Maria Gleta Independent Power Producer Phase 2 Power Plant

Updated Environmental and Social Impact Assessment

18 December 2018

Project No: 0445162

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ERM

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Signature Page

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Maria Gleta Independent Power Producer Phase 2 Power Plant

Updated Environmental and Social Impact Assessment

Henry Camp
Partner

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Acronyms and Abbreviations

A	A-weighting'
ABE	Benin Agency for Environment
ACC	Air-Cooled Condensers
AIIM	African Infrastructure Investment Managers
AfDB	African Development Bank
AoI	Area of Interest
APE	*Association des parents et des élèves*
AQS	Air Quality Standards
Area of Influence	The delineation of the Area of Influence (AoI) follows guidance from International Finance Corporation (IFC) Performance Standard 1, and covers the area likely to be affected by Project activities during construction and operation.
Associated Facilities	Associated Facilities (AFs) to the Project are those infrastructures that would not have been constructed or expanded if the Project did not exist and without which the Project would not be viable.
Biodiversity	The variety of plant and animal life in a particular habitat.
BOAD	West African Development Bank
BWSC	Burmeister Wain Scandinavian Contractors
CA	*Chef d'Arrondissement*
CBO	Community Base Organisation
CEB	*Communauté Electrique du Bénin*
CDC	Commonwealth Development Corporation
CIA	Cumulative Impact Assessment
CV	Curriculum Vitae
dB	Decibel
DEG	Deutsche Investitions und Entwicklungsgesellschaft mbH
DF	Dual Fire
DUP	*Declaration d'utilite publique*
EAIF	Emerging Africa Infrastructure Fund
E&S	Environmental and Social
ECC	Environmental Conformity Certificate
EHS	Environment, Health and Safety
En/Power	Enterprise Power
EPC	Company leading the detailed Engineering, Procurement and Construction of the Project.
EPRP	Emergency Preparedness and Response Plan
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FGD	Focus Group Discussion
FMO	*Financierings-Maatschappij voor Ontwikkelingslanden*
FSRU	Floating Storage and Regasification Unit
GHG	Greenhouse Gas
GIIP	Good International Industry Practice
GPH	IFC's Good Practice Handbook
ha	Hectare

HFO	Heavy Fuel Oil
HR	Human Resources
HSE	Heath, Safety and Environment
IAQM	Institute of Air Quality Management
IDB	Islamic Development Bank
IESIA	Integrated Environmental and Social Impact Assessment
IFC	International Finance Corporation
IFU	Investment Fund for Developing Countries (of Denmark)
IGN	*Institut géographique national*
INSAE	*Institut National de la statistique et de analyse économique du Bénin*
IPP	Independent Power Producer
Km	Kilometres
Km/h	Kilometres per hour
KII	Key Informant Interview
LAeq	Continuous equivalent sound pressure level
Lenders ("the Lenders")	The Consortium appointed the International Finance Corporation (IFC) and African Development Bank (AfDB) as joint Mandated Lead Arranger (MLA) for financing of the Project. Potential other financiers to the Project include: • West African Development Bank (BOAD); • Deutsche Investitions und Entwicklungsgesellschaft mbH (DEG); • Emerging Africa Infrastructure Fund (EAIF); • Financierings-Maatschappij voor Ontwikkelingslanden (FMO). •
m^3	Cubic metre
Management Plan	A documented plan that sets out the means by which one or more E&S hazards will be managed. The plan typically establishes: • The nature and scope of the hazard, including key risks/issues; • Standards/Objectives to be upheld; • Management Strategies, including relevant ESIA/Project commitments and key actions/control measures; • Performance indicators; • Monitoring plans and reporting plans; Reference documents.
ME	*Ministère de l'Energie*
MW	Mega-watts
NGO	Non-Governmental Organisation
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NSR	Noise Sensitive Receptors
O&M	Operations and Maintenance
O-ESMP	Operational Environmental and Social Management Plan
OFID	OPEC Fund for International Development
OHSAS	Occupational Health and Safety Assessment Series
OHSP	Occupational Health and Safety Plan
OS	Operational Safeguards
PAC	Project Affected Communities are landowners and users located in the inhabited areas adjacent and near to the Project site and associated infrastructure
PAP	Project Affected People are people who were relocated as part of the project.
PC	Process Contribution

