net coastal accretion, a closed to open Black Mangrove belt has developed. South of the Black Mangrove belt, herbaceous brackish water swamps (with or without scattered Black Mangrove trees) have developed on firmer soils on which a peat layer develops. Further inland, grass swamps become fresh and richer in species. Gradually low to high species-rich swamp wood may develop.

Original vegetation in the project area is expected to include Herbaceous brackish water swamp, dominated by Cat tails (*Typha dommingensis*) with or without scattered Black Mangrove trees, High swampwood, dominated by Swamp cork wood (*Pterocarpus officinalis*) and White cedar *(Tababuia insignis),* and Swamp scrub and bushes characterized by Swamp Plumb (*Chrysobalanus icaco*) and Swamp Soursop (*Annona glabra*).

The Tambaredjo Polder area has been substantially transformed by human activities such as dryland cropping, road construction, development of rice polders, abstraction and discharge of irrigation water and the development of the Tambaredjo oil polder (also listed in Section 4.1.5). Natural swamp and marsh habitat in most of the study area was cleared and drained / infilled to create polders for agriculture.

srk consulting	SARAMACCA POWER PLANT PROJECT Vegetation on the project site	Project No. 532091

Figure 4-12: Vegetation on the project site

Source: S. Reuther (1 August 2018)

Secondary marsh forest, dominated by Mira Udu (*Triplaris surinamensis*), has developed on long-abandoned land, where exotic formerly cultivated trees, such as Almond (*Terminalia catappa*) Coconut palm (*Cocos nucifera*), Guava (*Psidium gujave*) and Royal Palm (*Roystonia regia*), are also encountered, while Pina palm (*Euterpe oleracea*) is also commonly found. In addition, six other tree species were recorded in the marsh forest. Much of the forest edges is covered by Patatatetei (*Ipomoea tiliacea*). Ditches are present along all forest edges, and Mokomoko (*Montrichardia arborescens*) has developed in and along these ditches. On the excavated material, locally Busipapaya (*Cecropia obtusa*) has developed.

The secondary marsh forest has low plant diversity compared to undisturbed similar habitats. Secondary vegetation on land abandoned less than 10 years ago comprises shrubs, bushes and small trees. Temporary fallow land has low vegetation with grasses, rushes and herbs with very low biodiversity. The invasive[6] water hyacinth (*Eichhornia crassipes*) is also present in the area.

The observed low secondary marsh forest contains commonly encountered species, is still in its early stage of development and is relatively low in species diversity. No vulnerable, rare or endangered plant species are present in the study area. The study area is not deemed sensitive with regards to ecosystems and floral biodiversity.

4.1.8 Fauna

Fieldwork was undertaken on 9th October 2018 by Pieter Teunissen and Dirk Noordam, and included observations made at 12 locations to groundtruth desktop data.

The mudflats and the mangrove zone between the Coppename and the Suriname Rivers are important feeding and nesting areas for residential coastal **birds**, and important feeding and wintering grounds for migratory birds. Breeding colonies of Scarlet ibises and heron species are present in the young Black Mangrove forests along the Saramacca coast from March/April to August/September. The Saramacca coast hosts 13 bird species of international importance. It is expected that the bird species found in the study area also occur in similar (near-) coastal habitats throughout Suriname.

A 1999 survey recorded 41 bird species, noting that the great majority of the bird species observed in the Tambaredjo polder is found in neighbouring swamp habitats, including the coastal strip, while all species are also present elsewhere in the Young Coastal Plain. According to the IUCN Red List, all bird species in the estuarine zone are of Least Concern (IUCN 2018). However, two bird species of the estuarine zone are listed on CITES Appendix I, and therefore should be considered endangered species on a global scale: Jabiru (*Jabiru mycteria)* and Peregrine Falcon (*Falco peregrinus).*

Twenty-four bird species are listed on CITES Appendices II and III, and therefore should be considered vulnerable species on a global scale:

- Scarlet Ibis (*Eudocimus ruber*);
- American Flamingo (*Phoenicopterus ruber*);
- Osprey (*Pandion haliaetus*);
- All parrots (2 species);
- All hummingbirds (4 species in the estuarine zone);
- All hawks, except for the Peregrine Falcon = CITES appendix I (9 species);

[6] Although native to the Amazon Basin, including Suriname, the plant is invasive in the area.

- All New World vultures (3 species); and
- All owls (3 species).

Some of above species may be present in the Tambaredjo polder periodically or fly over the polder. Apart from the breeding colonies and migrant birds, seasonal patterns in bird distribution are not apparent.

A 1998 study of **fish** communities in the Tambaredjo Oil Field (near the TA-58 plant) identified various Characidae (particularly *Ctenobrycon spilurus*) and Cichlidae species as well as Guyana leaffish *(Polycentrus schomburgkii)* and Guppy *(Poecilia reticulate)*. Fish diversity in the Tambaredjo Oil Field was higher compared to undisturbed *Typha* swamp and high swampwood habitas in adjacent areas. This may indicate that river fish (Warawara [*Hypostomus* sp.]) enter the Tambaredjo oil polder via canals from the Saramacca River and that certain species (e.g. Swamp eel [*Synbranchus marmoratus*], Ston-walapa [*Erythrinus erythrinus*] and Datrafisi [*Crenicichla saxatilis*]) have low abundance or are difficult to catch in their natural swamp(wood) habitat.

Herpetofauna diversity in the area is expected to be limited. Reptiles occurring in the study area will include Iguana (*Iguana-iguana*), Spectacled Caiman (*Caiman crocodilus*) and Anaconda (*Eunectes murinus*); these are common in Suriname but diminishing in populated areas. No unique, *Rare, Endangered, Vulnerable* or biogeographically important species were previously found in the Buru Swamp area. The Saramacca coast north of the project area does not provide sand and shell beaches for sea turtle nesting. Most of the snakes and amphibians recorded in the Tambaredjo polder are also known to occur in the neighboring swamp habitats.

A number of **mammals**, including Capybara (*Hydrochoerus hydrochaeris)* and Howler monkey (*Alouatta)*, are known to occur in the region. None of the mammals occurring in the coastal area and listed on the IUCN Red List are confined to the coastal area, and none of them are listed as *Vulnerable* or *Endangered*. All mammals recorded in the Tambaredjo polder are also known to occur in the neighboring swamp habitats.

The Jaguar (*Panthera onca*), Giant Anteater (*Myrmecophaga tridactyla*) and the Neotropical Otter (*Lontra longicaudis enudris*) are included on the IUCN Red list and CITES appendices. The Brown Capuchin (*Cebus apella*) and the Spectacled Caiman (*Caiman crocodilus*) are included in Appendix II of CITES, indicating a globally vulnerable status. All other species expected to occur on the site and listed in Annexure B are of Least Concern (IUCN Red list) and not included in the CITES Appendices

Overall, the secondary marsh forest found at the project site is expected to have relatively low fauna diversity compared to undisturbed similar habitats, due to the fragmentation of higher secondary vegetation (which is more likely to harbour animals) and human activity in the area. The study area is not deemed sensitive with regards to ecosystems and fauna.

4.1.9 Conservation Areas

The Coppename Monding Nature Reserve was first established as a bird sanctuary in 1953 along the coast east of the Coppename River mouth, and declared a nature reserve in 1966 for the purpose of research, nature education and tourism. It is also listed as a Wetland of International Importance (RAMSAR site).

The southern boundary of the eastern-most portion of the Coppename Monding Nature Reserve is located 5.5 km north of the proposed power plant (see Figure 4-10).

4.2 Socio-Economic Environment

The project is located in the 872 km^2 Wayambo resort, which has the smallest population of the resorts of Saramacca district, with 1 186 residents, less than 10% of the district population of 15 696.

The only inhabited areas on the right (northern) bank of the Lower Saramacca River are located along (parts of) the Gangaram Panday Road, which branches off Wayambo Road (that leads towards Paramaribo) and extends for 30 km towards the west along the right bank of the Lower Saramacca River. Roughly 345 persons (less than 100 families) live permanently along the Gangaram Panday Road, in four settlements: Sarah Maria (near the existing Staatsolie facility), La Prevoyance (10-12 residences and local government institutions), Bombay (15-16 residences) and Huwelijkszorg (~30 residences).

Residential areas located nearest to the proposed power plant are shown in Figure 4-13. Eight residential clusters comprising 3-4 households each and one allotment project comprising 4 houses are located in the 8 km section from the intersection with Wayambo Road that leads past the Sarah Maria facility.

Most families residing along the Gangaram Panday Road practice horticulture (domestic cultivation). Crops include tomatoes, eggplant, beans and oerdi, the latter for commercial purposes. Farming activities include animal husbandry (cows and chickens) and cultivation of plantains and rice. Most farmland in the area lies fallow or has been abandoned. One sawmill operates along Gangaram Panday Road; logs are transported by river and processed planks are transported to Paramaribo by pick-up truck on the Gangaram Panday Road every two weeks. Approximately 20-25 persons living along Gangaram Panday Road are currently employed by Staatsolie.

Three school buses transport pupils to and from school on the Gangaram Panday Road. Other traffic on the road is used by commuting residents, Staatsolie personnel driving to and from the Sarah Maria facility, Staatsolie contractors/subcontractors driving to and from Staatsolie facilities and non-residents visiting their weekend/holiday homes and/or outsiders visiting the fishing spots.

Field observations noted frequent truck movements (sand transport). Traffic intensity peaks between 07h00 – 09h00 and 12h00 - 15h00, attributed to commuter traffic to and from the Sarah Maria facility.

Fishing spots are located on the private terrain of land owners living along the Gangaram Panday Road. During fishing season (usually the dry season), fishing spots or ‘fish holes’ (of which five are well known) are opened to the public. Staatsolie representatives reported that people illegally use Staatsolie’s concession area on the Tambaredjo polder for fishing and hunting.

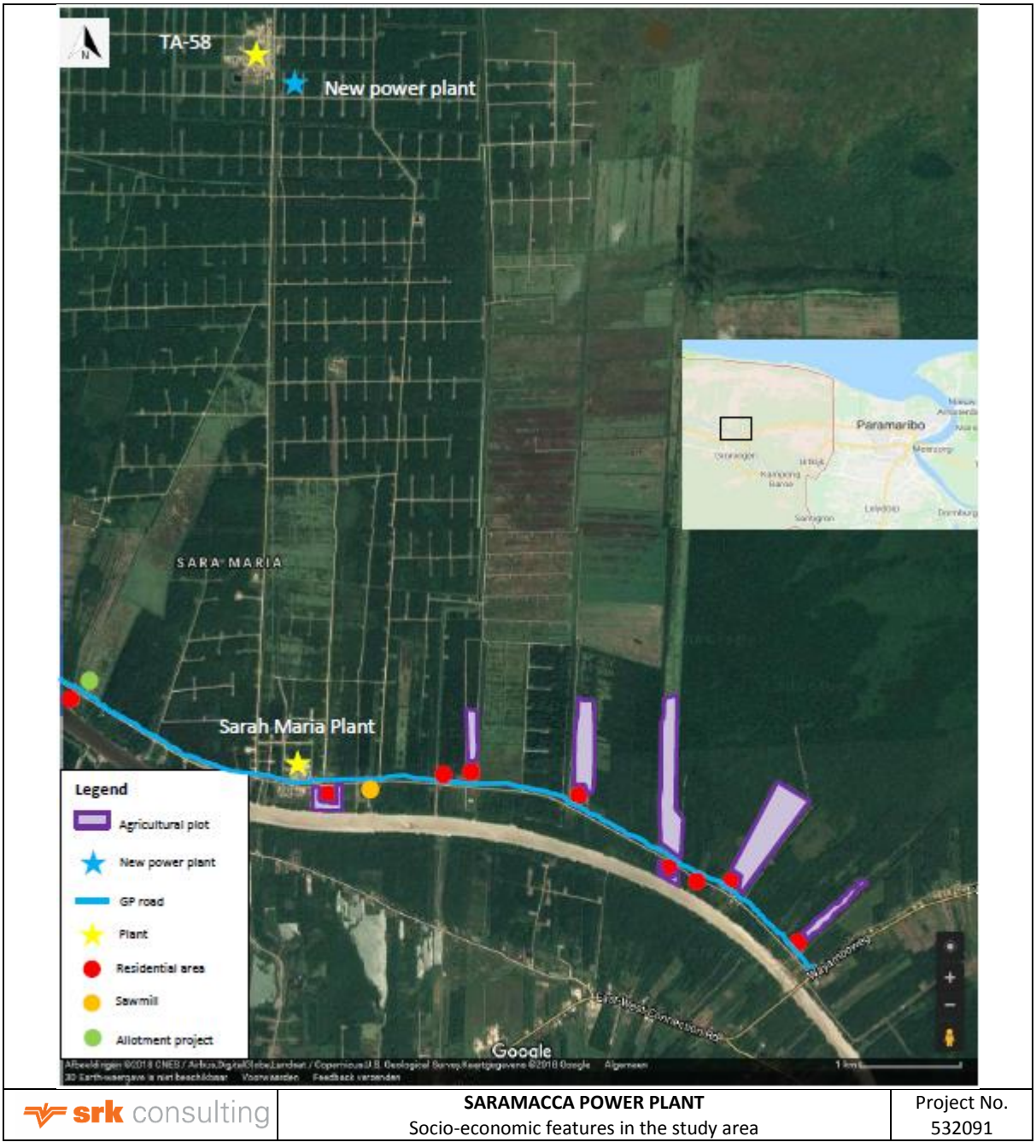
Some households have access to tap water, but most depend on rain water for drinking water. Water pipelines have been installed along Gangaram Panday Road from the intersection with Wayambo (km 0) to Km 3 and from Km 7 to Km 11.5, but none of the households have been connected yet. Connections are expected to be in place by end-2018. All household along Gangaram Panday Road have access to electricity.

While the district of Saramacca accommodates a multicultural society with different ethnic groups, the Hindustani and Javanese ethnic groups dominate the cultural landscape in this part of the country. Population data from 2014 show that 53.3% of the total district population is of Hindustani ethnic descent, while other ethnic groups included Javanese and Creole people (people of African descent).

The Gangaram Panday Road and its surrounding area is not a traditional residential area of Indigenous Peoples and Maroons, and these tribal communities are not present in the vicinity of the planned power plant.

The main religion practised in Saramacca district is Hinduism (44.6%). Other religions practised in this district include Christianity (23.5%), Islam (18.8%), and other religions (3%).

Three archaeological sites – all settlements with graves - are located in the area, on the left bank of the Saramacca River: they will not be affected by the project. Two Hindu temples located along the Gangaram Panday Road, one at Bombay and another one at Huwelijkszorg.



srk consulting | **SARAMACCA POWER PLANT** Socio-economic features in the study area | Project No. 532091

Figure 4-13: Socio-economic features in the study area

Source: Social Solutions (personal communication, 2018)

5 Stakeholder Engagement

Stakeholder engagement forms a key component of the ESIA process. The objectives of stakeholder engagement are outlined in this section, followed by a summary of the approach to be followed, in compliance with best practice and NIMOS guidelines.

5.1 Objectives and Approach to Stakeholder Engagement

The overall aim of public consultation is to ensure that all stakeholders have adequate opportunity to provide input into the process and raise their comments and concerns. More specifically, the objectives of public consultation are to:

- Identify stakeholders and inform them about the proposed development and ESIA process;
- Provide stakeholders with the opportunity to participate effectively in the process and identify relevant issues and concerns associated with the proposed project; and
- Provide stakeholders with the opportunity to review documentation and assist in identifying mitigation and management options to address potential environmental issues.

5.2 Stakeholder Engagement during the Scoping Phase

The key stakeholder engagement activities undertaken during the Scoping Phase are summarised in Table 5-1 below.

Table 5-1: Stakeholder engagement activities undertaken during the Scoping Phase

Task	Objectives	Dates
Release of a Background Information Document (Brochure)	To provide background information on the proposed project to key interested stakeholders	August 2018
Initial authority meetings	To introduce the project and ESIA process to key authorities and obtain input at an early stage	1 - 2 August 2018
Identify and compile a stakeholder database	To determine initial key stakeholders	August / September 2018
Release Scoping Report, including a Non-Technical Summary, and place on SRK website and at the offices of the DC of Saramacca, and NIMOS	To provide stakeholders with access to the Scoping Report.	18 October 2018
Direct notification to key registered stakeholders	To notify stakeholders of the opportunities to engage the ESIA and SOM project teams and comment on the project during the Scoping Phase.	23 October 2018
Advertise public stakeholder meeting	To notify stakeholders of the public stakeholder meeting, which provides an opportunity to discuss the proposed project and the proposed approach to the Impact Assessment Phase.	Daily 29 October 2018 – 1 November 2018
Public comment period	To provide stakeholders with the opportunity to review and comment on the findings of the Scoping Phase.	18 October 2018 – 9 November 2018
Public meeting	To present the findings of the Scoping Report to stakeholders and provide an opportunity for questions and discussion.	2 November 2018
Compile Issues and Responses Summary and finalise Scoping Report	To record all issues and concerns raised and collate these comments in the final report which provides NIMOS with information to decide whether to accept the Scoping Report.	November 2018

The key activities are described in further detail below.

5.2.1 Release of a Background Information Document

A Background Information Document was compiled by SRK and Staatsolie to provide high-level initial background information on the proposed project to key interested stakeholders, and to raise awareness of the project and ESIA process at an early date.

The Background Information Document is provided in Appendix A and was distributed to key authorities (in early August 2018) and uploaded to Staastolie's and SRK's websites for public access.

5.2.2 Initial Authority Meetings

Two initial meetings were held with key authorities to introduce the project and the ESIA process and to obtain authority input at an early stage of the project, to help to guide the assessment of potential impacts during the Impact Assessment Phase.

Initial authority meetings were held with:

- District Commissioner and *Bestuurs Opzichters* of Saramacca, at Groningen on 1 August 2018, and
- Representatives of EBS, NIMOS, and Ministry of Public Works, Transport and Communication at Paramaribo on 2 August 2018.

Meeting notes are provided in Appendix B.

5.2.3 Identification of Key Stakeholders

Relevant district and national authorities, organisations and representatives as well as surrounding landowners were identified by Staatsolie and SRK and registered as stakeholders on the initial project database.

These stakeholders have been notified of the ESIA and the release of the Scoping Report for comment.

In accordance with the best practice and NIMOS guidelines, all other persons can request in writing to be placed on the register, submit written comments or attend meetings in order to be registered as stakeholders and included in future communication regarding the project. All persons who submit written comments, attend meetings or request in writing to be placed on the register will be registered as stakeholders, and advertisements advise that stakeholders register as such.

A list of stakeholders currently registered is provided in Table 5-2 and will be updated throughout the ESIA process.

Table 5-2: Stakeholder database

Name	Organization
Lackin, W	Kabinet van de President Coordinatie Milieu
van Klaveren, W	Kabinet van de President Coördinatie Milieu
Nelom, C	NIMOS
Sewnath, M	NIMOS
Tjon Akon, Q	NIMOS
Woei, L	Ministerie van Ruimtelike Ordening, Grond-en Bosbeheer
Abeleven, D	Ministerie van Natuurlijke Hulpbronnen
Soman, S	Ministerie van Openbare Werken, Transport en Communicatie
Tewarie, A	Ministerie van Openbare Werken, Transport en Communicatie

Name	Organization
Doebay, L	DC Saramacca
Asmowidjojo, S	DC Saramacca
Meghoe-Bhairo, L.	DC Saramacca
Oedai, R.	BO Wayambo
Parmessar, R	N.V. Energie Bedrijven Suriname
Eijndhoven, M	N.V. Energie Bedrijven Suriname
Pancham, R	N.V. Energie Bedrijven Suriname
Resomardono, C	N.V. Energie Bedrijven Suriname
Oehlers, D	N.V. Energie Bedrijven Suriname
Esajas, H	LBB
Poeran, A	Private
Jibodh, R	Private
Sookhlall, A.	RR Wayambo
Lim A Po, D	Private
Dhr. J. Bakker	RR Wayambo
Wasimin, A.	Integra Marine & Freight services
Datgety, M.	Integra Marine & Freight services
Rotsburg, J.	Rudisa
Ramlal, R.	OBO
Jogi, W.	W. Jogi Surcom Electronics
Chotkan, S.	S. Chotkan & Sons NV

5.2.4 Notification of the ESIA Process and Scoping Report for Public Comment

On 23 and 24 October 2108, key stakeholders were directly notified of and invited to the stakeholder meeting. Newspaper advertisements inviting stakeholders to attend the public meeting were placed in:

- Dagblad of Suriname on 29 October 2018; and
- Times of Suriname on 31 October 2018.

Notifications were also placed on the facebook site of the Bic Saramacca initiative by the DC of Saramacca.

Hard copies of the full report were available for public viewing from 18 October 2018 at the following venues:

- NIMOS; and
- Office of the Saramacca District Commissioner at Groningen.

An electronic version of the Scoping Report can also be accessed on SRK's website www.srk.co.za (via the 'Library' and 'Public Documents' links).

Stakeholders were provided with a comment period ending 9 November 2018. Proof of notification is provided in Appendix C.

5.2.5 Public Meeting

A public meeting is a public forum at which the findings of the Scoping Phase are presented for discussion. A public meeting was held in Dutch during the comment period to provide stakeholders

with the opportunity to ask questions and discuss any concerns related to the project. This helped to guide the assessment of potential impacts during the Impact Assessment Phase.

The public meeting was held on:

- Date: 2 November 2018
- Venue: Staatsolie Sarah Maria facility

The public meeting was attended by 19 stakeholders (see Figure 5-1). The meeting notes and presentations by Staatsolie and SRK are provided in Appendix D.

srk consulting	SARAMACCA POWER PLANT Public meeting 2 November 2018	Project No. 532091

Figure 5-1: Public meeting 2 November 2018

5.2.6 Issues and Concerns Raised by Stakeholders during Scoping

Stakeholder comments on the project were received during the public meeting (see Appendix D). No additional comments were received during the comment period. Comments were also received from NIMOS.

Comments are briefly summarised below:

Table 5-3: Summary of stakeholder comments

Comment	Stakeholder	Response
Section 7.6.2: Assess the impacts of noise on surrounding communities….. This must be an error because this section regards air quality?	NIMOS	Thank you, this has been corrected.
Impact rating methodology: Is the Short-Term rating of 2 years for the Duration of the Impact not too long? E.g a noise or air quality impact over a period of two years would not be considered short-term by a human receptor. Maybe define it more narrowly between now and a year?	NIMOS	Impact rating methodologies vary, and we acknowledge that different durations are associated with a short-term impact duration. In our experience, short-term is often defined as less than 5 years; SRK has adopted a more conservative approach of up to 2 years for the short-term rating in our standard impact assessment methodology. We note that other factors, such as intensity, extent and probability, will also determine the impact significance. Irrespective of the derived rating, the environmental consultant and specialists will also generally comment on the acceptability of the impact.
When will the project be at full capacity and will less energy be purchased from EBS NV?	Jerrel Rotsburg (Rudisa)	The schedule for installing full capacity has not yet been determined. The motivation for this power plant is not to replace power obtained from EBS but as a backup.
Why is the plant required and will it	Dennis Lim A	Staatsolie is expanding drilling, processing and oil

Comment	Stakeholder	Response
release effluent?	Po	recovery activities in Saramacca, which increases power demand. The plant will have closed circuit cooling water and lubrication oil systems and produces no routine effluent.

These comments have been considered in the assessment of impacts in Section 6 of this report.

5.2.7 Submission of Final Scoping Report

The Final Scoping Report was submitted to NIMOS.

5.3 Stakeholder Engagement during the Impact Assessment Phase

Stakeholder engagement activities during the Impact Assessment Phase are aimed at ensuring that the specialist studies and assessment by the EIA project team adequately address the issues and concerns raised during the Scoping Phase. Opportunity to raise further issues is also provided.

The key public participation activities during the Impact Assessment Phase are summarised in Table 5-4 below.

Table 5-4: Stakeholder engagement activities undertaken and planned during the Impact Assessment Phase

Task	Objectives	Projected Dates
Release ESIA Report, including a Non-Technical Summary, and place on SRK website and at the offices of the DC of Saramacca, and NIMOS	To provide stakeholders with access to the ESIA Report.	February 2019
Direct notification to key registered stakeholders	To notify stakeholders of the opportunities to engage the ESIA and SOM project teams and comment on the project during the Impact Assessment Phase.	February 2019
Place advertisements	To announce the availability of the ESIA Report for public comment.	February 2019
Public comment period	To provide stakeholders with the opportunity to review and comment on the results of the Impact Assessment Phase, and to obtaining written comments from stakeholders and key stakeholders on the EIA Report.	until 5 March 2019
Public meeting	To present the findings of the ESIA Report to stakeholders and provide an opportunity for questions and discussion.	Thursday 28 February 2019
Compile Issues and Responses Summary and finalise ESIA Report	To record and respond to all issues and concerns raised and collate these comments. To present the findings of the ESIA process, incorporating stakeholder comment and submit the ESIA Report to NIMOS.	March 2019

The key activities are described in further detail below.

5.3.1 Notification of ESIA Report for Public Comment

Registered stakeholders will be notified of the release of the ESIA Report for public review. Notifications will be e-mailed to registered stakeholders.

Newspaper advertisements inviting stakeholders to attend the public meeting will be placed in:

- Dagblad of Suriname; and
- Times of Suriname.

Hardcopies of this report are available for public review at the following venues:

- NIMOS; and
- Office of the Saramacca District Commissioner at Groningen.

An electronic version of the ESIA Report can also be accessed on SRK's website www.srk.co.za (via the 'Library' and 'Public Documents' links).

Stakeholders are provided with a comment period ending 5 March 2019.

5.3.2 Public Meeting

A public meeting is a public forum at which the findings of the Impact Assessment Phase are presented for discussion. A public meeting will be held during the comment period to provide stakeholders with the opportunity to ask questions and discuss any concerns related to the project.

The public meeting will be held on Thursday 28 February 2019.

5.4 Next steps

Following the close of the comment period, an Issues and Responses Summary will be compiled for inclusion with the Final ESIA Report. The ESIA Report will be submitted to NIMOS.

6 Environmental Impact Assessment

6.1 Introduction

6.1.1 Environmental Impacts Identified

Based on the professional experience of the EIA team, legal requirements (Section 2), the nature of the proposed activity (Section 3), the nature of the receiving environment (Section 4) and issues raised in the stakeholder engagement process (Section 5), the following key environmental issues – potential negative impacts and potential benefits – were identified:

- **Air quality** – the proposed power plant will generate air emissions: these emissions include SO_2 and NO_2 from the combustion of fuel in the generator internal combustion engines, and Volatile Organic Compounds (VOC) fugitively emitted from liquid fuel storage tanks, potentially increasing ambient concentrations, including those emitted by the nearby TA-58, and impairing air quality. Vehicles generate dust on unpaved roads. However, the project site is far from the nearest receptors, which is expected to substantially mitigate the impact;
- **Noise** – the proposed power plant will generate engine noise during operation, increasing ambient noise levels. Due to the relatively remote and isolated location of the plant, impacts from plant noise are expected to be minimal;
- **Water quality** – the proposed power plant will use a closed cooling water system, and no routine discharges of wastewater from the plant are envisaged. Small, intermittent discharges are expected to disperse relatively rapidly in the environment, but may impact on the water quality – and biodiversity – in the immediate vicinity;
- **Terrestrial ecology** – the construction of the power plant will require the clearance of ~2.5 ha of vegetation on the project site, also affecting faunal habitat. No new access roads are required. As the project affects modified low-sensitivity secondary vegetation and habitats, the ecological impact is expected to be minimal. During operation, the plant will increase human activity in the area and emit noise and (some) vibrations that may affect fauna in the area. However, human activity is already intensive in the area, due oil production on a dense drill grid; and
- **Socio-economic** – the proposed power plant project primarily impacts nearby residents through increased traffic on Gangaram Panday Road (during the construction phase). Benefits are associated with employment generation, primarily during the construction phase.

6.1.2 Specialist Studies Undertaken

A number of specialist studies (see Table 4-1 and below) were undertaken during the Impact Assessment Phase to investigate the key potential direct, indirect and cumulative impacts (negative and positive) identified during Scoping. These specialist impact studies are as follows:

- Air Quality Impact Assessment;
- Noise Impact Assessment;
- Surface Water Quality Study;
- Terrestrial Ecology Impact Assessment; and
- Social Impact Assessment.

These specialist reports are included as Appendix E to Appendix I to this report.

6.1.3 Alternatives Assessed in the EIA

During the prefeasibility phase of most projects various development alternatives are investigated. Depending on the specific project circumstances the following alternatives may be considered:

- Site Alternatives;
- Design Alternatives;
- Process Alternatives; and
- The No-Go Alternative.

In the case of the Saramacca Power Plant project, various alternatives have been considered during the Concept and Feasibility phases of the project, and a preferred alternative was identified (refer to Section 3.3). As such, only that alternative (in addition to the No-Go alternative) will be assessed in Sections 6.2 to 6.7.

6.1.3.1 No-Go Alternative

The No-Go alternative entails no change to the status *quo*, in other words the proposed power plant site will remain undeveloped and no additional infrastructure will be built. This may impact on the proposed expansion of Staatsolie activities in the Saramacca area due to a lack of backup power.

6.1.4 Impact Rating Methodology

The assessment of impacts was based on specialists' expertise, SRK's professional judgement, field observations and desk-top analysis.

The significance of potential impacts that may result from the proposed project was determined in order to assist decision-makers (typically by a designated competent authority or state agency, but in some instances, the applicant).

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur.

The criteria used to determine impact consequence are presented in the table below.

Table 6-1: Criteria used to determine the consequence of the impact

Rating	Definition of Rating	Score
A. *Extent* *– the area (distance) over which the impact will be experienced*		
Local	Confined to project or study area or part thereof (e.g. the development site and immediate surrounds)	1
Regional	The region (e.g. Municipality or Quaternary catchment)	2
(Inter) national	Nationally or beyond	3
B. ***Intensity*** *– the magnitude of the impact in relation to the extent of the impact and sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. ***Duration*** *– the timeframe over which the impact will be experienced and its reversibility*		
Short-term	Up to 2 years and reversible	1
Medium-term	2 to 15 years and reversible	2
Long-term	More than 15 years and irreversible	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Table 6-2: Method used to determine the consequence score

***Combined Score* (A+B+C)**	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Once the consequence was derived, the probability of the impact occurring was considered, using the probability classifications presented in the table below.

Table 6-3: Probability classification

Probability *– the likelihood of the impact occurring*	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

The overall **significance** of impacts was determined by considering consequence and probability using the rating system prescribed in the table below.

Table 6-4: Impact significance ratings

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Finally the impacts were also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below.

Table 6-5: Impact status and confidence classification

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK's judgment and/or specialist knowledge.	Low
	Medium
	High

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity/development.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity/development.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity/development.

- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity/development.
- **HIGH**: the potential impact **will** affect the decision regarding the proposed activity/development.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

Practicable mitigation and optimisation measures are recommended and impacts are rated in the prescribed way both without and with the assumed effective implementation of mitigation and optimisation measures. Mitigation and optimisation measures are either:

- **Essential**: measures that must be implemented and are non-negotiable; and
- **Best Practice:** recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the applicant if not implemented.

In addition to essential and best practice measures, a very extensive suite of industry standard management measures and procedures will be implemented. These are presented in the ESMP (Staatsolie Report dated January 2019).

6.1.5 Integration of Studies into the EIA Report and Review

The completed specialist studies and their findings have been integrated into the EIA Report. The key findings of each specialist were evaluated in relation to each other to provide an overall and integrated assessment of the project impacts.

SRK has considered the suite of potential impacts in a holistic manner and in certain instances, based on independent professional judgment and this integrated approach, may have altered impact significance ratings provided by the specialist. Where this has been done it is indicated in the relevant section of the report.

Specialists have made recommendations for the management of impacts, and the EIA team has assessed these recommendations. For the sake of brevity, only **key** (i.e. non-standard essential) mitigation measures are presented in impact rating tables (later in this section), with a collective summary of all recommended mitigation measures presented at the end of each discipline.

6.2 Less Significant (or Minor) Impacts

More significant impacts are assessed later in this chapter. Certain impacts, while important, are anticipated to be of limited or **low significance** either by virtue of the scale of the impacts, their short duration (e.g. construction phase only) and/or the disturbed nature of the receiving environment. These impacts include:

- Vibration impacts;
- Groundwater impacts;
- Visual impacts; and
- Traffic impacts.

If recommended mitigation measures are adopted, these impacts are not expected to be significant nor long term and have therefore not been subjected to detailed impact analysis. However, they have been assessed by the ESIA team and are discussed below.

6.2.1 Vibration Impacts

Ground vibration is a natural result of various activities, e.g. blasting, drilling and piling. The shock wave energy that travels from source could cause damage and annoyance. Energy is transmitted through the ground, creating vibration waves that propagate through the various soil and rock strata to the foundations of nearby buildings. Once the vibration reaches a building, it is transferred through the foundations into the structure. Any structural resonances that may be excited will increase the effect of the vibration.

Humans are extremely sensitive to low levels of vibration and can detect levels of ground vibration of less than 0.1 mm/s, less than one hundredth of the levels which could cause even minor cosmetic damage to a normal building. Complaints and annoyance regarding ground vibration are therefore much more likely to be determined by human perception than by noticing minor structural damage. However, these effects, and the startling effect of sudden impulses of both sound and vibration can be a source of nuisance.

During *construction*, potential sources of vibration and associated impacts on nearby structures include the various construction activities, such as compacting, drilling and/or piling. Typical vibration levels of vibration-generating equipment and activities such as piling and compacting are low, and only portions of Staatsolie's own TA-58 plant are located in the vicinity (120 m) of the project site.

During *operation*, potential sources of vibration and associated impacts on nearby structures include the operation (and vibration) of the generator units. It is assumed that the design of the new power plant will include vibration control and damping equipment that sufficiently mitigates ground vibration from the new power plant.

The significance of potential vibration impacts on structures and humans is considered *very low*.

The above assessment is based on the assumption that the following measures are implemented in the project design, construction and operation phases:

- Incorporate vibration control and damping equipment in the plant design.

6.2.2 Groundwater Impacts

Leaks and spills of contaminants on exposed land (mainly during construction) could, in principle, contaminate underlying groundwater. During operation, the power plant will have closed circuit cooling water and lubrication systems, and most of the power plant site will be sealed and bunded, severely limiting the prospect of groundwater contamination.

Groundwater from aquifers north of the Saramacca River is naturally brackish and/or has an objectionable oily taste, and potable (drinking) water is thus not abstracted in this area. Drinking water is abstracted from the Coesewijne aquifer south of the Saramacca River, e.g. in Tijgerkreek, Tambaredjo and Groningen – any pollution from the power plant is not expected to reach this area.

The magnitude of potential groundwater impacts is considered *insignificant*.

The above assessment is based on the assumption that the following measures are implemented in the project design, construction and operation phases:

- Develop (or maintain and adapt) procedures for the safe transport, handling and storage of potential pollutants;
- Design and construct hazardous material storage facilities with suitable impermeable materials and a minimum 110% containment capacity;
- Ensure all on site staff are trained in the use of spill prevention measures; and

- Clean up any spills immediately, through containment and removal of free product and appropriate rehabilitation or disposal of contaminated soils.

6.2.3 Visual Impacts

The current visual quality and sense of place of the power plant site is defined by the remoteness and undeveloped nature of the site.

Potential sources of visual impacts include construction equipment and activities during construction and the power plant and associated structures and activities during operation. The magnitude of potential visual impacts from the above sources is considered insignificant, as:

- No public receptors (communities and commuters) are located within ~8 km of the site, which is located within Staatsolie's concession area and not publicly accessible;
- The visual screening capacity of the landscape is considered to be high, as trees will effectively shield visual impacts; and
- The visual impact from construction activities is relatively short-lived.

The above assessment is based on the assumption that the following measures are implemented in the project design, construction and operation phases:

- Retain screening vegetation around the site as much as possible;
- Implement mitigation measures to reduce visible emissions to the atmosphere; and
- Regularly collect and dispose of redundant equipment, waste and litter.

6.2.4 Traffic Impacts

The Sarah Maria facility, and Saramacca power plant site, are serviced by the East-West Road and Gangaram Panday Road. These roads are also used by many other private and commercial vehicles as well as Staatsolie employees and contractors currently working at Sarah Maria, and are most busy during the morning and afternoon rush hour.

During construction, potential sources of traffic impacts include construction vehicles moving to and from the power plant site to transport workers, execute works or deliver materials. The magnitude of potential traffic impacts from the above sources is considered very low, as:

- The construction workforce is relatively small (maximum ~215 personnel);
- Material will mostly be delivered outside of peak rush hour; and
- The construction period is relatively short.

During operation, potential sources of traffic impacts include employees travelling to work at the power plant, and ongoing commercial and some fuel deliveries. Fuel will be sourced primarily on-site from the TA-58. The magnitude of potential traffic impacts from these sources during the operation of the power plant is considered insignificant, as the additional workforce of ~10 will generate only a very negligible addition to existing traffic volumes.

It must be noted that the above assessment is based on the assumption that the following measures are implemented in the project design, construction and operation phases:

- Schedule delivery of material transported by road to times that fall outside of rush hour; and
- Ensure that trucks transporting large equipment or hazardous material are clearly marked and accompanied by safety vehicles, if necessary.

6.3 Potential Air Quality Impacts

6.3.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Air Quality Study undertaken by Airshed Planning Professionals (see Appendix E). The purpose of the study was to assess the potential impacts of the project on air quality, indicate its environmental acceptability and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the study were to:

- Purchase and process five years of modelled MM5 or WRF meteorological data;
- Describe the regional climate and site-specific atmospheric conditions impacting on the dispersion potential of the project location;
- Identify potentially sensitive receptors within the vicinity of the proposed site susceptible to air quality impacts;
- Provide an overview of the legislation and regulatory context as it pertains to the regulation of atmospheric emissions and air pollutant concentrations;
- Prepare topographical, meteorological, land use, source and emissions data required for input to the dispersion model;
- Utilise an approved atmospheric dispersion model and simulate incremental air pollutant concentrations of the identified pollutants occurring as a result of the facility;
- Conduct an air quality impact assessment including:
  - Compliance evaluation of emissions and air pollutant concentrations based on Suriname standards (if available), international air quality guidelines and standards; and
  - Analysis of the potential for local air quality impacts given sensitive receptor locations;
- Describe and rate the impacts using SRK's impact rating methodology;
- Recommend mitigation measures to avoid and/or minimise impacts and/or optimise benefits associated with the proposed project;
- Recommend air quality monitoring locations and methods; and
- Compile specialist air quality baseline and impact assessment report.

The Air Quality Assessment included the establishment of an emission inventory for the proposed project and the configuration of an AERMOD dispersion model using simulated Fifth-Generation Penn State/NCAR Mesoscale Model (MM5) data for a period between January 2015 to December 2017.

Dispersion modelling was undertaken to determine highest hourly, highest daily and annual average ground level concentrations for each of the pollutants considered in the study. Averaging periods were selected to facilitate the comparison of simulated pollutant concentrations to relevant ambient air quality and inhalation health criteria (described in Section 2.3.2.1).

The pollution parameters of interest and the associated standards / guidelines adopted for the study are summarized in Table 6-6. Adopted standards / guidelines generally represent the available or more stringent criteria for the pollutant in question.

Table 6-6: Pollution parameters and standards / guidelines adopted for the study

Pollutant	Averaging Period	Standard / Guideline (µg/m³)	Source

Pollutant	Averaging Period	Standard / Guideline (µg/m³)	Source
PM_{10}	24-hour Mean	50	WHO GV
	Annual Mean	20	WHO GV
$PM_{2.5}$	24-hour Mean	25	WHO GV
	Annual Mean	10	WHO GV
SO_2	1-hour Mean	350	EC Limits and SA NAAQS
	Annual Mean	50	SA NAAQS
NO_2	1-hour Mean	200	WHO GV
	Annual Mean	40	WHO GV
CO	1-hour Mean	30 000	SA NAAQS
VOCs	1-hour Mean	1 000	TCEQ Short-term ESL
	Annual Mean	100	TCEQ Short-term ESL
VOC (Benzene)	Annual Mean (µg/m³)	5	SA NAAQS
VOC (Toluene)	1-hour Mean (µg/m³)	640	TCEQ Short-term ESL
VOC (Ethyl Benzene)	1-hour Mean (µg/m³)	2 560	TCEQ Short-term ESL
VOC (Xylene)	1-hour Mean (µg/m³)	350	TCEQ Short-term ESL
Hydrogen fluoride	1-hour Mean (µg/m³)	18	TCEQ Short-term ESL
	Annual Mean (µg/m³)	8.7	TCEQ long-term ESL

Based on the nature of the proposed project and expected air quality impacts, the study area was defined as the area within 10 km of the proposed site. The nearest sensitive receptors live approximately 8 km south of the site (see Figure 6-1).

srk consulting	SARAMACCA POWER PLANT Nearest air quality sensitive receptors (R1, R2 and R3)	Project No. 532091

Figure 6-1: Nearest air quality sensitive receptors (R1, R2 and R3)

6.3.2 Typical health effects of pollutants

SO_2 is damaging to the human respiratory system. Exposure to SO_2 concentrations above certain threshold levels increases the prevalence of chronic respiratory disease and the risk of acute respiratory illness. As it is highly soluble, SO_2 is more likely to be adsorbed in the upper airways rather than penetrate to the pulmonary region.

NO_x, primarily in the form of nitrogen oxide (NO), are one of the primary pollutants emitted during combustion. Although NO is not of particular health concern, it forms NO_2 once released into the air. NO_2 is an irritating gas that is absorbed into the mucous membrane of the respiratory tract. Exposure to NO_2 is linked with increased susceptibility to respiratory infection, increased airway resistance in asthmatics and decreased pulmonary function. Available data from both animal and human toxicology experiments indicate that acute exposure to NO_2 concentrations above 200 µg/m³ produces observable effects.

The impact of particles on human health is largely dependent on (i) particle characteristics, particularly particle size and chemical composition, and (ii) the duration, frequency and magnitude of exposure. Larger particles are deposited in the nasal region or at the bends of the nasal passages. Smaller particles (particles with an aerodynamic diameter less than 10 micron, also referred to as **PM_{10}**) pass through the nasal region and are deposited in the tracheobronchial and pulmonary regions. Air quality guidelines for particulates are given for various particle size fractions, including total suspended particulates (TSP) and inhalable particulates (PM_{10}).