PEC	Predicted Environmental Concentration
PM	Particulate matter
Policy	A statement of the overall intentions and direction of the organisation as formally expressed by top management. It provides a framework for action and for the setting of objectives.
Project („the Project")	Maria Gleta IPP Project in Benin comprising construction and operation of a new 144MW combined-cycle, thermal power generation plant made up of the following: • Seven dual-fuel reciprocating engines each producing 18.2 MW for a total of 127 MW (MAN Group 18V51/60 DF units are specified), with a load factor considered to 95 percent; • Steam turbine system producing 18 MW; and • Plant support infrastructure.
Project Personnel	All persons working for, or on behalf of the Project, including contractors and subcontractors.
Project Standards	All relevant legislation, including International legislation to which Benin subscribes, National Legislation and Project Permits; Equator Principles, IFC Performance Standards and international good practice
Q	Quarter
RCIA	Rapid Cumulative Impact Assessment
RNIE	*Route Nationales Inter-Etat*
SBEE	*Société Beninoise d'Énergie Electrique*
SEP	Stakeholder Engagement Plan
SO_2	Sulphur Dioxide
SPV	Special Purpose Vehicle
UNFCCC	United Nations Framework Convention on Climate Change
UV	Ultraviolet
WAGP	West Africa Gas Pipeline
WHO	World Health Organization
WHRB	Waste Heat Recovery Boilers

1. CONTEXT AND PROJECT JUSTIFICATION

1.1 INTRODUCTION

1.1.1 Background

At the beginning of 2015, the Government of the Republic of Benin issued a call to participate in a closed tender for the development of new independent power producer (IPP) power plant in the town of Maria Gleta near Cotonou (the Project). A *Consortium*, comprising the following organisations, was selected by the government to build, own, operate and transfer the plant:

- Burmeister Wain Scandinavian Contractor (BWSC);
- African Infrastructure Investment Managers (AIIM);
- Enterprise Power (En/Power); and
- Investment Fund for Developing Countries (of Denmark) (IFU).

The Consortium appointed the International Finance Corporation (IFC) and the African Development Bank (AfDB) as joint Mandated Lead Arranger (MLA) for financing of the Project.

Prior to the selection of the Consortium the Government of the Republic of Benin *(Ministere de l'Energie, de l'Eau et des Mines or MEEM)* appointed Tractebel Engineering to undertake an ESIA for the Maria Gleta Power Plant - *Projet de Construction de la Centrale Thermique a Moteurs Dual Fuel (Gaz-HFO) sur le Site De Maria-Gleta 2 (400 Mw) Rapport d'Etude a'Impact sur l'Environnementale (April 2017*) (referred to in this report as the *Original ESIA*).

Subsequent to the drafting of the Original ESIA the project design has changed. The Original ESIA was undertaken to meet Beninese permitting requirements and assessed a 400 MW power plant. In reality two separate 127 MW power plants will be constructed with a shared 18 MW steam turbine.

Table 1-1. Original ESIA Timeline

Date	Activity	Note
2014	Initial consultations with government representatives	MEEM
17 May 2014	Consultations with Affected People (also related to land acquisition process)	Tractebel and MEEM
25 May 2016	Meeting of Benin Environmental Agency (ABE) to approve the Draft Terms of Reference for the ESIA	ABE
1 June 2016	Final Terms of References for ESIA prepared by Ministry of Energy, Water, and Mines (MEEM), Department of Electric Power (SBEE)	Tractebel on behalf of MEEM
2016 and 2017	Execution of the ESIA and preparation of the report: Environmental and social studies and surveys Stakeholder engagement during ESIA Execution of the ESIA and preparation of the report:	Undertaken by Tractebel
27 March 2017	Submission of draft ESIA report to ABE	Tractebel

	Public disclosure – report available for review at ABE	No further details available
30-31 March 2017	ABE panel review	ABE
7 April 2017	Submission of final ESIA report to ABE	Undertaken by Tractebel
11 April 2017	Environmental Conformity Certificate issued by ABE (valid until 11 April 2018)	An update to the authorisation was issued on 6 July 2017
10 August 2018	Letter from ABE confirming validity of Environmental Conformity Certificate	ABE

1.1.2 Project Promoter

A Special Purpose Vehicle (SPV) is being formed between the four Consortium members as the Project Company called Benpower SA.

BWSC has been appointed as the EPC Contractor for the Project.

1.1.3 Scope of Additional Work

The Consortium engaged *Environmental Resources Management (ERM*) to provide technical and advisory support for the planning and implementation of the Project, as well as the compilation of this Updated ESIA.

Figure 1-1. Overview of ERM Scope of Work

The initial work in this regard involved a Gap Assessment of Project planning relative to the requirements of potential lenders using the *IFC Performance Standards on Environmental and Social Sustainability (2012) (the IFC Performance Standards)* as reference. The Gap Assessment involved desktop-based document review, interviews, and on-site inspections with the purpose to identify gaps and to specify corrective actions. The Gap Assessment also drew on a preliminary gap assessment undertaken by AIIM and IFU.