Carbon Monoxide (CO) can be absorbed through the lungs and reduces the blood's capacity to transport available oxygen to the tissues. Approximately 80-90% of the absorbed CO binds with haemoglobin to form carboxyhaemoglobin, which lowers the oxygen level in blood. Since more blood is needed to supply the same amount of oxygen, the heart needs to work harder. These are the main causes of tissue hypoxia produced by CO at low exposure levels. At higher concentrations, the rest of the absorbed CO binds with other haeme proteins such as myoglobin and with cytochrome oxidase and cytochrome P-450. CO uptake impairs perception and thinking, slows reflexes and may cause drowsiness, angina and, at very acute levels, unconsciousness or death.

6.3.3 Assessment of Impacts: Construction Phase

The following potential direct construction phase impacts on air quality were identified:

- A1: Impaired human health from increased ambient pollutant concentrations associated with construction activities; and
- A2: Impaired human health and other effects from dust generated by project traffic (identified by Social Solutions, the consultancy which undertook the Social Impact Assessment [SIA]).

6.3.3.1 Potential Impact A1: Impaired Human Health from Increased Ambient Pollutant Concentrations Associated with Construction Activities

Atmospheric emissions and air quality impacts may occur during the construction phase of the project. The most significant sources of fugitive particulate matter (TSP, PM_{10} and $PM_{2.5}$) at the site include bulk earthworks, windblown dust from exposed surfaces, stockpiles and the construction of infrastructure. Particulate matter and gases from combustion of fuels by mobile equipment (CO, PM_{10}, $PM_{2.5}$, SO_2 and VOCs) will also be emitted. The extent of increased ambient pollutant concentrations and dustfall rates will depend on the level of activity but is expected to be within air quality criteria at AQSRs.

The impact is assessed to be of ***very low*** significance with and without the implementation of mitigation (Table 6-7).

Table 6-7: Significance of impaired human health from increased ambient pollutant concentrations associated with construction activities

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Short-term 1	**Very Low** **3**	Definite	**VERY LOW**	– ve	High

Essential mitigation measures:
• Limit and phase vegetation clearance and the construction footprint to what is essential.
• Reduce airborne dust through e.g.:
  o Dampening dust-generating areas, roads and stockpiles with water.
  o Utilising screens in high dust-generating areas.
• Maintain all generators, vehicles and other equipment in good working order to minimise exhaust fumes.								

With mitigation	Local 1	Low 1	Short-term 1	**Very Low** **3**	Definite	**VERY LOW**	– ve	High

6.3.3.2 Potential Impact A2: Impaired human health and other effects from dust generated by project traffic

The Gangaram Panday Road is the only access road leading to the Sarah Maria facilities where the proposed power plant will be constructed. Vehicles may generate dust, reducing air quality which may pose a human health risk. Furthermore, dust settles on the roofs of houses, cars and any other surface within the homes, posing a nuisance to residents living along the road.

The impact is assessed to be of ***very low*** significance (Table 6-8). No mitigation is possible.

Table 6-8: Significance of impaired human health and other effects from dust generated by project traffic

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Short-term 1	**Very Low 3**	Definite	**VERY LOW**	– ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Short-term 1	**Very Low 3**	Definite	**VERY LOW**	– ve	High

6.3.4 Assessment of Impacts: Operational Phase

The following potential direct operational phase impacts on air quality were identified:

- A3: Impaired human health from increased ambient pollutant concentrations associated with power plant emissions.

6.3.4.1 Potential Impact A3: Impaired Human Health from Increased Ambient Pollutant Concentrations Associated with Power Plant Emissions

During operations, primary pollutants from combustion engines are SO_2, NO_x, CO and, to a lesser extent, VOCs. PM is also a primary pollutant for combustion engines using liquid fuels. The formation of NO_x is strongly dependent on the high temperatures developed in the combustor; while CO, VOC, hazardous air pollutants (HAPs), and PM emissions are primarily the result of incomplete combustion. Oxides of sulphur (SOx) will be emitted in a significant quantity when HFO is utilised; otherwise, they are emitted in trace to low amounts. SO_2 emissions are directly related to the sulphur content of the fuel (US EPA, 2000). In addition to the above, VOCs will also be released from storage tanks vents as well as during the off-loading and handling of fuel.

Simulated ground level concentrations for all pollutants of interest are very low at receptors and did not result in any exceedances of applicable limits (see Table 6-9). Only SO_2 and NO_2 emissions are expected to reach more than 1% of the limit. As measured baseline concentration of pollutants in the region are also very low, impacts due to the proposed project are expected to contribute minimally to the cumulative pollutant levels in the region.

Table 6-9: Maximum GLCs at nearest AQSR (R1, R2 and R3)

Pollutant	Averaging Period	Concentration at receptors (µg/m³)			Adopted Criteria (µg/m³)	Highest concentration as % of limit
		R1	R2	R3		
PM_{10}	24-hour Mean	0.27	0.31	0.28	**50**	0.62%
	Annual Mean	0.01	0.02	0.04	**20**	0.20%
$PM_{2.5}$	24-hour Mean	0.27	0.31	0.28	**25**	1.24%
	Annual Mean	0.01	0.02	0.04	**10**	0.40%
SO_2	1-hour Mean	43.8	42.7	36.2	**350**	12.51%
	Annual Mean	0.18	0.51	1.26	**50**	2.52%
NO_2	1-hour Mean	33.6	39.4	34.3	**200**	19.70%
	Annual Mean	0.17	0.49	1.21	**40**	3.03%
CO	1-hour Mean	12.3	12.0	10.2	**30 000**	0.04%
VOCs	Annual Mean	0.01	0.02	0.04	**100**	0.01%

Simulated ground level concentrations (GLCs) are presented as isopleths. It should be noted that the nearest AQSRs are located 8 km to the south of the proposed project and are not shown in the maps below.

Simulated maximum daily and annual average ground level concentrations for $PM_{10}/PM_{2.5}$ due to power plant emissions are low and did not result in any exceedances of the assessment criteria. Simulated maximum daily and annual concentrations are 2.5 µg/m³ and 1.2 µg/m³, respectively. Simulated maximum daily and annual average GLCs are presented in Figure 6-2 and Figure 6-3 respectively.

Simulated maximum hourly and annual average GLCs for NO_2 due to power plant emissions are low and did not result in any exceedances of the assessment criteria. The simulated maximum hourly and annual concentrations are 198 µg/m³ and 37.8 µg/m³. Simulated maximum hourly and annual average NO_2 GLCs are presented in Figure 6-4 and Figure 6-5 respectively.

Simulated maximum hourly and annual average GLCs for SO_2 due to power plant emissions are low and did not result in any exceedances of the assessment criteria. Simulated maximum hourly and annual concentrations are 239 µg/m³ and 39.5 µg/m³. Simulated maximum hourly and annual average SO_2 GLCs are presented in Figure 6-6 and Figure 6-7 respectively.

Simulated maximum hourly and annual average GLCs for VOCs due to power plant and tank farm emissions are low and did not result in any exceedances of the assessment criteria. Simulated maximum hourly and annual concentrations are 602 µg/m³ and 64.1 µg/m³. Simulated annual average VOCs GLCs are presented in Figure 6-8: Simulated annual average VOCs concentrations.

Simulated maximum daily and annual average GLCs for CO due to power plant emissions are low and did not result in any exceedances of the assessment criteria. Simulated maximum hourly concentration is 67.2 µg/m³. Simulated maximum hourly CO GLCs are presented in Figure 6-9: Simulated maximum hourly CO concentrations.

In summary, simulated maximum daily and annual average GLCs for all pollutants are low and did not result in any exceedances of their respective assessment criteria. Similarly, maximum simulated GLCs at closest AQSRs are very low and did not result in any exceedances of the assessment criteria. Consequently, emissions from the project are expected to contribute only minimally to the cumulative ambient concentrations in the region.

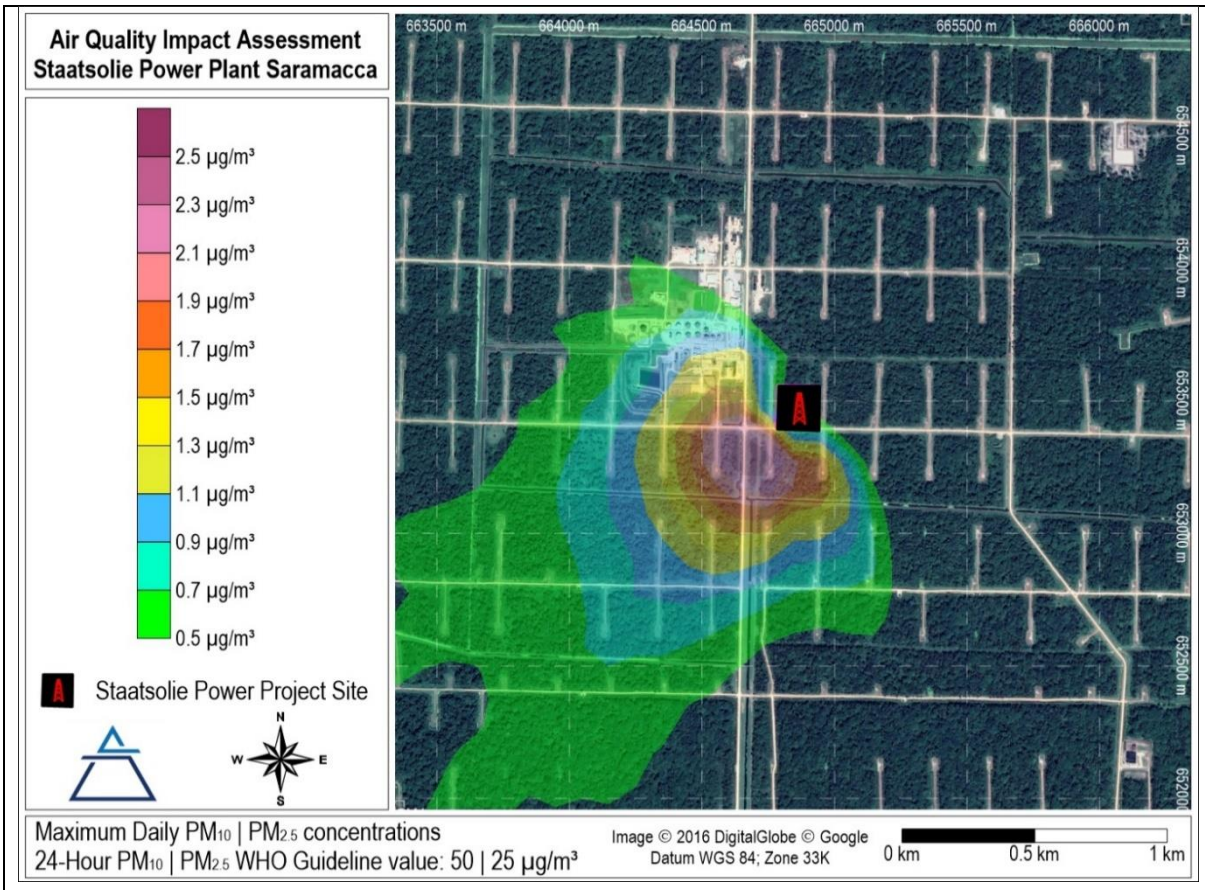


Figure 6-2: Simulated maximum daily PM_{10} / $PM_{2.5}$ concentrations

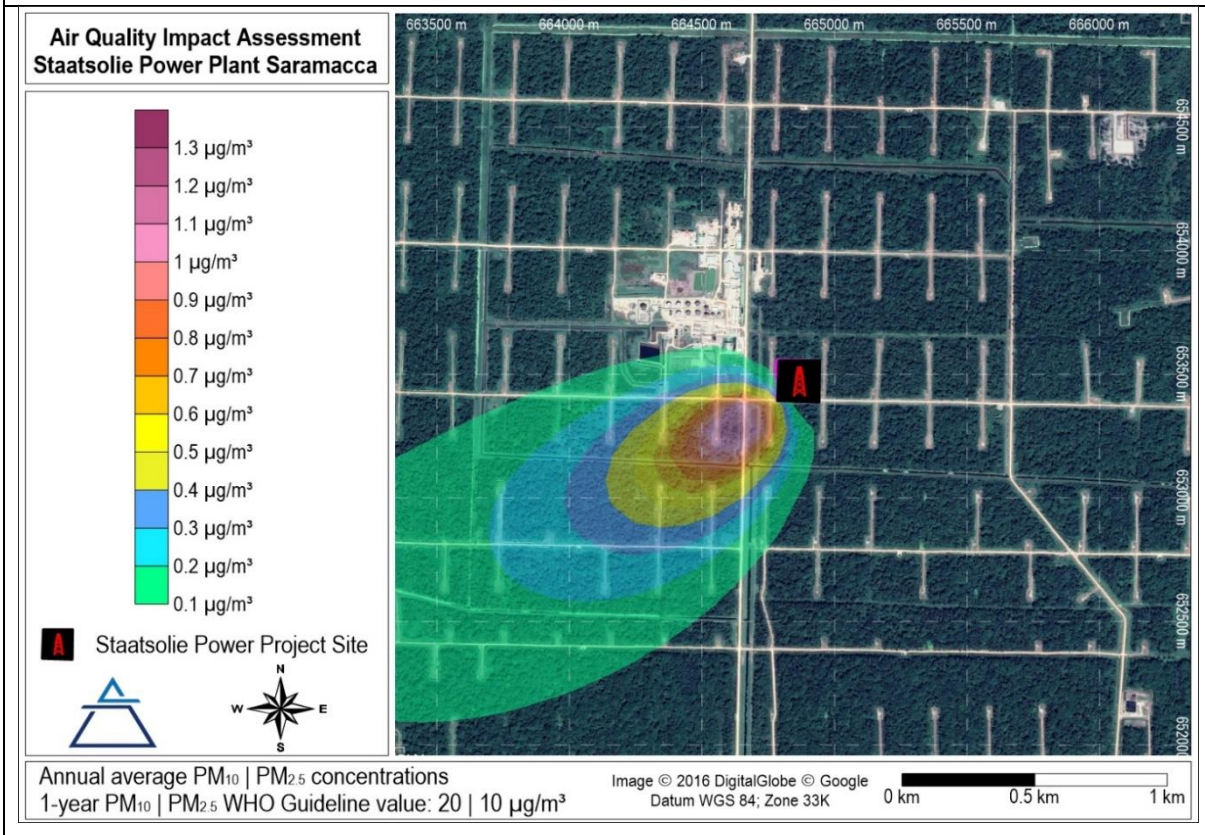


Figure 6-3: Simulated annual average PM_{10} / $PM_{2.5}$ concentrations

srk consulting	**SARAMACCA POWER PLANT** Simulated maximum daily and annual average GLCs for PM_{10}/$PM_{2.5}$	Project No. 532091

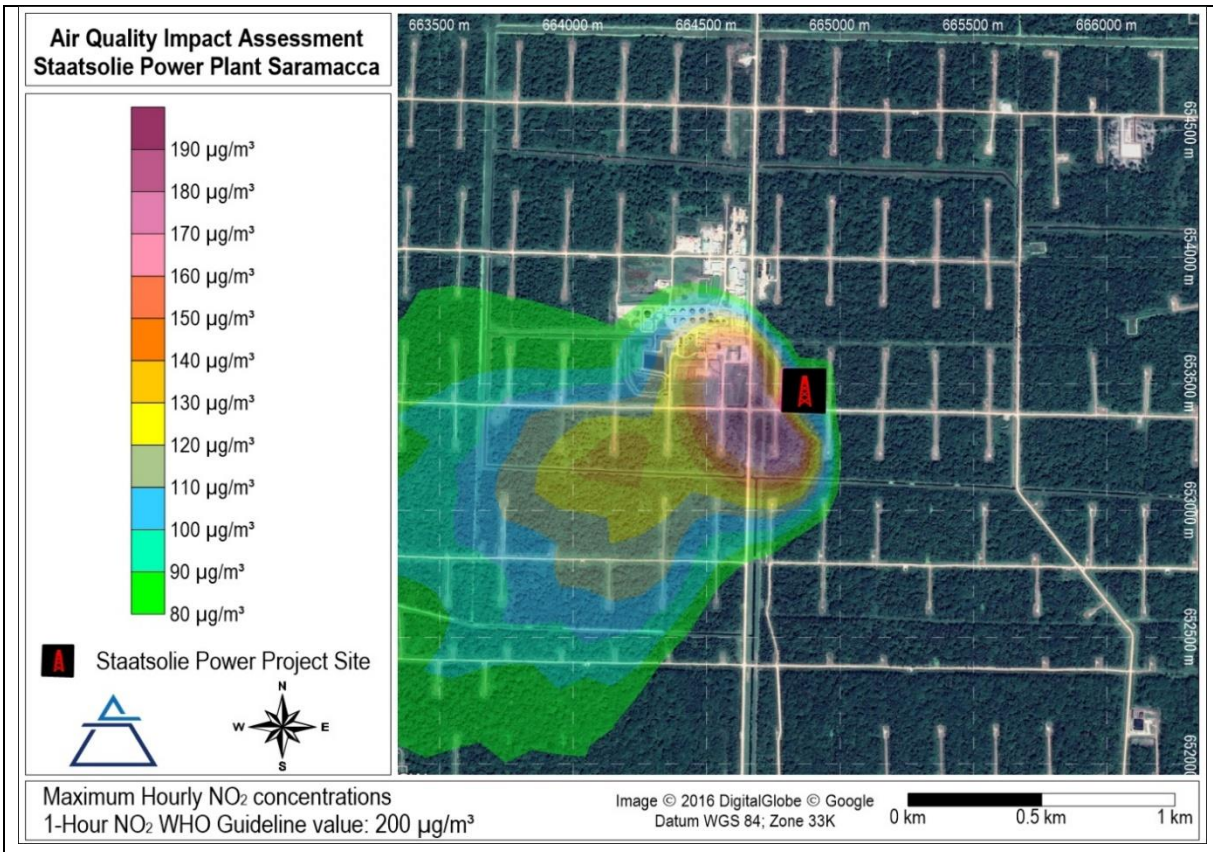


Figure 6-4: Simulated maximum hourly NO_2 concentrations

Figure 6-5: Simulated annual average NO_2 concentrations

srk consulting	**SARAMACCA POWER PLANT** Simulated maximum daily and annual average GLCs for NO_2	Project No. 532091

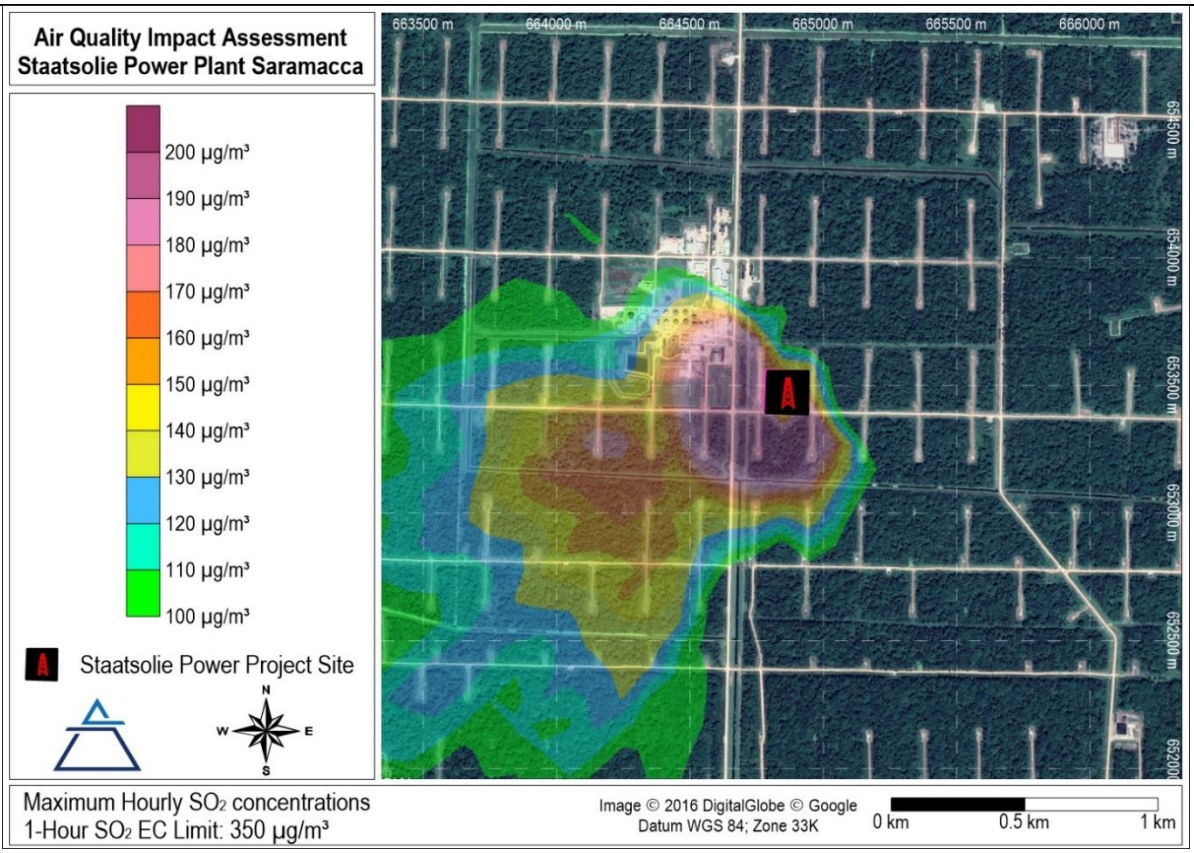


Figure 6-6: Simulated maximum hourly SO_2 concentrations

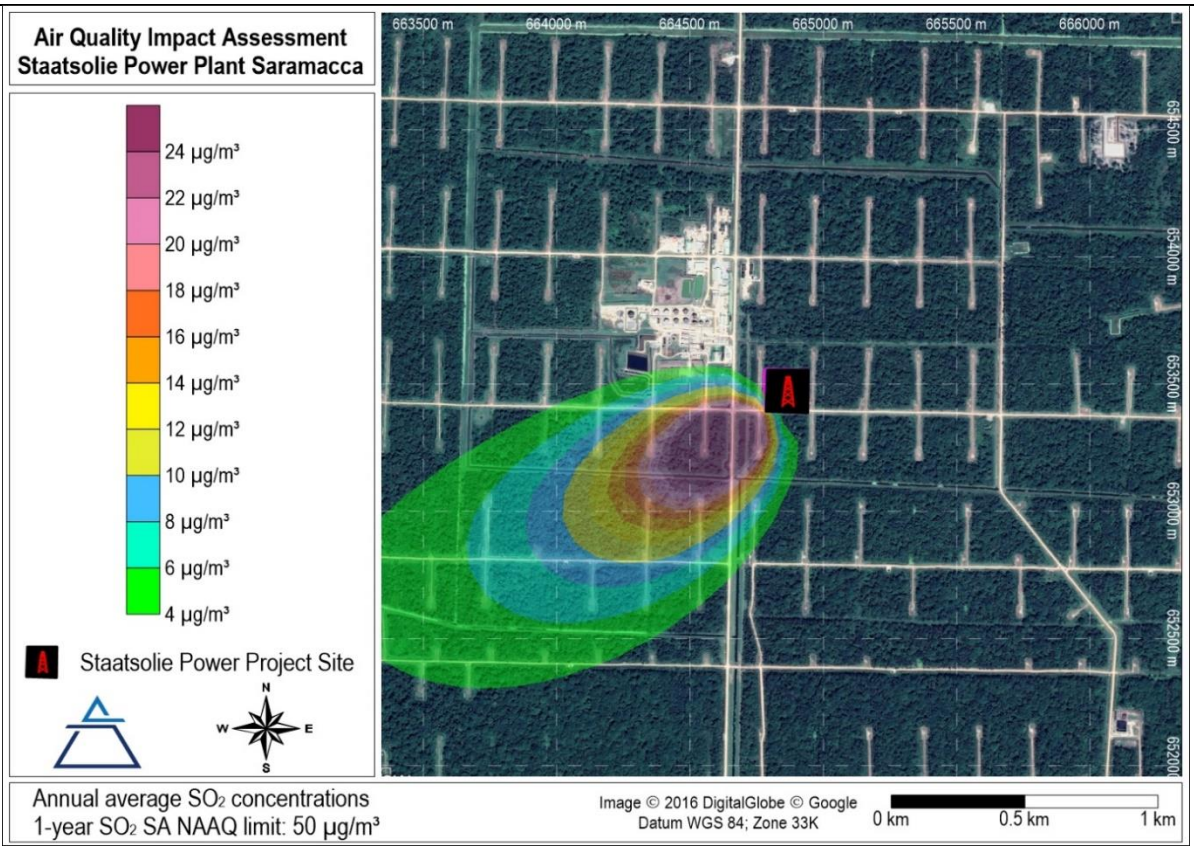


Figure 6-7: Simulated annual average SO_2 concentrations

srk consulting	**SARAMACCA POWER PLANT** Simulated maximum daily and annual average GLCs for SO_2	Project No. 532091

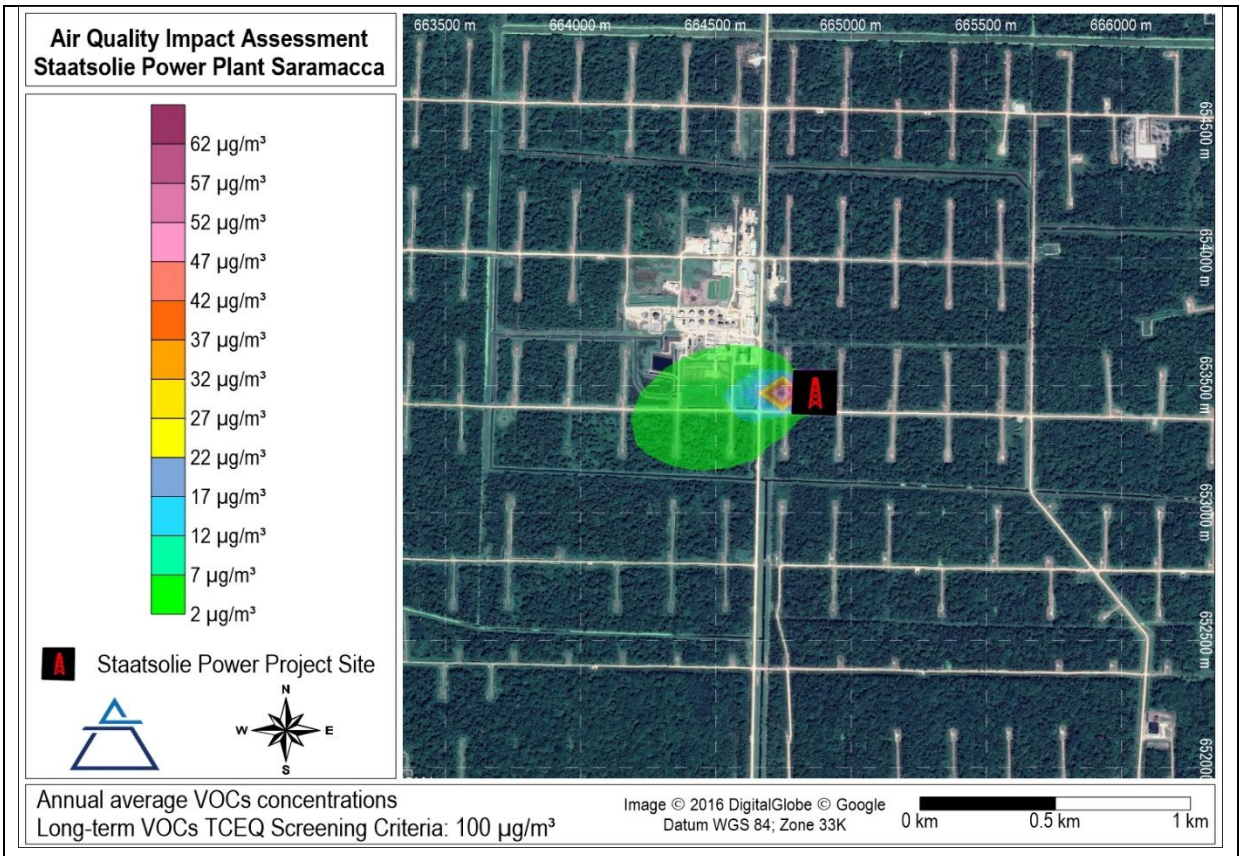


Figure 6-8: Simulated annual average VOCs concentrations

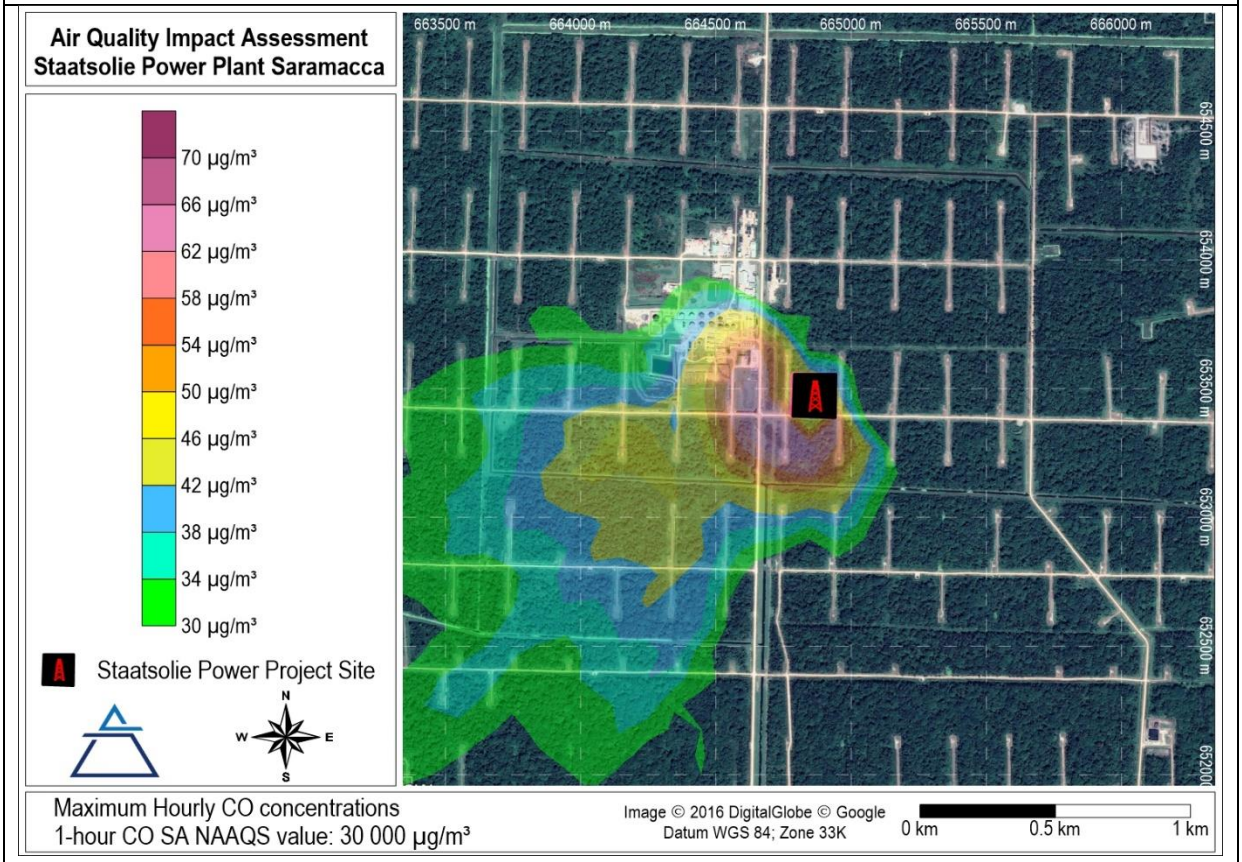


Figure 6-9: Simulated maximum hourly CO concentrations

srk consulting	**SARAMACCA POWER PLANT** Simulated maximum daily and annual average GLCs for VOCs	Project No. 532091

A sample of Saramacca crude oil was collected and analysed by Intertek International Suriname N.V. for mercury content. The analysis indicates a very low value of less than 1 ppb by weight, which is equivalent to less than 1 µg/kg mercury in the fuel. Consequently, mercury emissions from the proposed project are expected to be insignificant.

The impact is assessed to be of ***very low*** significance with and without the implementation of mitigation (Table 6-10).

Table 6-10: Significance of impaired human health from increased ambient pollutant concentrations associated with power plant emissions

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Medium-term 2	**Very Low** **4**	Definite	**VERY LOW**	– ve	High
Essential mitigation measures: • Adopt appropriate technology to ensure power generating units meet the World Bank emission guidelines for reciprocating engines and turbines. • Operate the power generating units according to design specifications and manufacturer's instructions to meet the emission limits. • Regularly maintain the power plant to minimise exhaust emissions. • Test exhaust emissions on power generating units once they are fully operational, to confirm emission rates and compliance with equipment manufacturer emission specifications.								
With mitigation	Local 1	Low 1	Medium-term 2	**Very Low** **4**	Definite	**VERY LOW**	– ve	High

6.3.5 The No-Go Alternative

The No-Go alternative entails no change to the *status quo,* and ambient air quality will remain unchanged.

6.3.6 Mitigation Measures: Potential Air Quality Impacts

Essential air quality mitigation measures during **construction** are as follows:

- Limit and phase vegetation clearance and the construction footprint to what is essential;
- Reduce airborne dust through e.g.:
  - Dampening dust-generating areas, roads and stockpiles with water; and
  - Utilising screens in high dust-generating areas.
- Maintain all generators, vehicles, vessels and other equipment in good working order to minimise exhaust fumes.

Best practice noise mitigation measures during **construction** are as follows:

- Schedule logistics to minimise traffic on the Gangaram Panday Road;
- Inform nearby residents and businesses in a timely manner of delivery schedules;
- Avoid deliveries at night;
- Publicise delivery schedules in the media (newspaper, radio, television) and social media;
- Monitor trucks at strategic points along the Gangaram Panday Road to determine compliance with traffic rules agreed upon between Staatsolie and contractor; and

- Intensify the dust suppression programme on the Gangaram Panday Road during construction, especially the section from the beginning of the Gangaram Panday Road to the entrance to TA-58 (Km 6).

Essential air quality mitigation measures during **operations** are as follows:

- Adopt appropriate technology to ensure power generating units meet the World Bank emission guidelines for reciprocating engines and turbines;
- Operate the power generating units according to design specifications and manufacturer's instructions to meet the emission limits;
- Regularly maintain the power plant to minimise exhaust emissions; and
- Test exhaust emissions on power generating units once they are fully operational, to confirm emission rates and compliance with equipment manufacturer emission specifications.

Best practice air quality mitigation measures during **operations** are as follows:

- Use water injection or Selective Catalytic Reduction for combustion engines in order to minimise NOx emissions;
- Store liquids in fixed roof tanks since only low VOC emissions are expected from the storage of fuel due to its low vapour pressure; and
- Undertake once-off ambient SO_2 and NO_2 monitoring once the project it is fully operational (to validate the modelling results).

6.4 Potential Noise Impacts

6.4.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Noise Study undertaken by Airshed Planning Professionals (see Appendix F). The purpose of the study was to assess the potential impacts of the project on noise, indicate its environmental acceptability and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the study were to:

- Review legal requirements and environmental noise level guidelines;
- Conduct a desktop analysis and assess existing (baseline) sources of noise;
- Conduct an environmental noise monitoring campaign;
- Establish a source inventory;
- Conduct noise propagation simulations using CadnaA software for industrial applications;
- Describe and rate the impacts using SRK's impact rating methodology;
- Recommend mitigation measures to avoid and/or minimise impacts and/or optimise benefits associated with the proposed project; and
- Compile a noise impact assessment report.

The following protocol applied to noise monitoring:

- The measurements were carried out using a Type 1 sound level meter (SLM) that meets all appropriate International Electrotechnical Commission (IEC) standards and is subject to annual calibration by an accredited laboratory;

- The acoustic sensitivity of the SLM was tested with a portable acoustic calibrator before and after each measurement session;
- The environmental measurements were between 10 and 90 minutes in duration and are representative and adequate for statistical analysis;
- The noise measurement was taken with the use of the portable SLM capable of logging data continuously over the time;
- Measurements representative of day- and night-time conditions were taken. South African National Standard (SANS) 10103 defines day-time as between 06:00 and 22:00, and night-time between 22:00 and 06:00;
- As generally recommended, the following acoustic indices were recoded: LZeq (T), LAeq (T), LAIeq (T); LAFmax; LAFmin; statistics and 3rd octave frequency spectra; and
- The SLM was located approximately 1.5 m above the ground and not closer than 10 m from reflecting surfaces.

The propagation of noise from proposed activities was simulated with the DataKustic CadnaA software. Use was made of the International Organisation for Standardization's (ISO) 9613 module for outdoor noise propagation from industrial noise sources.

ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission. These conditions are for downwind propagation or, equivalently, propagation under a well-developed moderate ground based temperature inversion, such as commonly occurs at night.

The method also predicts an average A-weighted sound pressure level. The average A-weighted sound pressure level encompasses levels for a wide variety of meteorological conditions. The source (or sources) may be moving or stationary.

If the dimensions of a noise source are small compared with the distance to the listener, it is called a point source. All sources of noise at the proposed power plant were quantified as point sources or areas represented by point sources. The sound energy from a point source spreads out spherically, so that the sound pressure level is the same for all points at the same distance from the source, and decreases by 6 dB per doubling of distance. This holds true until ground and air attenuation noticeably affect the level. The impact of an intruding industrial/mining noise on the environment will therefore rarely extend over more than 5 km from the source and is therefore always considered "local" in extent.

The propagation of noise was calculated over an area of 5km east-west by 5km north-south with the proposed power plant located centrally. The area was divided into a grid matrix with a 10m resolution. The model calculates L_P's at each grid point at a height of 1.5m above ground level.

6.4.1.1 Noise Guidelines

The IFC General EHS Guidelines on noise address impacts of noise beyond the property boundary of the facility under consideration and provides noise level guidelines. The IFC states that noise impacts should not exceed the levels presented in Table 6-11, or result in a maximum increase above baseline levels of 3 dBA at the nearest receptor location off-site (IFC, 2007). For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. Δ = 3 dBA is, therefore, a useful significance indicator for a noise impact.

Table 6-11: IFC ambient noise guidelines

Receptor	Maximum Allowable Ambient Noise Levels	
	1-hour L_{Aeq} (dB(A))	
	Day Time	Night Time
	07:00 – 22:00	22:00 – 07:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70
Note: No L_{Aeq} values are stipulated for rural areas.		

SANS 10103 (2008) provides a useful guideline for estimating community response to an increase in the general ambient noise level caused by intruding noise (Table 6-12). If Δ is the increase in noise level, the following criteria are of relevance:

Table 6-12: Response intensity and noise impact for increases of the ambient noise

Increase (dB)	Response Intensity	Remarks	Noise Impact
0	None	Change not discernible by a person	None
3	None to little	Change just discernible	Very low
3 ≤ 5	Little	Change easily discernible	Low
5 ≤ 7	Little	Sporadic complaints	Moderate
7	Little	Defined by South African National Noise Regulations as being 'disturbing'	Moderate
7 ≤ 10	Little - medium	Sporadic complaints	High
10 ≤ 15	Medium	Change of 10dB perceived as 'twice as loud', leading to widespread complaints	Very high
15 ≤ 20	Strong	Threats of community/group action	Very high

The categories of community response overlap because the response of a community does not occur as a stepwise function, but rather as a gradual change.

6.4.2 Assessment of Impacts: Construction Phase

The following potential direct construction phase impact on noise was identified (by Social Solutions, the consultancy which undertook the SIA):

- N1: Increased noise levels along access roads.

6.4.2.1 Potential Impact N1: Increased Noise Levels along Access Roads

During the construction phase of the proposed project, construction activities will require a great deal of transport of persons, materials and equipment. As the Gangaram Panday Road is the only road providing access to the Sarah Maria facilities, traffic is expected to increase during project implementation and will generate noise. Excessive noise will disturb local area users, including the residents living along the road. At night, noise may disturb residents living at a greater distance from the road.

The impact is assessed to be of ***very low*** significance (Table 6-13). No mitigation is possible.

Table 6-13: Significance of increased noise levels along access roads

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Short-term 1	**Very Low 3**	Definite	**VERY LOW**	– ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Short-term 1	**Very Low 3**	Definite	**VERY LOW**	– ve	High

6.4.3 Assessment of Impacts: Operational Phase

The following potential direct operational phase impact on noise was identified:

- N2: Noise impacts of the power plant.