A Resettlement Review was conducted as a separate study determine the status of resettlement on the site and identify gaps from a resettlement perspective specifically.

Gaps were identified where:

- Information provided was insufficient in level of detail;
- Gaps exist between current or planned activities and the applicable Project Standards;
- If implemented, proposed mitigation or management measures as described are considered ineffective; and
- Significant risk exists.

Based on the Gap Assessment findings the following work was proposed to be undertaken by ERM (through the Consortium) in order to fill the gaps:

- Updated Project Description to detail changes in Project design since the Original ESIA.
- Updated Social Baseline to enable future monitoring, particularly around resettlement impacts.
- Supplemental Impact Assessment covering the following aspects
  - Air quality assessment;
  - Noise assessment;
  - Specialist input on groundwater impact;
  - Specialist input on traffic assessment; and
  - Updated cumulative impact assessment.
- Update of Operational ESMP commitments.
- Update of Construction ESMP, including the following specific plans:
  - Construction Occupational Health and Safety Plan (OHSP); and
  - Construction Emergency Preparedness and Response Plan (EPRP).
- Other plans to be developed for the Project included the following:
  - Stakeholder Engagement Plan; and
  - Traffic Management Plan.

The work described above has been collated and is presented in this Updated ESIA. The information for the remainder of this Updated ESIA was sourced from the Original ESIA.

1.1.4 ESIA Consultant

ERM is a global environmental consulting organisation employing over 5,000 specialists in over 150 offices in more than 40 countries. The role of the environmental consultants is to provide credible, objective and accessible information to lenders and other stakeholders, so that an informed decision can be made about whether the Project should proceed or not.

The ERM and specialist team selected to produce the Updated ESIA possess the relevant expertise and experience to undertake this assessment. Please refer to Table 1.2 below for the details of the ESIA team.

Table 1-2. ESIA Team

Name	Role
Henry Camp	Partner in Charge

Claire Alborough	Project Manager
Reinett Mogotshi	Project Consultant/Environmental Specialist
Marina Johnson	Social Specialist
Chris Hazell-Marshall	Air Quality Specialist
Adeyinka Afon	Noise Specialist
Ken King	Groundwater Specialist
Ben Sussman	Traffic Specialist
David Katz	Environmental and Social Management Specialist
Euloge Ogouwale	In Country Environmental and Social Specialist

1.1.5 Purpose of this Report

The purpose of this report is to provide an Updated ESIA for lender disclosure which includes the updated information prepared and gathered to address the gaps identified in the Original ESIA.

The Updated ESIA will also be submitted to the Benin Agency for Environment (ABE) for their review, however they have confirmed that they will not issue a new Environmental Conformity Certificate as the original certificate, issued in 2017, remains valid. ABE have confirmed that they will provide input as necessary into the ESMP.

1.1.6 Report Structure

The Updated ESIA report is structured as follows:

Table 1-3. Updated ESIA Report Structure

Chapter	Title	Requirement / Description
1	Introduction and Project Description	Overview of the Project, Project promoter, ESIA consultant and a description of the Project.
2	ESIA Methodology	Overview of the ESIA process.
3	Legal and Policy Framework	Overview of the legal framework in Benin.
4	Environmental and Social Baseline	Description of the environmental and social baseline for the Project Area.

5	Stakeholder Engagement	Overview of the stakeholder undertaken for the ESIA and the ESIA Update.
6	Impact Assessment	Potential impacts associated with air and noise were evaluated in the Original ESIA, however to address comments from the Gap Assessment, and take account of new Project design information, these assessments have been re-modelled. Supplementary impact assessment to cover the following aspects: ■ Air Quality ■ Noise Specialist input and verification on the following topics: ■ Groundwater ■ Traffic A Cumulative Impact Assessment (CIA) was undertaken as part of the Original ESIA. Based on the updated modelling for air and noise and the specialist input on groundwater and traffic, the CIA has been updated.
7	Environmental and Social Management Plan	A consolidation of the Original ESIA commitments and additional commitments identified during the supplementary work undertaken.
8	Environmental and Social Monitoring Plan	A consolidated list of monitoring requirements for construction and operation.
Annexes		
Annex A	Air Quality Specialist Report	The technical air quality specialist report
Annex B	Noise Specialist Report	The technical noise specialist report
Annex C	Framework ESMS	A framework for the development of the ESMS
Annex D	Stakeholder Engagement Plan	The Stakeholder Engagement Plan, including Grievance Mechanism.
Annex E	Transport/Traffic Management Plan	A framework plan for the management of traffic for the Maria Gleta Project.
Annex F	Occupational Health and Safety (OHS) Plan	A plan for the management of Occupational Health and Safety

Annex G	Emergency Preparedness and Response Plan (EPRP)	A plan dealing with Emergency Preparedness and Response

1.2 PROJECT DESCRIPTION

1.2.1 Project History

1.2.1.1 Original Project

The Original ESIA, undertaken by Tractebel Engineering for Benin *Ministere de l'Energie, de l'Eau et des Mines* covered the construction and operation of a 400 MW thermal power plant to be developed in two phases.