6.4.3.1 Potential Impact N2: Noise Impacts of the Power Plant

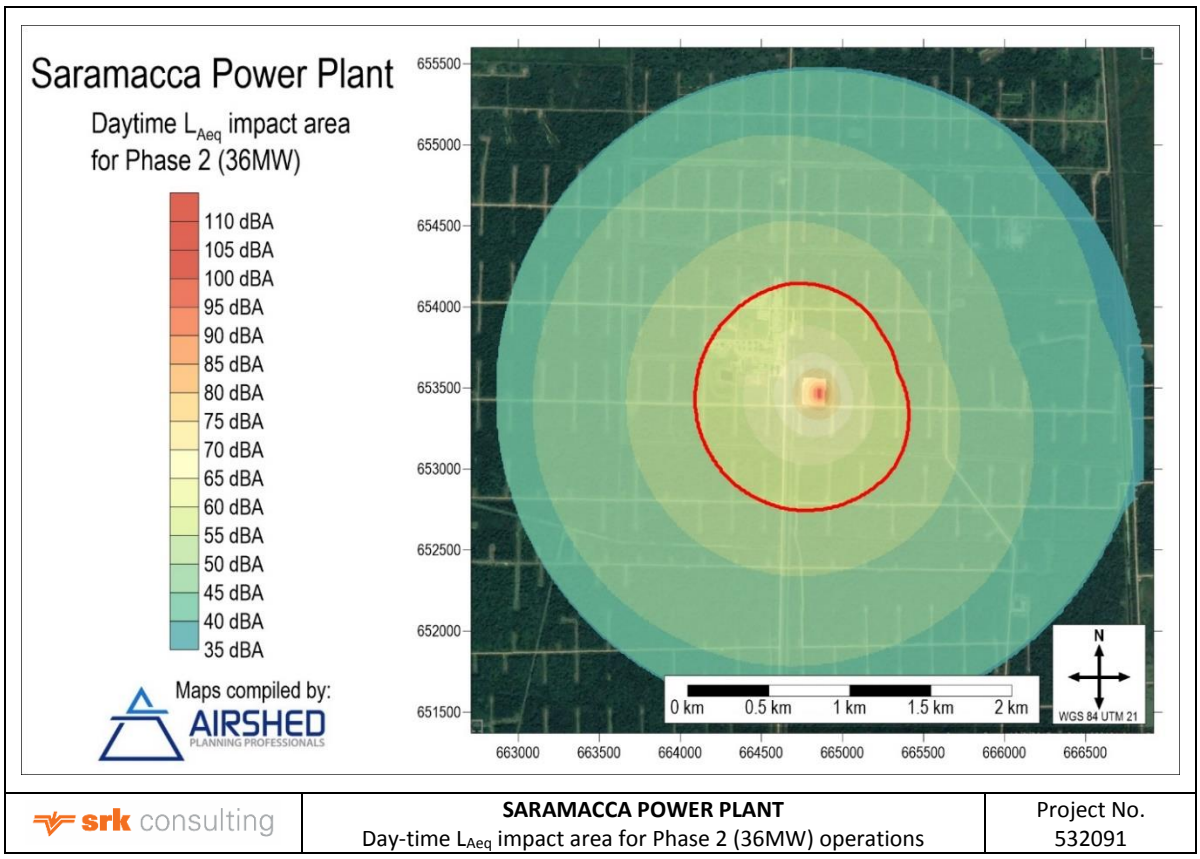
Main sources of industrial noise at the proposed power plant include six 6MW diesel engines (three of which will be operational during Phase 1) as well as four 10MVA transformers. Noise generated by the engines was estimated using the estimation techniques for industrial machinery. Other sources of noise at the facility include pumps, compressors, air conditioners, workshop activities and traffic. The contribution of these to overall noise is however considered immaterial.

Since the engine units will be housed within an engine building, what is known in the acoustics as the 'room equation' was applied to estimate equivalent LW's of engine hall facades (walls). The calculation takes into account the enclosed source's strength energy absorption and transmission losses, the building size (surface area) and the average distance from the enclosed source to a façade.

Due to the absence of noise sensitive receptors in the area of impact, noise impacts are presented as isopleth plots of incremental impact due to the proposed facility and the increase from measured baseline noise levels due to the proposed operations. An isopleth is a line on a map connecting points at which a given variable (in this case L_P) has a specified constant value. This is analogous to contour lines on a map showing terrain elevation. In the assessment of environmental noise, isopleths present lines of constant noise level as a function of distance.

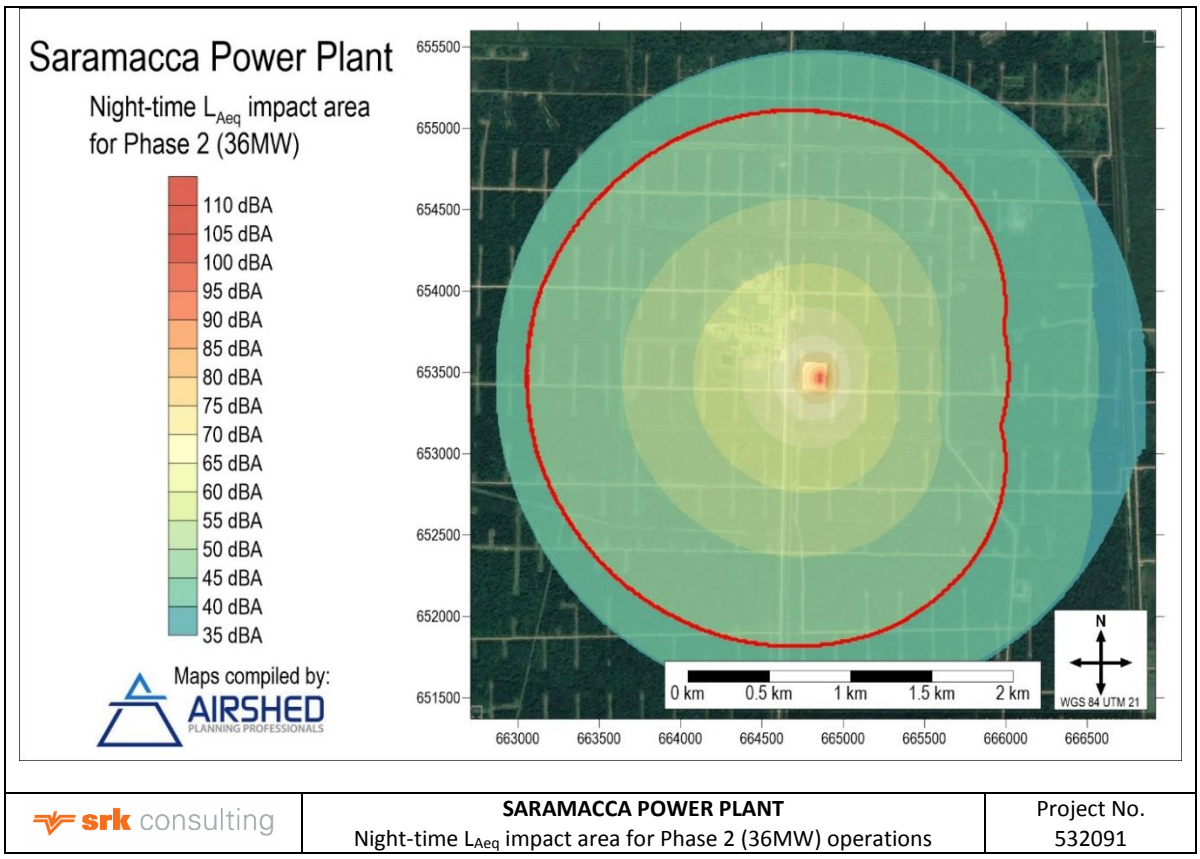
Impacts were assessed according to guidelines published by the IFC. To assess modelled increases from baseline noise levels, reference was also made to guidelines published in SANS 10103.

Isopleth plots showing the incremental impact in environmental noise levels due to Phase 2 operations are shown in Figure 6-10 to Figure 6-13. The impact of Phase 1 operations is expected to be less significant and the area of impact smaller than for Phase 2 operations, therefore only Phase 2 modelling results are presented in this section.



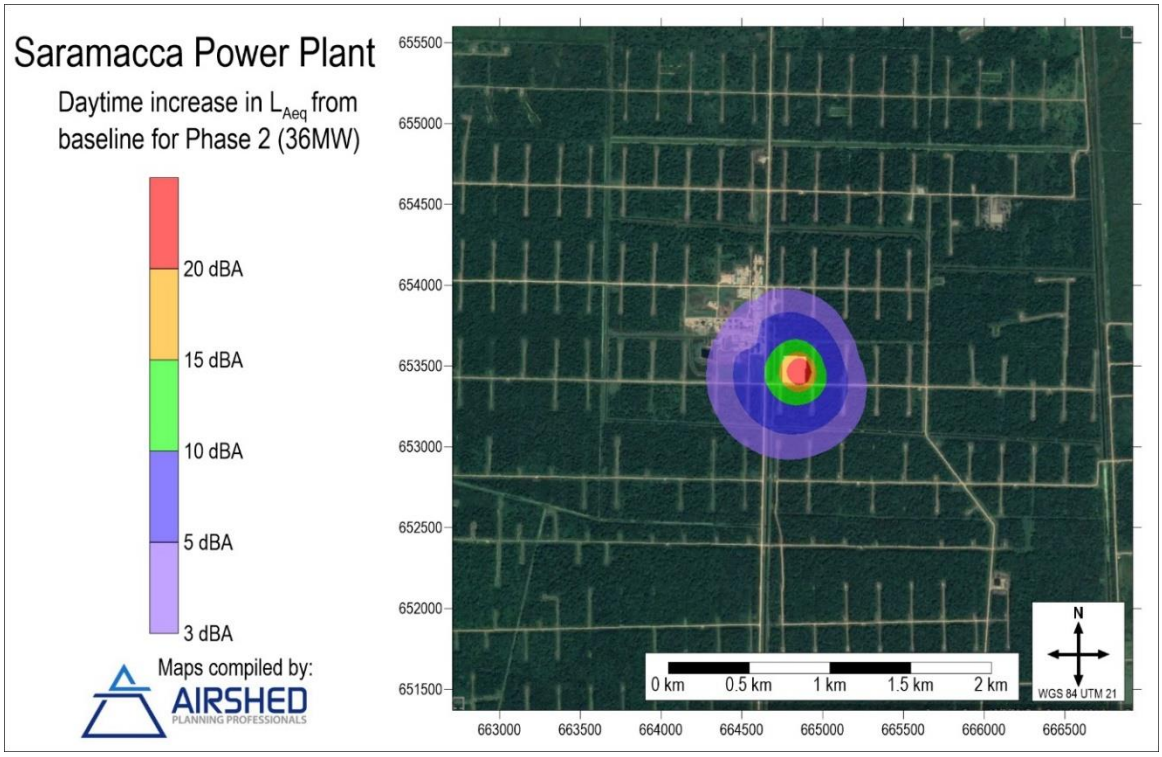
srk consulting	**SARAMACCA POWER PLANT** Day-time L_{Aeq} impact area for Phase 2 (36MW) operations	Project No. 532091

Figure 6-10: Day-time L_{Aeq} impact area for Phase 2 (36MW) operations



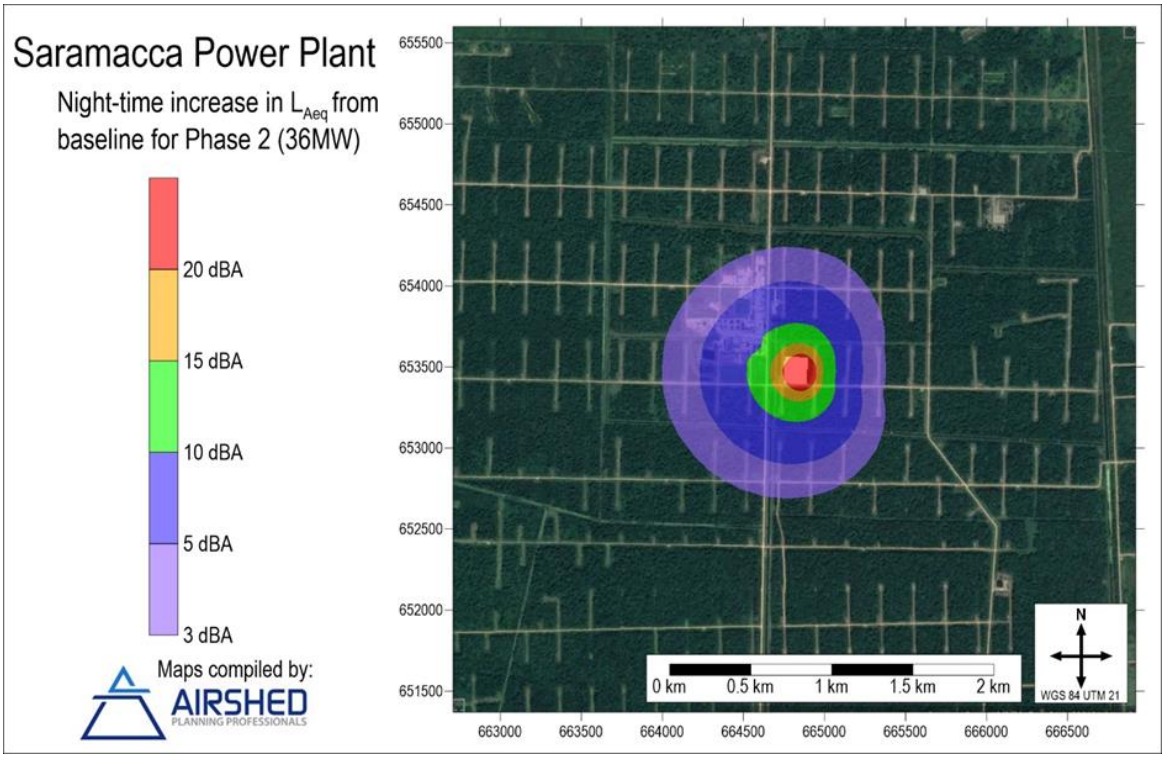
srk consulting	**SARAMACCA POWER PLANT** Night-time L_{Aeq} impact area for Phase 2 (36MW) operations	Project No. 532091

Figure 6-11: Night-time L_{Aeq} impact area for Phase 2 (36MW) operations



srk consulting	**SARAMACCA POWER PLANT** Day-time increase in LAeq from baseline conditions for Phase 2 (36MW) operations	Project No. 532091

Figure 6-12: Day-time increase in L_{Aeq} from baseline conditions for Phase 2 (36MW) operations



srk consulting	**SARAMACCA POWER PLANT** Night-time increase in LAeq from baseline conditions for Phase 2 (36MW) operations	Project No. 532091

Figure 6-13: Night-time increase in L_{Aeq} from baseline conditions for Phase 2 (36MW) operations

An increase in environmental noise levels of 3 dBA is modelled for up 1 km from the power plant; there are no sensitive receptors located within this area. As expected, the noise impact area extends further from site at night, and further to the south and west than to the north and east due to the prevailing wind direction. Due to the large distance between sensitive receptors and the proposed location of the power plant, the power plant is expected to have no impact on environmental noise levels at sensitive receptor locations.

The impact is assessed to be ***insignificant*** (Table 6-14). No mitigation is possible.

Table 6-14: Significance of noise impacts of the power plant

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Medium-term 3	**Very Low** **5**	Improbable	**INSIGNIFICANT**	– ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Medium-term 1	**Very Low** **3**	Improbable	**INSIGNIFICANT**	– ve	High

6.4.4 The No-Go Alternative

The No-Go alternative entails no change to the *status quo,* and ambient noise levels will remain unchanged.

6.4.5 Mitigation Measures: Potential Noise Impacts

No **essential** noise mitigation measures were identified.

Best practice noise mitigation measures during **construction** are as follows:

- Schedule logistics to minimise traffic on the Gangaram Panday Road;
- Inform nearby residents and businesses in a timely manner of delivery schedules;
- Avoid deliveries at night;
- Publicise delivery schedules in the media (newspaper, radio, television) and social media; and
- Monitor trucks at strategic points along the Gangaram Panday Road to determine compliance with traffic rules agreed upon between Staatsolie and contractor.

Best practice noise mitigation measures during **operations** are as follows:

- Implement a once off noise monitoring programme to validate simulation results, identify any unforeseen noise issues and track the effectiveness of noise management measures already employed.

6.5 Potential Water Quality Impacts

6.5.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Water Study undertaken by Dirk Noordam (see Appendix G). The purpose of the study was to assess the potential impacts of the project on hydrogeology and surface water, indicate its environmental acceptability and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the study were to:

- Describe the hydrogeological characteristics of the study area in general, providing detail regarding any aquifers, surface water bodies and stormwater drainage;
- Describe the baseline surface water chemistry;
- Prepare a hydrological analysis (catchment mapping, flood risk, peak rainfall etc);
- Determine the potential for the project to impact on nearby surface water bodies;
- Assess the vulnerability of surface water resources, including the identification of potential pollutant linkages; and
- Recommend mitigation measures to reduce the potential for impacts on surface water.

6.5.2 Assessment of Impacts: Construction Phase

The following potential direct construction phase impact on surface water[7] was identified:

- W1: Contamination of surface water affecting ecosystems.

6.5.2.1 Potential Impact W1: Contamination of surface water affecting ecosystems

Site preparation, excavation and construction of the power plant will likely result in some direct impact on the water quality in the Kisoensingh-west Canal. This canal is already impacted by Staatsolie activities in the polder. The most likely potential contaminants and their potential effects are:

- Hydrocarbons, such as oil, petrol or diesel from construction equipment and associated fuels, which could impact on water quality of the receiving water body. Small amounts of hydrocarbons are readily broken down in the soil and aquatic environment, and only larger volumes are of significant concern; and
- Suspended solids, which can also be harmful to biota and the aquatic environment as they affect benthic ecosystems, block respiratory organs of fish, reduce photosynthesis in plants, etc.

Given the characteristics of the receiving canal environment, impacts due to contamination are considered of medium intensity in localised areas close to point source discharges.

The impact is assessed to be of ***very low*** significance (Table 6-15). No mitigation is possible.

Table 6-15: Significance of contamination of surface water affecting ecosystems

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Medium 2	Short-term 1	**Very Low 4**	Definite	**VERY LOW**	– ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Medium 2	Short-term 1	**Very Low 4**	Definite	**VERY LOW**	– ve	High

[7] Groundwater contamination will not occur (construction and operation), because there is no deep flow of shallow (superficial) groundwater, while the aquifers below the project site are deep and covered by thick impermeable clay layers.

6.5.3 Assessment of Impacts: Operational Phase

The following potential direct operational phase impact on surface water was identified:

- W2: Contamination of surface water by the power plant affecting ecosystems.

6.5.3.1 Potential Impact W2: Contamination of surface water by the power plant affecting ecosystems

The power plant will have closed circuit cooling water and lubrication systems, so that there is no planned effluent release from the plant. During maintenance and top up, spent lubrication oil will be drained and treated at a treatment plant. The project will have bunded and diked areas to minimise surface water runoff to the surrounding area. Consequently, the operation of the power plant is not expected to have significant impact on the surface water in the project area, also due to the much lower probability of effluent reaching the environment.

The impact is assessed to be of ***insignificant*** with and without the implementation of mitigation (Table 6-16).

Table 6-16: Significance of contamination of surface water by the power plant affecting ecosystems

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Medium 2	Short-term 1	**Very Low 4**	Possible	**INSIGNIFICANT**	– ve	High
Essential mitigation measures: • Implement design measures as specified and intended (e.g. closed-circuit cooling water and lubrication system, treatment of used oil and appropriate bunding of the facility).								
With mitigation	Local 1	Medium 2	Short-term 1	**Very Low 4**	Possible	**INSIGNIFICANT**	– ve	High

6.5.4 The No-Go Alternative

The No-Go alternative entails no change to the *status quo,* and the surface water regime will remain unchanged.

6.5.5 Mitigation Measures: Potential Water Quality Impacts

Essential water quality mitigation measures during **construction** are as follows:

- Implement design measures as specified and intended (e.g. closed-circuit cooling water and lubrication system, treatment of used oil and appropriate bunding of the facility).

6.6 Potential Ecological Impacts

6.6.1 Introduction, Terms of Reference and Methodology

This assessment is based on the Flora and Fauna Study undertaken by Dirk Noordam (see Appendix H). The purpose of the study was to assess the potential impacts of the project on biodiversity, indicate its environmental acceptability and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the study were to:

- Describe the vegetation and fauna baseline based on a literature review supplemented by a single field campaign within the project footprint and immediate surroundings;
- Describe and rate the impacts using SRK's impact rating methodology; and

- Recommend mitigation measures to avoid and/or minimise impacts and/or optimise benefits associated with the proposed project.

6.6.2 Assessment of Impacts: Construction Phase

The following potential direct construction phase ecological impacts were identified:

- F1: Loss of flora during vegetation clearing; and
- F2: Effects on wildlife during construction.

6.6.2.1 Potential Impact F1: Loss of Flora and Fauna during Vegetation Clearing

The secondary marsh forest vegetation on the project site will be cleared prior to the construction of the power plant. However, none of the vegetation comprises vulnerable, rare or endangered plant species, and the vegetation has a secondary character and it occurs commonly in the Young Coastal Plain. Moreover, it covers only a minor area (2.5 ha) within the 4 600 ha Tambaredjo polder.

The impact is assessed to be of ***low*** significance (Table 6-17). No mitigation is possible.

Table 6-17: Significance of loss of flora and fauna during vegetation clearing

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Definite	**LOW**	– ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Definite	**LOW**	– ve	High

6.6.2.2 Potential Impact F2: Effects on Fauna during Construction

The power plant site will be cleared, hence some loss of habitat will occur. However, the project area is only expected to support a few adapted species, because it is close to human activity (passing traffic and operations at TA-58). Moreover, any wildlife can shift to neighbouring forest areas. Potential disturbances to wildlife will be caused mainly by vehicles, construction machinery, and human presence. However, in general, the species present in the vicinity of the project site are already adapted to a certain amount of disturbance from adjacent industrial activities.

Wildlife in the surrounding area may be temporarily disturbed during the construction period. However, there is sufficient opportunity to move to less noisy areas in the surrounding marsh forest.

The impact is assessed to be of ***very low*** significance (Table 6-18). No mitigation is possible.

Table 6-18: Significance of effects on fauna during construction

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Short-term 1	**Very Low** **3**	Probable	**VERY LOW**	– ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Short-term 1	**Very Low** **3**	Probable	**VERY LOW**	– ve	High

6.6.3 Assessment of Impacts: Operational Phase

The following potential direct operational phase ecological impact was identified:

- F3: Effects on wildlife during operations.

6.6.3.1 Potential Impact F3: Effects on Fauna during Operations

The power plant site will be cleared, hence some loss of habitat will occur. The current project area is, however, only expected to support a few adapted species, because it is close to human activity (passing traffic and operations at TA-58). Moreover, any wildlife can shift to neighbouring forest areas. Potential disturbances to wildlife will be caused mainly by vehicles, noise from operations noise and human activity. However, in general, the species present in the vicinity of the project site are already adapted to a certain amount of disturbance from adjacent industrial activities.

Design and management measures at the plant are expected to minimise pollution from e.g. noise, emissions and waste, thereby minimizing possible disturbance to wildlife in surrounding areas.

The impact is assessed to be of ***low*** significance (Table 6-19). No mitigation is possible.

Table 6-19: Significance of effects on fauna during operations

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	– ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Long-term 3	**Low 5**	Probable	**LOW**	– ve	High

6.6.4 The No-Go Alternative

The No-Go alternative entails no change to the *status quo,* and flora and fauna will be unaffected.

6.6.5 Mitigation Measures: Potential Water Quality Impacts

No **essential or best practice** ecological mitigation measures were identified.

6.7 Potential Socio-economic Impacts

6.7.1 Introduction, Terms of Reference and Methodology

This assessment is based on the SIA undertaken by Social Solutions (Appendix I). The purpose of the study was to assess the potential impacts of the project on the socio-economic environment, indicate its environmental acceptability and recommend practicable mitigation measures to minimise potential impacts and maximise potential benefits.

The ToR for the study were to:

- Undertake stakeholder meetings;
- Collect socio-economic baseline field data;
- Describe and rate the socio-economic impacts of the project using SRK's impact rating methodology; and
- Recommend mitigation measures to avoid and/or minimise impacts and/or optimise benefits associated with the proposed project.

Staatsolie has conducted several ESIA studies in the Tambaredjo polder and surroundings. As such, extensive baseline information about the study area is available. Existing baseline information informed the SIA. Primary data was collected through fieldwork, from 1 – 24 August 2018. During fieldwork, information was gathered through interviews with local stakeholders / key informants, field observations, and mapping. This primary information served to complement existing information and fill knowledge gaps identified during desktop research.

6.7.2 Assessment of Impacts: Construction Phase

The following potential direct construction phase socio-economic impacts were identified:

- SE1: Compromised drinking water quality from dust generated by project traffic;
- SE2: Increased safety risk from heavy vehicles during construction;
- SE3: Employment opportunities created by the project; and
- SE4: Damage to archaeological sites due to site clearing and earthworks.

6.7.2.1 Potential Impact SE1: Compromised Drinking Water Quality from Dust Generated by Project Traffic

Households located along the Gangaram Panday Road are not yet connected to the water distribution network. As such, most families living along the road rely on the collection of rain water for use as drinking water. Traffic on the unpaved Gangaram Panday Road, generates dust, which settles on roofs and in gutters, contaminating drinking water collected in storage tanks.

The impact is assessed to be of ***very low*** significance and with the implementation of (best practice) mitigation is reduced to ***insignificant*** (Table 6-20).

Table 6-20: Significance of compromised drinking water quality from dust generated by project traffic

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Medium 2	Short-term 1	**Very Low 4**	Definite	**VERY LOW**	– ve	High
Essential mitigation measures: • None.								
With mitigation	Local 1	Low 1	Short-term 1	**Very Low 3**	Improbable	**INSIGNIFICANT**	– ve	High

6.7.2.2 Potential Impact SE2: Increased Safety Risk from Heavy Vehicles during Construction

Residents living along the Gangaram Panday Road complain that the speed limit (40 km/h) is regularly exceeded by heavy vehicles. More traffic (and speeding) increases the risk of accidents.

The impact is assessed to be of ***very low*** significance and with the implementation of mitigation is reduced to ***insignificant*** (Table 6-21).

Table 6-21: Significance of increased safety risk from heavy vehicles during construction

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Medium 2	Short-term 1	**Very Low 4**	Definite	**VERY LOW**	– ve	High
Essential mitigation measures: • Continue to publicise and implement the existing Staatsolie grievance mechanism.								
With mitigation	Local 1	Low 1	Short-term 1	**Very Low 3**	Improbable	**INSIGNIFICANT**	– ve	High

6.7.2.3 Potential Impact SE3: Employment Opportunities created by the Project

Construction activities will provide jobs to local construction firms and workers, including subcontractors. National producers and suppliers of construction materials may experience increased business. It is expected that the project construction phase will provide jobs for 215 people, while the operational phase will generate employment for 10 persons.

The impact is assessed to be of ***very low*** significance (positive) and with the implementation of mitigation is increased to ***low*** (Table 6-22).

Table 6-22: Significance of employment opportunities created by the project

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Regional 2	Local 1	Short-term 1	**Very Low 4**	Probable	**VERY LOW**	+ ve	High
Essential mitigation measures: • Procure and utilise local skills and resources wherever possible. • Train local people to acquire skills required for the project.								
With mitigation	Regional 2	Medium 2	Short-term 1	**Low 5**	Definite	**LOW**	+ ve	High

6.7.2.4 Potential Impact SE4: Damage to Archaeological Sites due to Site Clearing and Earthworks

No known archaeological sites will be affected by the project; however, unregistered sites could exist in the project footprint, as few places have been excavated.

The impact is assessed to be of ***very low*** significance and with the implementation of mitigation is reduced to ***insignificant*** (Table 6-23).

Table 6-23: Significance of damage to archaeological sites due to site clearing and earthworks

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Short-term 1	**Very Low 3**	Probable	**VERY LOW**	– ve	High
Essential mitigation measures: • Compile and implement a chance finds procedure.								
With mitigation	Local 1	Low 1	Short-term 1	**Very Low 3**	Possible	**INSIGNIFICANT**	– ve	High

6.7.3 The No-Go Alternative

The No-Go alternative will bring none of the socio-economic benefits of the project such as employment, associated income generation and skills transfer. However, potential impacts to drinking water and road safety would also not arise.

6.7.4 Mitigation Measures: Potential Socio-economic Impacts

Essential socio-economic mitigation measures during **construction and operations** are as follows:

- Continue to publicise and implement the existing Staatsolie grievance mechanism;
- Procure and utilise local skills and resources wherever possible;
- Train local people to acquire skills required for the project; and
- Compile and implement a chance finds procedure.

Best practice socio-economic mitigation measures during **construction and operations** are as follows:

- Encourage foreign engineering companies to partner with local counterparts;
- Schedule logistics to minimise traffic on the Gangaram Panday Road;
- Inform nearby residents and businesses in a timely manner of delivery schedules;
- Avoid deliveries at night;

- Publicise delivery schedules in the media (newspaper, radio, television) and social media;
- Monitor trucks at strategic points along the Gangaram Panday Road to determine compliance with traffic rules agreed upon between Staatsolie and contractor; and
- Intensify the dust suppression programme on the Gangaram Panday Road during construction, especially the section from the beginning of the Gangaram Panday Road to the entrance to TA-58 (Km 6).

6.8 Potential contribution to Climate Change

6.8.1 Overview for Suriname

Suriname has a low-lying coastal zone where 80 % of the population lives and most economic activities take place. As such, Suriname is highly susceptible to the effects of sea level rise and is considered one of the so-called small island developing states, a group of developing countries that were recognised as low lying coastal countries that tend to share similar sustainable development challenges including small but growing populations, fragile environments, vulnerability to external shocks and few or no opportunities to create economies of scales (Ginmardo Kromosoeto, 2011).

The 2008 GHG inventory for Suriname (Office of the President of the Republic of Suriname, 2016) found that:

- Total GHG emissions equalled 6.4 million tonnes CO_2-equivalent (Mt CO_2-e) (versus reported GHG emissions of 8.9 Mt CO_2-e in 2003 [NIMOS, 2005]), of which 59% are generated by the energy sector. In 2014 estimated GHG emissions had again risen to 8.04 Mt CO_2-e (Climate Watch, 2018);
- Total CO_2 removals (GHG sinks) capacity equalled 8.2 Mt CO_2-e (versus reported GHG removals of 3.8 Mt CO_2-e in 2003 [NIMOS, 2005]), primarily from forestry and agriculture; and
- Suriname acts as a net GHG sink of 1.9 Mt CO_2-e annually (versus reported net GHG emissions of 5.0 Mt CO_2-e in 2003 [NIMOS, 2005]).

GHG emissions declined sharply in 1999 due to the closure of the Aluminium Smelter but grew again in subsequent years. Energy is derived mainly from hydrocarbons and hydropower. As a result, the energy sector is the largest GHG source, followed by Land-Use Change and Forestry and Agriculture (NIMOS, 2005; Office of the President of the Republic of Suriname, 2016).

6.8.2 Contribution by the Project

The project area itself is located in Suriname's low-lying coastal plain on a polder surrounded by swamp. This area is likely to be vulnerable to possible effects of climate change such as sea level rise and changing rainfall and wind patterns. The burning of fossil fuels is generally accepted to be a factor contributing to climate change. As such, project is likely to have some impact on climate change and/or *vice versa*.

The plant is likely to contribute to climate change, mainly through the emission of CO_2 from the burning of HFO[8], used to generate electricity. Approximately 112 kl of HFO will be used per day to power the plant (assuming four of the six generators are in use at any one time, each consuming 28 000 litres per day). Assuming the plant will operate 365 days per year, the yearly consumption of HFO is estimated at 41 million litres[9].

[8] CO_2 emissions generated by associated activities such as oil extraction and transport depend on many variables. As such, CO_2 emissions associated with these items are not quantified.
[9] It is assumed that this is approximately equivalent to 41 000 tonnes.

Based on the above assumptions, CO_2 release by the power plant from the burning of HFO is estimated at approximately 131 733 t CO_2-e year[10].

The CO_2 emissions from the power plant from the burning of HFO are the approximate equivalent of:

- 2% of Suriname's total GHG emissions, as reported in the 2008 inventory (or 1.6% of estimated 2014 emissions);
- 1.6% of Suriname's total GHG removals (sequestration) by its forest, as reported in the 2008 inventory; and
- 3.4% of the GHG emissions by the energy sector, as reported in the 2008 inventory.

The effects of climate change are global, and CO_2 is emitted worldwide from a vast number of sources. Seldom is any one source a significant emitter, but combined they emit enormous quantities of CO_2. As such, it is difficult to meaningfully rate the contribution of the power plant as a single emission source, and the impact has not been rated formally. The CO_2 emissions associated with the power plant are noticeable but low compared to those of Suriname, and very low compared to those of major power plants in other parts of the world, particularly developing countries.

Measures to reduce the CO_2 emission volumes associated with the power plant can include operational changes, including increasing energy efficiency and substitution of HFO for cleaner-burning fuels. However, the implementation of such measures is expected to require operational adjustments at the plant that might not be technically or financially feasible.

Offset measures, such as the support of carbon-reducing schemes, can also be considered, but it is noted that the 2008 inventory identifies Suriname as a net GHG sink.

6.9 Cumulative Impacts

6.9.1 Introduction

Anthropogenic activities can result in numerous and complex effects on the natural and social environment. While many of these are direct and immediate, the environmental effects of individual activities (or projects) can combine (additive impact) and interact (synergistic impact) with other activities in time and space to cause incremental or aggregate effects. Effects from ongoing but unrelated activities may accumulate or interact to cause additional effects (Canadian Environmental Protection Agency, no date), known as "cumulative" effects or impacts (hereafter cumulative impacts).

Cumulative impacts are defined by the International Finance Corporation (IFC, 2013) as "those that result from the successive, incremental, and / or combined effects of an action, project, or activity when added to other existing (i.e. ongoing), planned, and / or reasonably anticipated future" actions, projects or activities.

Key to the theoretical understanding of cumulative impacts is that the effects of previous and existing actions, projects or activities are already present and assimilated into the biophysical and socio-economic baseline. For the purposes of this report, cumulative impacts are defined as 'direct and

[10] The annual CO_2-emissions generated by the combustion of HFO is calculated as follows (TÜV, 2007):
CO_2 = (mass of fuel) x (carbon content) x (molecular weight of CO_2/atomic weight of C) x oxidation factor, where:
- mass of fuel = mass of HFO = 41 000 t
- carbon content = 0,8806 t C / t fuel (based on analysis of the HFO used at the Vasilikos Power Station)
- molecular weight of CO_2/atomic weight of C = 44 / 12 = 3,667
- oxidation factor = 0,995, giving:

CO_2 = 41 000 x 0,8806 x 3.667 x 0,995 = 131 733 t CO_2

indirect project impacts that act together with external stressors and existing or future potential effects of other activities or proposed activities in the area/region that affect the same resources and/or receptors, also referred to as Valued Environmental and Social Components (VECs)'.

For the most part, cumulative effects or aspects thereof are too uncertain to be quantifiable, due to mainly lack of data availability and accuracy.

6.9.2 Methodology

The IFC Good Practice Handbook for Cumulative Impact Assessment (2013), describes five / six key steps and considerations in the assessment of cumulative impacts:

- Definition of the Area of Influence (AoI);
- Identification of VECs, and their baseline condition;
- Identification of activities or stressors that contribute or are anticipated to contribute to cumulative effects in the foreseeable future (i.e. for all phases of the project);
- Implementation of a suitable methodology to assess cumulative impacts and evaluate their significance; and
- Identification of measures to manage and monitor cumulative impacts.

The **Area of Influence** (AoI) can be defined as the area likely to be affected, and the period or duration of occurrence of effects. In practice the AoI is a function of a large number of factors which have changing and varying degrees of influence on the areas surrounding the project throughout the course of the project cycle. The geographical extent of some of these factors can be partially quantified (e.g. air emissions can be defined by a delineated plume under specified meteorological conditions), whilst the extent of others is very difficult to measure (e.g. direct and indirect socio-economic effects).

In CIA it is good practice to focus on **VECs**, which are environmental and social attributes that are considered to be important in assessing risks and can be defined as essential elements of the physical, biological or socio-economic environment that may be affected by a proposed project. Types of VECs include physical features, habitats, wildlife populations (e.g. biodiversity), ecosystem services, natural processes (e.g. water and nutrient cycles, microclimate), social conditions (e.g. health, economics) or cultural aspects (e.g. traditional spiritual ceremonies). VECs should reflect public concern about social, cultural, economic, or aesthetic values, and also the scientific concerns of the professional community (Beanlands and Duinker, 1983).

Activities of potential interest include other past, present and future activities that might have caused or may cause impacts on the VECs affected by the project, and / or may interact with impacts caused by the project under review:

- **Cumulative impacts of past and existing activities**: It is reasonably straightforward to identify significant past and present projects and activities that may interact with the project to produce cumulative impacts, and in many respects, these are taken into account in the descriptions of the biophysical and socio-economic baseline (see respective sections in Section X); and
- **Potential cumulative impacts of planned and foreseen activities**: Relevant future projects that will be included in the assessment are defined as those that are 'reasonably foreseeable', i.e. those that have a high probability of implementation in the foreseeable future; speculation is not sufficient reason for inclusion.

Stressors can be defined as natural or anthropogenic aspects which cause a change in, i.e. impact on, the structure or function of the environment. Natural and anthropogenic stressors often have similar effects, e.g. both drought and wood harvesting result in a loss of habitat. Due to rapid

increases in human population, anthropogenic stressors on the environment have increased greatly (Cairns, 2013).

6.9.3 Cumulative Impact Assessment

Cumulative impacts for this project have been identified based on the extent and nature of the AoI of the projects, status of VECs and understanding of external natural and social stressors. These insights have been informed by engagements with project stakeholders, review of existing documentation, field observations and data collection.

As the cumulative impacts of past and existing projects are incorporated in the baseline, the focus hereafter is on planned and foreseen projects and activities. Given the limited detail available regarding such future developments, the analysis is of a more generic nature and focuses on key issues and sensitivities for the project and how these might be influenced by cumulative impacts with other activities. The future developments that are considered are:

- Those for which approvals have already been granted;
- Those that are currently subject to environmental applications and for which there is currently information available; and
- Those forming part of district or national initiatives.

Where further developments are identified, but are not yet at the stage of planning as detailed above, these are noted in the cumulative impact assessment.

Projects and stressors that have been considered in the cumulative impact analysis are listed in Table 6-24

Table 6-24: Projects / stressors considered in the cumulative impact analysis

Project / stressor	Common VECs
Past and present projects / stressors	
Agricultural activities in the resort	Ecology
Oil & Gas activities and other industries in the resort, e.g. sawmill and oil production	Air quality Noise Water quality Employment
Future projects / stressors	
Not applicable	None

Cumulative impacts are only assessed for VECs on which the project has a potentially significant impact.

The cumulative impacts considered are:

- Decline in Air Quality:
  - Impaired human health and other effects from dust generated by project traffic;
  - Impaired human health from increased ambient pollutant concentrations associated with power plant emissions; and
- Increased noise levels along access roads;
- Contamination of surface water affecting ecosystems;
- Ecological impacts:
  - Loss of flora during vegetation clearing;

- Effects on wildlife during construction;
- Effects on wildlife during operations; and

- Employment opportunities created by the project.

In the sections below, the severity and extent of cumulative impacts is qualitatively rated to derive a high, medium or (very) low significance rating.

6.9.3.1 Cumulative Air Quality Impacts

A number of existing emission sources are likely to contribute to air pollution, including oil fields in the Saramacca District, oil processing plants (TA-58 and Jossie), traffic on the Gangaram Panday Road, river traffic on the Saramacca River and – during the dry season – commercial agricultural activities. These sources emit a number of primary pollutants, including SO_2, HF, NO_{xes}, PM, CO and VOCs (such as toluene, benzene, xylene etc).

The cumulative effect of emissions from these sources was already taken into account in the baseline and impact assessment and is reflected in the low significance impact rating of the project. All measured pollutants are low, and well below their respective extrapolated seven-day screening limits, indicating that baseline air quality is good. Measured pollutant concentrations represent between 0.5% and 15.6% of their respective seven-day screening limits.

The cumulative impact on ambient air quality in the study area is assessed to be of ***very low*** significance.

6.9.3.2 Cumulative Noise Impacts

Baseline noise levels are typical of rural areas, with daytime sound pressure levels ranging from 46 dBA to 66 dBA along a road characterised by significant light and heavy vehicle traffic. Key sources of environmental noise include the TA-58 plant, fauna and vehicle traffic. Due to a large number of insects, night-time noise in some areas is higher than daytime levels.

The cumulative noise impact from activities in the area is not significant, and the contribution of the new power plant is considered negligible due to the absence of proximate receptors. Cumulative traffic noise will increase, primarily during the construction phase, but will have very little cumulative effect during the operational phase.

The cumulative impact on ambient noise levels in the study area is assessed to be of ***very low*** significance.

6.9.3.3 Cumulative Water Quality Impacts

Water quality in the Coastal Plain varies from saline to brackish near the coast to freshwater further south, while water quality in the Kisoensingh-west Canal is already impacted by Staatsolie activities in the Tambaredjo polder.

Construction activities may affect water quality in the canal, but leaks and spills can be can managed / remediated and cumulative effects are likely to be negligible.

The cumulative impact on water quality in the study area is assessed to be of ***very low*** significance.

6.9.3.4 Cumulative Ecological Impacts

The Tambaredjo polder area has been substantially transformed by human activities and is characterised by secondary marsh forest of low plant diversity compared to undisturbed similar habitats. The study area is not deemed sensitive with regards to ecosystems and floral biodiversity. Similarly, the secondary marsh forest found at the project site is expected to have relatively low fauna diversity and the study area is not deemed sensitive with regards to ecosystems and fauna.

Cumulative impacts, therefore, are mainly a consequence of prior agricultural activity, and the power plant – on a 2.5 ha site – will not have any meaningful cumulative effects.

The cumulative ecological impact in the study area is assessed to be of ***very low*** significance.

6.9.3.5 Cumulative Economic Impacts

Unemployment is a concern in the Saramacca District, and new employment (and wealth creation) opportunities are limited. In the short term during construction, the project will have a noticeable effect on employment, but of little effect during operations.

The cumulative economic impact in the study area is assessed to be of ***very low*** significance (positive).

6.9.4 Management of Cumulative Impacts

The management of cumulative impacts will depend on the context in which the development is occurring, i.e. the impacts from other projects and natural drivers that affect the VECs, and the characteristics of the of the power plant project impacts. Since cumulative impacts result from the actions of multiple stakeholders, the responsibility for their management is collective.

Since, all cumulative impacts are assessed to be of ***very low*** significance, no additional mitigation measures are required in the ESMP.

6.10 Environmental and Social Management Plan

It is critical that mechanisms are in place to ensure that the recommendations and mitigation measures contained in the ESIA Report are fully and effectively implemented. Typically, a customised management plan is the mechanism through which these measures are implemented.

The preparation of management plans is also consistent with the EA Guidelines (Annex 7) published by NIMOS, which require, *inter alia*, that ESIA reports should include:

(8) Proposed Mitigation Measures or an Environmental Management Plan (EMP);

(11) Follow Up & Monitoring Plan[11]; and

(12) Decommissioning Plan[12].

An ESMP has been developed by SRK as part of the ESIA process. The objective of the ESMP is to set out the management and monitoring measures required to both minimise any potentially adverse environmental impacts and enhance the environmental benefits of the project. A further objective of the ESMP is to ensure that responsibilities and appropriate resources are efficiently allocated to implement the plan.

Management and monitoring measures have been developed from the recommendations and mitigation measures listed in the ESIA Report. By formally documenting environmental management measures and commitments, the ESMP serves a vital role in ensuring that potential impacts of the project are minimised, and that the significance of those impacts is as predicted by the ESIA process. The ESMP has been formatted so that it can be developed into a practical document for implementation on site and incorporated into tender documents where appropriate, and also contains environmental management and training requirements to implement the ESMP.

[11] Monitoring measures are recorded in the ESMP.

[12] As plant decommissioning is not envisaged for at least 25 years, SRK recommends that a comprehensive decommissioning plan is compiled closer to decommissioning; once more information on the timing of decommissioning is available. The scale of the proposed power plant project does not warrant comprehensive decommissioning planning at this stage in an ESIA, as it should not influence decisions around environmental authorisation, and is typically a requirement pertaining only to large-scale mining projects. Decommissioning of the power plant is expected to be a relatively simple and straightforward exercise.

The ESMP was released to stakeholders for comment together with the ESIA Report. It is important to recognise that management plans in general are living documents that will need to be periodically reviewed and updated even after their initial completion.

7 Conclusions and Recommendations

Staatsolie proposes to construct a new thermal HFO power plant of up to 36 MW in phases at the Sarah Maria facility in the Tambaredjo Oil Field to provide backup power. In accordance with NIMOS's EA guidelines, a full ESIA process has been undertaken for the project.

The ESIA has examined the available project information and drawn on both available (secondary) and specifically collected (primary) baseline data to identify and evaluate environmental (biophysical and socio-economic) impacts of the proposed power plant. The ESIA Report aims to inform decision-makers of the key considerations by providing an objective and comprehensive analysis of the potential impacts and benefits of the project and has created a platform for the formulation of mitigation measures to manage these impacts, presented in the ESMP, which should be read together with the ESIA Report.

This chapter evaluates the impact of the proposed power plant and presents the principal findings of the ESIA. It further summarises the general conclusions that have been drawn from the ESIA process and which should be considered in evaluating the project. It should be viewed as a supplement to the detailed assessment of individual impacts presented in Chapter 6.

7.1 Summarised Evaluation of Impacts

The evaluation is undertaken in the context of:

- The project information provided by the proponent;
- The assumptions made for this ESIA Report;
- The assumption that the recommended (essential) mitigation measures will be effectively implemented; and
- The assessments provided by specialists.

This evaluation aims to provide answers to a series of key questions posed as objectives at the outset of this report, which are repeated here:

- Assess in detail the environmental and socio-economic impacts that may result from the project;
- Identify environmental and social mitigation measures to address the impacts assessed; and
- Produce an ESIA Report that will assist NIMOS's evaluation of the project.

The evaluation and the basis for the subsequent discussion are represented concisely in Table 7-1, which summarises the potentially significant impacts and their significance ratings before and after application of mitigation and/or optimisation measures.

Table 7-1: Summary of potential impacts of the Saramacca Power Plant

*Potential negative impacts are shaded in reds, benefits are shaded in greens. Insignificant impacts have not been shaded. Only **key (non-standard essential)** mitigation/optimisation measures are presented. Other management measures are presented in the ESMP.*

ID #	Impact	Significance rating		Key mitigation/optimisation measures
		Before mitigation/ optimisation	After mitigation/ optimisation	
CONSTRUCTION PHASE IMPACTS				
A	**Impacts on Air Quality**			

A1	Impaired human health from increased ambient pollutant concentrations associated with construction activities	Very Low	Very Low	• Limit and phase vegetation clearance and the construction footprint to what is essential.
				• Reduce airborne dust through e.g.:
				  ○ Dampening dust-generating areas, roads and stockpiles with water.
				  ○ Utilising screens in high dust-generating areas.
				• Maintain all generators, vehicles, vessels and other equipment in good working order to minimise exhaust fumes.

A2	Impaired human health and other effects from dust generated by project traffic	Very Low	Very Low	• None; industry standard management measures are incorporated in the ESMP.
N	**Noise Impacts**			
N1	Increased noise levels along access roads	Very Low	Very Low	• None; industry standard management measures are incorporated in the ESMP.
W	**Water Quality Impacts**			
W1	Contamination of surface water affecting ecosystems	Very Low	Very Low	• None; industry standard management measures are incorporated in the ESMP.
F	**Ecological Impacts**			
F1	Loss of flora during vegetation clearing	Low	Low	• None; industry standard management measures are incorporated in the ESMP.
F2	Effects on wildlife during construction	Very Low	Very Low	• None; industry standard management measures are incorporated in the ESMP.
SE	**Socio-economic Impacts**			
SE1	Compromised drinking water quality from dust	Very Low	Insignificant	• None; industry standard management measures are incorporated in the ESMP.

ID #	Impact	Significance rating		Key mitigation/optimisation measures
		Before mitigation/ optimisation	After mitigation/ optimisation	
	generated by project traffic			
SE2	Increased safety risk from heavy vehicles during construction	Very Low	Insignificant	• Continue to publicise and implement the existing Staatsolie grievance mechanism
SE3	Employment opportunities created by the project	Very Low	Low	• Procure and utilise local skills and resources wherever possible. • Train local people to acquire skills required for the project.
SE4	Damage to archaeological sites due to site clearing and earthworks	Very Low	Insignificant	• Compile and implement a chance finds procedure.
OPERATIONAL PHASE IMPACTS				
A	**Air Quality Impacts**			
A3	Impaired human health from increased ambient pollutant concentrations associated with power plant emissions	Very Low	Very Low	• Adopt appropriate technology to ensure power generating units meet the World Bank emission guidelines for reciprocating engines and turbines. • Operate the power generating units according to design specifications and manufacturer's instructions to meet the emission limits. • Regularly maintain the power plant to minimise exhaust emissions. • Test exhaust emissions on power generating units once they are fully operational, to confirm emission rates and compliance with equipment manufacturer emission specifications.
N	**Noise Impacts**			
N2	Noise impacts of the power plant	Insignificant	Insignificant	• None; industry standard management measures are incorporated in the ESMP.
W	**Water Quality Impacts**			
W2	Contamination of surface water by the power plant affecting ecosystems	Insignificant	Insignificant	• Implement design measures as specified and intended (e.g. closed-circuit cooling water and lubrication system, treatment of used oil and appropriate bunding of the facility).
F	**Ecological Impacts**			
F3	Effects on wildlife during operations	Low	Low	• None; industry standard management measures are incorporated in the ESMP.

7.2 Principal findings

The proposed power plant will entail so-called triple bottom line costs, i.e. social, environmental and economic costs. The triple bottom line concerns itself with environmental (taken to mean biophysical) sustainability, social equity and economic efficiency and is typically employed by companies seeking to report on their performance. The concept serves as a useful construct to frame the evaluation of environmental impacts of the project.

The challenge for NIMOS is to consider a project which should aim to be sustainable in the long term, but which will probably entail trade-offs between social, environmental and economic costs and benefits. The trade-offs are documented in the report, which assesses environmental impacts and benefits and compares these to the No-Go alternative.

There are a number of minor or less significant impacts associated with the power plant. If recommended mitigation measures are adopted, these impacts are not expected to be significant nor long-term. They include vibration and visual impacts.

Relevant observations with regard to potentially significant impact ratings, assuming mitigation measures are effectively implemented, as summarised in Table 7-1, are:

- The predicted **air quality** impacts and associated impairment in human health arising from the release of fugitive particulate matter and dust fallout along gravel sections of the Gangaram Panday Road during construction, and emissions of primary pollutants from combustion engines (SO_2, NO_x, CO and, to a lesser extent, VOCs) as well as particulate matter during operations, are rated as ***very low.***
- The predicted **noise** impacts and associated human health or nuisance effects arising from construction traffic on the Gangaram Panday Road during construction and operation of diesel engines and four 10MVA transformers will be of short duration (traffic) or not be discernible by receptors (power plant), are rated as ***very low*** *during construction and* ***insignificant*** *during operations.*
- The predicted **water quality** impacts from accidental spills of hydrocarbons and elevated levels of suspended solids during construction and unplanned release of effluent can be readily mitigated and are rated as ***very low*** *during construction and* ***insignificant*** *during operations.*
- The predicted **ecological** impacts associated with loss of flora from vegetation clearing and disturbance to wildlife during construction and long term displacement of fauna caused by operational activities, are rated as ***low****.*
- The predicted **social** impacts from compromised drinking water quality in rain tanks and increased safety risk from heavy vehicles along sections of the Gangaram Panday Road during construction, are rated as ***insignificant.***
- The predicted **economic** impacts (benefits) of employment (and wealth creation) opportunities created by the project, primarily during construction, are rated as ***low.***
- The predicted **heritage and archaeological** impacts from damage to archaeological sites due to site clearing and earthworks, are rated as ***insignificant.***
- The plant is also likely to emit an estimated 131 733 tonnes of CO_2-e per year from the burning of HFO used to generate electricity. This would be equivalent to approximately 1.6% of Suriname's 2014 GHG emissions.

Cumulative impacts in the region may derive from existing agricultural, Oil & Gas and limited industrial activities, and the proposed development of the power plant. Cumulative biophysical impacts include a decline in air quality, increased noise levels along access roads, contamination of

surface water affecting ecosystems and ecological impacts. Given the relatively small scale of the project, absence of a significant number of proximate receptors and the transformed ecological environment, biophysical cumulative impacts are qualitatively rated as *very low*.

Cumulative socio-economic impacts include employment opportunities in an area affected by unemployment, but the modest scale of such opportunities, socio-economic cumulative impacts (benefits) are qualitatively rated as *very low*.

Power generation is not an intrinsically hazardous activity and the main risks, if any, will relate to the storage and handling of hazardous materials, in this case HFO. As HFO has a flash point of 103°C, the probability of ignition for all quantities of HFO is zero, as is the risk from HFO fires.

The No-Go alternative implies no change to the *status quo* and thus no additional, albeit limited, biophysical and adverse socio-economic impacts, while modest socio-economic benefits would be forgone.

A number of mitigation and monitoring measures have been identified to avoid, minimise and manage potential environmental impacts associated with the proposed power plant. These are further laid out in the ESMP.

7.3 Recommendations

The specific recommended mitigation and optimisation measures are presented in Chapter 6 and/or the ESMP and key measures are summarised in Table 7-1 above. Staatsolie would need to implement these mitigation measures to demonstrate compliance and adherence to best practice.

Key recommendations, which are considered essential, are:

1. Implement the ESMP to guide construction and operational activities and to provide a framework for the ongoing assessment of environmental performance;
2. Ensure that the appropriate personnel and sufficient resources are allocated to expedite implementation of the ESMP;
3. Ensure adequate response mechanisms are in place and corrective action is taken to address any instances of non-compliance with standard management measures or procedures;
4. Maintain lines of communication with the local communities in the vicinity of the power plant. Ensure that local communities are aware of the Staatsoile grievance mechanism and how to utilise it. Develop a complaints registry and investigation procedure to ensure that all grievances are adequately addressed;
5. Maximise the employment of local (Surinamese) nationals and the procurement of local resources during the construction and operations phases to ensure maximum benefit to the local economy;
6. Compile and implement a detailed Emergency Response Plan prior to commencing with construction, setting out roles, responsibilities and procedures to address all potential incidents; and
7. Compile and implement a Conceptual Decommissioning Plan at the end of the operational life of the plant.

8 Way Forward

This Draft ESIA Report has identified and assessed the potential impacts associated with the proposed Staatsolie power plant at the Sarah Maria facility. The Draft ESIA Report and Draft ESMP are now available for public comments and we invite stakeholders to review the report and to participate in the stakeholder engagement process.

This Draft ESIA Report and the ESMP are not final reports and may be amended based on comments received from stakeholders. The (English and Dutch) NTS of the ESIA Report will be sent to all registered stakeholders. Copies of the complete ESIA Report and ESMP are available for viewing at the following venues:

- NIMOS; and
- Office of the Saramacca District Commissioner at Groningen.

An electronic version of the reports can also be accessed on SRK's website www.srk.co.za (via the 'Library' and 'Public Documents' links).

Stakeholders are invited to attend a **Public Meeting** where the information presented in the ESIA Report and ESMP will be discussed and additional concerns and issues can be raised with the environmental consultants and the project team.

The public meeting will be held on Thursday 28 February 2019

The public is invited to review the ESIA Report and ESMP and send written comment to:

SRK Consulting:		Staatsolie:
Contact persoon: **Sue Reuther**	of	Contact persoon: **Jacintha Sanches**
E-mail: sreuther@srk.co.za		**E-mail:** jsanches@staatsolie.com
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Stakeholders will be provided with a 21-day comment period. For comments to be included in the Final ESIA Report and ESMP, they must reach one of the above contact persons **no later than 5 March 2019.**

Once stakeholders have commented on the information presented in the Draft ESIA Report, the Final ESIA Report will be prepared and submitted to NIMOS for consideration. NIMOS will evaluate the environmental and social sustainability of the proposed Project and advise Staatsolie of their decision.

Prepared by	**Reviewed by**
Sue Reuther	Chris Dalgliesh
Principal Environmental Consultant	Partner

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

9 References

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Milieu- en Sociale Effectenanalyse van de Staatsolie Warmtekrachtcentrale in Saramacca

Niet-Technische Samenvatting: ESIA-Rapport

Februari 2019 SRK projectnummer: 532091

1. INLEIDING

Staatsolie Maatschappij Suriname N.V. (Staatsolie) beheert drie olievelden en twee olieverwerkingsinstallaties in het district Saramacca. De N.V. Energie Bedrijven Suriname (EBS) voorziet via een transmissielijn in de elektriciteitsbehoefte van de Staatsolie operatie in Saramacca.

De elektriciteitsbehoefte zal naar verwachting blijven groeien door de uitbreiding van de activiteiten in de olievelden. Staatsolie wil daarom een nieuwe warmtekrachtcentrale (zware olie [HFO]) van maximaal 36 MW in fasen bouwen in de buurt van het TA58 emplacement in het Tambaredjo-olieveld (afbeelding 1). Dit moet ook als back-up dienen zodat er zich minimale elektriciteits-onderbrekingen voordoen.

Het Zuid-Afrikaanse adviesbureau SRK Consulting, met ruime werkervaring in Suriname, is aangesteld om de *Environmental and Social Impact Assessment* (ESIA)) te doen.

Op pagina 6 vindt u meer informatie over hoe u kunt deelnemen aan dit proces.

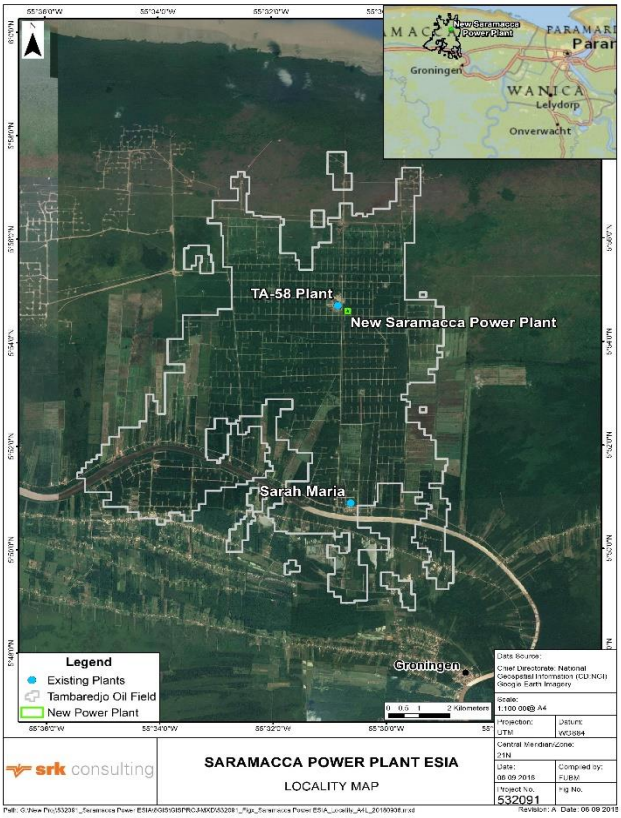
2. WETTELIJK EN REGELGEVEND KADER

Uitgangspunten voor Suriname's milieubeleidsvisie zijn terug te vinden in de Grondwet en het Nationaal Ontwikkelingsplan. Er wordt gewerkt aan een basis voor milieuwetgeving en zijn er richtlijnen voor milieueffectenanalyse gepubliceerd. Het ESIA-proces dat bij de voorgestelde krachtcentrale zal worden gevolgd, gebeurt in overeenstemming met deze richtlijnen en andere relevante wet- en regelgeving.

Naast nationale regelgeving, worden internationale milieunormen en –standaarden van de Wereldbank toegepast in de ESIA.

2.1 Nationale normen

Het *Nationaal Instituut voor Milieu en Ontwikkeling in Suriname* (NIMOS) is verantwoordelijk voor de verdere ontwikkeling van de milieuwetgeving en het beheer van het milieueffectenanalyse proces.



Afbeelding 1: Locatie

Naar aanleiding van de Verklaring van Rio uit 1992 werd een **Ontwerpwet milieu** samengesteld. Dit handvest omvat beginselen met betrekking tot de bescherming en het beheer van een gezond milieu binnen het kader van duurzame ontwikkeling. Het wetsontwerp is in behandeling bij de Raad van Ministers en De Nationale Assemblee (DNA), en is dus nog niet uitgevaardigd. De principes van het wetsontwerp worden echter als leidraad gebruikt voor het uitvoeren van ESIA's in Suriname.

ESIA-uitvoeringsbesluiten die zullen worden uitgevaardigd zodra de Milieuwet in werking treedt, worden ook al ontwikkeld sinds 2003 en bevatten vereisten voor ESIA-processen en publieke participatie. De milieu-uitvoeringsbesluiten worden nog aangepast en zijn nog niet in werking.

Hoewel er nu geen wetgevende basis bestaat voor de analyse van milieueffecten van ontwikkelingsvoorstellen in Suriname, heeft het NIMOS richtlijnen voor milieuanalyses gepubliceerd. Deze richtlijnen worden door het NIMOS gebruikt bij het uitgeven van vergunningen en van projectontwikkelaars wordt verwacht dat ze de richtlijnen

volgen. De NIMOS Environmental Assessment *(EA) Guidelines Volume V: Power Generation and Transmission Projects*, zijn ook gebruikt bij dit project.

Volgens Volume I van de EA-richtlijnen valt de constructie en het beheer van een nieuwe krachtcentrale onder een categorie A-project, type "krachtcentrale (ongeacht het type energiebron) boven 10 MW", waarvoor een alomvattende ESIA wordt vereist.

2.2 Internationale Normen

SRK Consulting laat zich leiden door internationale normen en Good International Industry Practice (GIIP) bij het uitvoeren van de ESIA, de daarbij horende publieke consultatie en het proces voor het vrijgeven van de informatie, waaronder:

- Prestatienormen van de Internationale Financieringsmaatschappij (IFC).
- Specifieke management richtlijnen van IFC voor milieu, gezondheid en veiligheid rond warmtekrachtcentrales.

2.3 Bedrijfsnormen

Om het milieu te beschermen past Staatsolie procedures toe die voldoen aan internationale standaarden. Staatsolie houdt zich binnen al haar operaties aan een geïntegreerd beleid met betrekking tot *Health, Safety, Environment and Quality* (HSEQ) om negatieve effecten op de gezondheid en veiligheid van werknemers, contractors en betrokken gemeenschappen en het milieu te minimaliseren en beheersen in het kader van continue verbetering.

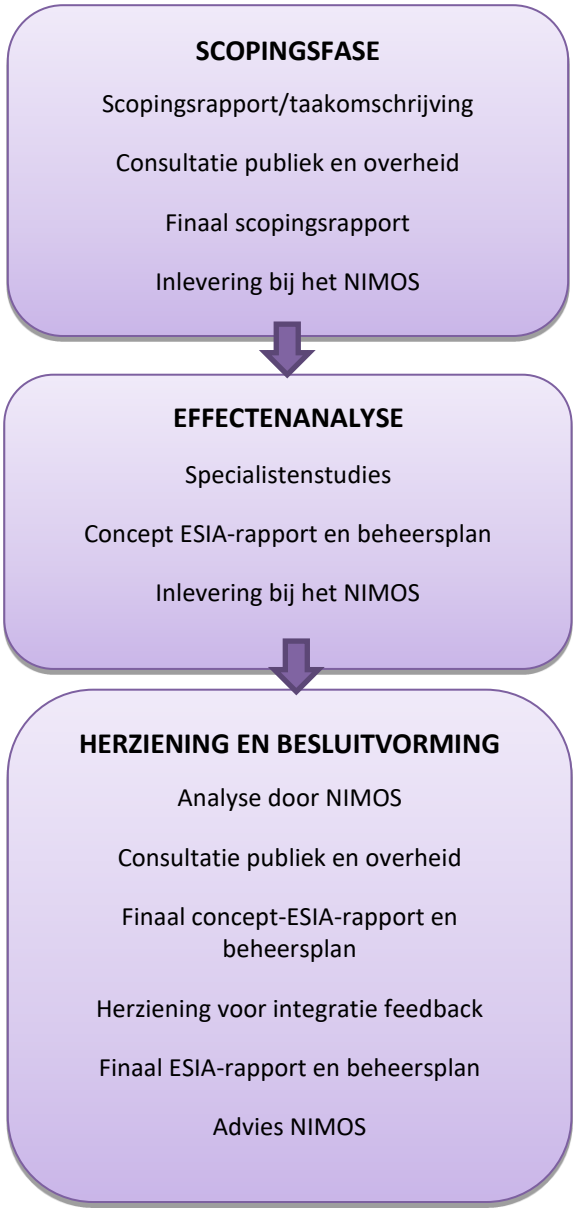
3. HET ESIA-PROCES

Bij het uitvoeren van het ESIA-proces, worden de richtlijnen van het NIMOS gevolgd, zoals uiteengezet in de richtlijnen voor milieu-analyses van 2009 en de *Guidance Note Environmental Assessment Process* (2017) en worden ook hoge internationale normen toegepast.

De objectieven van de ESIA zijn het:

- beschrijven en documenteren van de ecologische uitgangssituatie (baseline) van het studiegebied en de sociaal-economische omstandigheden van betrokken gemeenschappen;
- analyseren van de potentiële milieu- en sociaal-economische effecten van het project;
- informeren en betrekken van stakeholders, waaronder relevante overheden en het publiek, om hun bevindingen en bedenkingen te behandelen;
- identificeren van mitigerende maatregelen op sociaal en milieuvlak om de vastgestelde effecten te behandelen;
- ontwikkelen van een Milieu- en Sociaal Management Plan), gedeeltelijk gebaseerd op de mitigerende maatregelen uit het ESIA-rapport.

Het ESIA-proces bestaat uit verschillende fases: de screeningfase (reeds ondernomen door Staatsolie voor SRK Consulting werd aangesteld), de scopingsfase (voltooid in december 2018), de effectenanalyse *(huidige fase)* en de herzieningsfase. Afbeelding 2 geeft een overzicht van het ESIA-proces.



Afbeelding 2: Overzicht van het ESIA-proces

4. BESCHRIJVING LOCATIE EN MILIEU

Het Tambaredjo-olieveld bevindt zich tussen de Oost-Westverbinding en de oceaan, voornamelijk ten noorden van de Saramaccarivier (afbeelding 1).

Het studiegebied bevindt zich in de Jonge Kustvlakte van het Guyana bassin, op Holocene afzettingen van de Coronie-formatie. De Jonge Kustvlakte bestaat voornamelijk uit vlakke, laaggelegen zwampen en moerassen met kleibodems op 1 – 1,5 meter boven de zeespiegel, waarop zich een veenlaag heeft ontwikkeld.

De locatie ligt tussen de oliebronnen in de Tambaredjo-polder, op een hoogte van 2 meter boven het gemiddeld zeeniveau. De locatie is verlaten en bedekt met een gewijzigde, secundaire schorre vegetatie en er is relatief weinig faunadiversiteit. De Tambaredjo-polder is grotendeels gewijzigd door menselijke activiteiten (afbeelding 3).

Afbeelding 3: Locatie van de toekomstige krachtcentrale

Binnen het gebied bevinden zich een paar belangrijke bronnen van luchtverontreiniging. De TA58 Crude Treatment Facility (ruwe olie verwerkingsinstallatie), die zich op zo'n 150 meter ten noordwesten van de voorgestelde krachtcentrale bevindt, veroorzaakt wat atmosferische emissies. Andere potentiële bronnen van luchtvervuiling zijn de voertuigen op de zandwegen en de agrarische activiteiten in aangrenzende gebieden. Luchtkwaliteitsmetingen in de omgeving van de projectlocatie tonen aan dat al de gemeten emissies laag zijn en dat de luchtkwaliteit goed is.

In rurale gebieden is er een laag geluidsniveau, met een dagniveau van 46 decibel (dB) ten westen van de TA58 Crude Treatment Plant (waar er weinig verkeer is) en 66 dB op de Wayamboweg (met openbaar verkeer).

District Saramacca bestaat uit ongeveer 3320 km^2 kust**zwampgebied**, waarvan zo'n 370 km^2 ingenomen wordt door mangrovebossen. Bij het testen van het oppervlaktewater tijdens het droge- en regenseizoen werd vastgesteld dat de waterkwaliteit niet drastisch gewijzigd was in vergelijking met metingen uit 1999. De TA58-centrale, het boren naar en het verwerken van olie en het gebruik van pesticiden worden aangewezen als mogelijke, maar beperkte bronnen van vervuiling.

Het noordelijke gebied huisvest belangrijke ecosysteemgoederen- en diensten, waaronder het Coppename Monding **Natuurreservaat**, dat zich op 5,5 km ten noorden van de voorgestelde centrale bevindt dat een 'Wetland of International Importance' is (RAMSAR gebied).

In de kustvlakte van Suriname bevinden zich drie belangrijke aquifers van de Corantijngroep.

Het gebied wordt niet als kwestbaar beschouwd wat betreft ecosystemen en biodiversiteit van flora en fauna.

Residentiële gebieden die zich het dichtst bij de voorgestelde projectlocatie bevinden zijn die aan de Gangaram Pandayweg (8 km in zuidelijke richting). De meeste families die er wonen, doen aan tuinbouw (voor huishoudelijk gebruik). De meeste agrarische gronden in het gebied liggen er verlaten of braak bij. Terwijl er gewerkt wordt aan waterleiding infrastructuur, zijn de meeste huishoudens nog steeds aangewezen op regenwater om in hun drink- en huishoudelijke behoeftes te voorzien.

Er bevinden zich geen belangrijke culturele of historische objecten/plaatsen in het gebied.

5. PROJECTBESCHRIJVING

De voorgestelde krachtcentrale wordt gebouwd op een ~2,5-hectare grote locatie, in het zuidoosten van de bestaande TA58 Crude Treatment Plant, en bevat de volgende belangrijke onderdelen:

- Powerhouse, interne verbrandingsmotoren en bijbehorende equipment;
- Brandstofverwerkingsfaciliteit;
- Opslagfaciliteiten voor brandstof en smeerolie;
- Transformatoren; en
- Onderhouds-, opslag- en kantoorgebouwen.

De voorgestelde krachtcentrale bestaat uit maximaal zes 6 MW motoren, elk met een individuele, 30 meter hoge schoorsteen, die als back-up of reserve beschouwd kunnen worden (i.e. niet alle motoren zullen tegelijkertijd werken).

De motoren werken voornamelijk op Saramacca Crude, en soms op HFO (*Heavy Fuel Oil*) of *Light Fuel Oil* (LFO). De Saramacca Crude komt via een pijpleiding van de bestaande TA58 Crude Treatment Plant, terwijl HFO en LFO met vrachtwagens getransporteerd zullen worden vanuit de raffinaderij in Tout Lui Faut, bij Paramaribo. Het geschatte maximale brandstofgebruik per generator bedraagt 28.000 liter per dag.

De motoren worden afgekoeld door een gesloten-circuit koelwatersysteem (radiatoren). De koelleidingen lopen meestal door betonnen kabelgoten; indien er zich uitzonderlijk toch een lekkage zou voordoen, dan zal het koelwater ingedamd blijven en niet in het milieu terecht komen.

De centrale zal worden voorzien van een brandblusinstallatie, inclusief een tank, pijpleidingen en pompen.

Het project wordt in fases gebouwd. Fase 1 bestaat uit drie generator eenheden van elk 6 MW. De constructiefase bestaat uit:

- Ontruimingswerkzaamheden;
- Voorbereiding van de locatie, inclusief opvullen met zand;

- Gieten van funderingspijlers;
- Constructie van de beton fundering (gebouwen, tanks, generators en transformatoren);
- Installatie van drainage en landschapsarchitectuur;
- Constructie van gebouwen, onderhoudsstructuren en een tank park;
- Vervoer en installatie van generatoren ;
- Elektrische installaties;
- Oplevering en testen.

De meeste materialen worden voorzien en geleverd door de EPC-contracter en aangevoerd in dumptrucks (ruwe materialen) en diepladers (benodigdheden, containers, pijpleidingen).

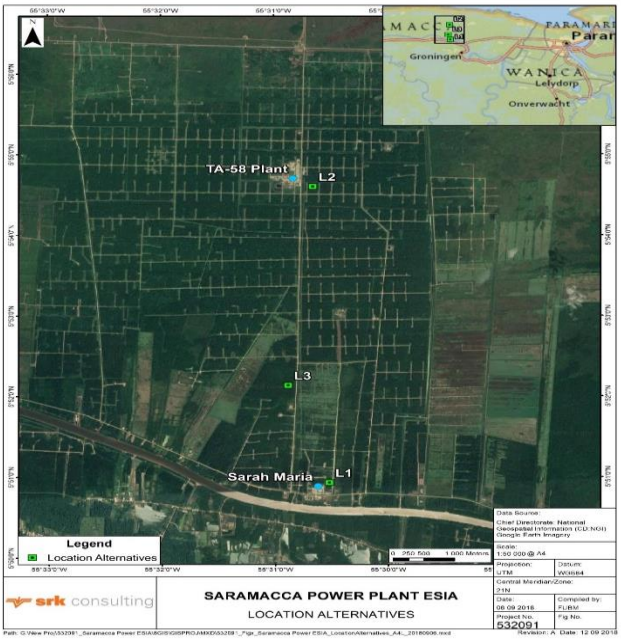
Fase 1 van de centrale zou in 2020 operationeel moeten zijn. De (minimale) operationele leeftijd van de centrale is 20 jaar.

Naar verwachting zal het project 215 banen creëren tijdens de constructie en 10 tijdens de operationele fase.

6. ANALYSE VAN ALTERNATIEVEN

Tijdens de planningsfase heeft Staatsolie een aantal alternatieven onderzocht om de elektriciteitsvoorziening aan de Saramacca operatie te verbeteren, waaronder drie locatie-alternatieven nabij de Sarah Maria emplacement (Afbeelding 1):

- L1: Nabij de Sarah Maria kantoren;
- L2: Nabij de TA58 verwerkingsinstallatie;
- L3: +/- 5 km ten zuiden van de TA58-installatie.



Afbeelding 1: Locatie alternatieven

De locatie L2 is gekozen, gebaseerd op een matrix van technische/design, financiële en milieucriteria, want:

- Ze is verder verwijderd van de woonbuurten;
- Ze vereist lagere investeringskosten;
- Er zijn kortere pijpleidingen nodig vanuit TA58 als de hoofdleverancier van brandstof;
- Er is genoeg plaats voor de krachtcentrale zonder dat bestaande structuren gewijzigd moeten worden.

In de effectenanalyse worden geen andere locatie-alternatieven geëvalueerd.

7. OVERLEG MET STAKEHOLDERS

Volgens de hoogste normen en richtlijnen van het NIMOS, is het overleg met stakeholders cruciaal in het ESIA-proces.

De activiteiten die worden uitgevoerd tijdens dit proces worden uiteengezet in tabel 1.

Tabel 1: Overleg stakeholders tijdens Scopingsfase

Activiteit	Datum
Scopingsfase	
Opsturen concept-ToR naar belangrijkste stakeholdersgroepen, publiek	augustus 2018
Eerste bijeenkomsten met instanties	1 - 2 augustus 2018
Samenstelling stakeholders database	augustus/ september 2018
Aankondiging begin ESIA-process en vrijgeven scopingsrapport voor publiek commentaar	18 oktober 2018
Periode publieke becommentariëring	18 oktober 2018 – 9 november 2018
Openbare bijeenkomst	2 november 2018
Documenteren aanbevelingen en feedback, finaliseren scopingsrapport	november 2018
Effectenanalyse	
Beschikbaar maken van ESIA-rapport en ESMP aan het publiek	februari 2019
Periode publieke becommentariëring	tot 21 maart 2019
Openbare bijeenkomst	28 februari 2019
Documenteren aanbevelingen en feedback, finaliseren MSEA-Rapport	maart 2019

Tot op heden is er tijdens het overleg met stakeholders geen tegenstand waargenomen.

8. EFFECTENANALYSE

De volgende specialistenstudies werden ondernomen om de belangrijkste directe, indirecte en cumulatieve effecten te onderzoeken:

- Onderzoek over luchtkwaliteit;
- Onderzoek over geluidshinder;
- Onderzoek naar kwaliteit oppervlaktewater;

- Onderzoek over terrestrische fauna; en
- Socio-economisch onderzoek

Voor alle potentiële effecten werd het belang van het verwachtte effect beoordeeld – met en zonder voorgestelde mitigeringsmaatregelen. De effecten worden hieronder samengevat.

- Het verwachtte effect op de *luchtkwaliteit* en de daarmee gepaard gaande aantasting van de gezondheid van de mens, veroorzaakt door de emissies van de verbrandingsmotoren en de voertuigen op de onverharde transportwegen, wordt als *heel laag* beoordeeld.
- Het verwachtte effect op het *geluid* en de daarmee gepaard gaande schade voor de gezondheid van de mens of hinder zal van korte duur (verkeer) of niet waarneembaar zijn (krachtcentrale) en wordt als *heel laag* beoordeeld tijdens de constructie en *onbelangrijk* tijdens de werkzaamheden.
- Het verwachtte effect van niet-routinematige of ongecontroleerde lozingen op de *waterkwaliteit* kan heel snel behandeld worden en wordt als *heel laag beoordeeld* tijdens constructie en *onbelangrijk* tijdens *de* werkzaamheden.
- De verwachtte *ecologische* effecten door het verlies aan flora door het opruimen van vegetatie en verstoring van fauna worden als *laag* beoordeeld.
- De verwachtte *sociale* effecten van vervuild drinkwater in regentanks en een verhoogd veiligheidsrisico door de zware voertuigen die delen van de Gangaram Pandayweg tijdens constructie zullen gebruiken, worden als *onbelangrijk* beoordeeld
- De verwachtte *economische* effecten (voordelen) van de tewerkstelling die door het project wordt gecreëerd, vooral tijdens de constructie, worden als *laag* beoordeeld
- De verwachtte effecten op *erfgoed* en *archeologie*, door schade aan archeologische plekken tijdens de constructie, worden als *onbelangrijk* beoordeeld.

Cumulatieve effecten in de regio kunnen voortkomen uit de bestaande landbouw-, olie- en gas- en andere beperkte industriële activiteiten, en uit de voorgestelde ontwikkeling van de krachtcentrale. Cumulatieve biofysische effecten omvatten een afname van de luchtkwaliteit, verhoogde geluidsniveaus langs de toegangswegen, vervuiling van ecosystemen in het oppervlaktewater en ecologische effecten. Gezien de relatief kleine schaal van het project en de afwezigheid van een groot aantal nabijgelegen receptoren en de gewijzigde ecologische omgeving, worden de *biofysische, cumulatieve effecten* kwalitatief als *heel laag* beoordeeld.

Cumulatieve sociaal-economische effecten omvatten werkgelegenheid in een regio die te maken heeft met werkloosheid, maar gezien de geringe schaal van die gelegenheid worden de *sociaal-economisch cumulatieve effecten* (voordelen) kwalitatief als *heel laag* beoordeeld

Om de mogelijke effecten van de geplande krachtcentrale op het milieu te vermijden, te verminderen en beheersbaar te maken, werden een aantal maatregelen en controlemechanismen voorgesteld. Deze worden verder uiteengezet in het ESMP.

Tabel 4 hieronder beschrijft:

- De effecten die beoordeeld werden in de ESIA;

  De mate van impact van de effecten voordat en nadat de mitigeringsmaatregelen zijn toegepast, waarop de classificatie van hun prioriteit gebaseerd is;
- De belangrijkste (niet-standaard essentiële) mitigeringsmaatregelen.

Criteria voor classificatie van de effecten:

Beoordeling	**+**	**-**
Onbelangrijk	O	O
Heel laag	HL	HL
Laag	L	L
Matig	M	M
Hoog	H	H
Heel hoog	HH	HH

Tabel 4: Samenvatting effectenanalyse

Impact	**Beoordeling**	
	Voor mitigatie	**Na mitigatie**
IMPACT TIJDENS CONSTRUCTIEFASE		
Impact op Luchtkwaliteit		
Aantasten gezondheid van de mens door verhoogde concentraties van vervuiling in de atmosfeer tijdens de constructie	Heel laag	Heel laag
Aantasten gezondheid van de mens en andere effecten van stof veroorzaakt door verkeer van het project	Heel laag	Heel laag
Impact op geluid		
Verhoogd geluidsniveau langs toegangswegen	Heel laag	Heel laag
Impact op waterkwaliteit		
Vervuiling ecosystemen in het oppervlaktewater	Heel laag	Heel laag
Impact op ecologie		
Verlies van flora tijdens het opruimen van vegetatie	Laag	Laag
Impact op fauna tijdens constructie	Heel laag	Heel laag
Socio-economische Impact		
Vervuild drinkwater door opwaaiend stof van het projectverkeer	Heel laag	Onbelangrijk

Impact	Beoordeling	
	Voor mitigatie	Na mitigatie
Verhoogd veiligheidsrisico door zware constructievoertuigen	Heel laag	Onbelangrijk
Tewerkstelling die door het project gecreëerd wordt	Heel laag	Laag
Schade aan archeologische plekken door opruim- en graafwerkzaamheden	Heel laag	Onbelangrijk
Aantasten gezondheid van de mens door verhoogde concentraties van vervuiling in de atmosfeer door de krachtcentrale	Heel laag	Heel laag
IMPACT TIJDENS DE OPERATIONELE FASE		
Impact op Luchtkwaliteit		
Aantasten gezondheid van de mens door verhoogde concentraties van luchtvervuiling door de krachtcentrale	Heel laag	Heel laag
Impact op geluid		
Impact op geluidsniveaus door de krachtcentrale	Onbelangrijk	Onbelangrijk
Impact op waterkwaliteit		
Vervuiling ecosystemen in het oppervlaktewater door de krachtcentrale	Onbelangrijk	Onbelangrijk
Impact op ecologie		
Impact op fauna tijdens de werking van de centrale	Laag	Laag

Er wordt verwacht dat de centrale jaarlijks ongeveer 131.733 ton CO_2-e zal uitstoten door het verbranden van HFO om elektriciteit te produceren. Dit is vergelijkbaar met ongeveer 1,6% van Suriname's broeikasgasemissie van 2014.

Belangrijkste aanbevelingen / mitigatiemaatregels zijn:

- Het ESMP in werking stellen; het zal de constructie- en operationele activiteiten begeleiden en als kader dienen voor de permanente evaluatie van milieuprestaties;
- Er op toezien dat bevoegd personeel en toereikende middelen voorzien worden zodat de implementatie van het ESMP zo snel mogelijk afgehandeld kan worden;
- Er op toezien dat er gepaste reactiemechanismes zijn en dat correctieve actie genomen wordt indien zich voorvallen voordoen waarbij de standaard beheersmaatregelen of procedures niet gevolgd worden;
- Het onderhouden van open communicatielijnen met de plaatselijke bewoners in de nabijheid van de krachtcentrale. Ervoor zorgen dat de lokale gemeenschappen op de hoogte zijn van de Staatsolie-klachtenprocedures en hoe die te gebruiken. Ontwikkelen van een klachtenregister en onderzoeksprocedures om te garanderen dat al de klachten adequaat behandeld worden;
- De tewerkstelling van lokaal kader en de aanbesteding van lokale hulpbronnen tijdens de constructie en inbedrijfstelling te optimaliseren om zo maximaal bij te dragen aan de lokale economie;
- Het opstellen en implementeren van een gedetailleerd rampenplan voordat met de constructie wordt begonnen. Dit plan moet de rollen, verantwoordelijkheden en procedures beschrijven om alle potentiele incidenten beheersbaar te maken; en
- Het opstellen en implementeren van een conceptueel ontmantelingsplan aan het einde van het operationele leven van de krachtcentrale.

9. CONCLUSIES

Het concept ESIA-rapport heeft de potentiële biofysische en socio-economische effecten van de voorgestelde Saramacca krachtcentrale geïdentificeerd en geanalyseerd.

Het project is een compromis tussen sociale-, milieu- en economische kosten en voordelen. De voor- en nadelen worden in het rapport afgewogen; de milieueffecten en voordelen worden vergeleken met het 'No-Go' alternatief.

Er zijn een paar kleinere of minder belangrijke effecten verbonden aan de krachtcentrale. Indien de voorgestelde mitigeringsmaatregelen gevolgd worden, dan wordt verwacht dat deze effecten niet ernstig, noch van lange duur zullen zijn.

HOE U KUNT DEELNEMEN IN HET ESIA-PROCES

Dit ESIA-rapport is geen finaal rapport en kan worden aangepast op basis van de feedback van stakeholders. Daarom worden stakeholders graag uitgenodigd om deel te nemen aan het ESIA-proces, door zich aan te melden op de database van het project en/of een openbare vergadering bij te wonen:

RAADPLEEG HET RAPPORT

Een kopie van het volledige rapport is beschikbaar voor publieke consultatie bij:

- NIMOS;
- Het commissariaat van Saramacca in Groningen;
- SRK Consultancy website: www.srk.co.za – druk op de link 'Recent Publications' en dan 'Public Documents'.

WOON EEN VERGADERING BIJ

Een Openbare vergadering zal op 28 februari 2019 worden gehouden waarin de informatie uit het ESIA-rapport besproken zal worden en waar bijkomende aanbevelingen en bedenkingen gedeeld kunnen worden met de milieuconsultants.

REGISTREERT U ZICH **OP DE DATABASE**

OF GEEF UW MENING

Registreer/stuur een schriftelijke bedenking aan:

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Of

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Stuur uw bedenkingen aan één van boven-staande contacten vóór **21 maart 2019.**