- Phase A – development of a 120 MW thermal power plant (nominal power), consisting of 7 engines with a unit capacity of 16.6 MW, operating on natural gas as well as on heavy fuel oil (HFO) ("dual fuel" concept). It was assumed that Phase A would operate on HFO until gas became available.
- Phase B – installation of an additional 19 engines similar to those installed during Phase A. It was assumed for Phase B that gas would be available and that the proposed power plant would operate 95% of the time on gas and 5% of the time on HFO.

The Original ESIA assumed the use of Wärtsilä 18V50DF engines.

Subsequent to the development of the Original ESIA a number of aspects of the Project Description have changed, including the Project phasing, timing of HFO availability, size, and types of engines to be used. The Project covered by the Original ESIA could now be considered to cover the development of the 127 MW IDB Power Plant (described in Section 1.2.2.2 *Planned* below) as Phase A and the 144 MW IPP Power Plant (this Project) as Phase B.

1.2.1.2 Current Project

The Project comprises construction and operation of a new 144 MW combined-cycle, thermal power generation plant made up of the following:

- Seven (7) dual-fuel reciprocating engines each producing 18.2 MW for a total of 127 MW (MAN Group 18V51/60 DF units are specified);
- Steam turbine system producing 18 MW (utilising steam from both the IDB and IPP Power Plants); and
- Plant support infrastructure including:
  - Liquid fuel storage tanks (3 x 3,500 m^3) and truck offloading station;
  - Connection to natural gas supply manifold;
  - Connection to power grid sub-station; and
  - Plant support facilities.

Associated facilities are defined in IFC (2012) as follows:

'…facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.'

The reconfiguration of the power evacuation lines to tie in an existing power line to the existing substation may be regarded as an associated facility. The need for reconfiguration is dependent on the technical studies of the grid capacity which are ongoing. The reconfiguration is expected to involve only limited activities and would be restricted to within existing industrial areas. If more extensive work is required this would involve consultation with environmental authorities and possible further approvals.

1.2.2 Project Location

The power plant will be built on a portion of a 23.5ha parcel of land (of this 20ha has been acquired and a further 3.5ha is in the process of being acquired by the Government of Benin) located in the town of Maria Gleta about 20 km to the west of the city of Cotonou. Of the 23.5ha parcel of land, 3ha has been leased by the Project for the construction of the IPP power plant. A similarly sized portion has been leased for the IDB power plant with the remainder of the land is set aside for future use by the Government of Benin. The parcel of land is located in an urbanised area with surrounding, relatively dense residential, business, and industrial development.

The Project site is in a location that has been identified by the government for installation and operation of power generation facilities. The Project site is adjacent to other existing and planned power plants as follows and shown in *Figure 1-2* below.

1.2.2.1 Existing

- Communauté Electrique du Bénin (CEB) Power Plant, a 20MW permanent power plant located on Site 4 (the CEB Power Plant);
- Rental Power Plant 1 (Aggreko) a 50MW temporary power plant comprised of 55 x 0.9MW containerised dual-fuel engines on Site 1 (expected to be decommissioned by end 2019);
- Rental Power Plant 2, a 50MW temporary power plant comprised of two containerised dual-fuel turbines also on Site 1; and
- Turbine Power Plant, an 80MW power plant located on Site 3, currently not operating and slated for decommissioning.

It is understood that all besides the 20MW CEB Power Plant will be mothballed or decommissioned upon commissioning of the IDB and IPP Power Plants.

1.2.2.2 Planned

- New 127MW power plant currently under construction on the same site as the Project site (referred to in this report as the IDB Power Plant [because one of the main financiers of the project is the Islamic Development Bank]); and
- New IPP plant, a 20MW power plant that will be located on Site 2, currently in early development and under discussion with government.

1.2.2.3 Relationship to the IDB Power Plant

The Project will be built directly adjacent to the IDB Power Plant currently under construction. The IDB Power Plant is of similar design using the same types and size of engines. The Project will share some of

the IDB Power Plant's land and infrastructure. The steam turbine system will use steam from the IDB Power Plant as well as the Project.

The IDB Power Plant is sponsored by the Government of the Republic of Benin. The EPC for the IDB currently under construction is BSWC and the Project is also due to be built by BSWC.

1.2.3 Project Justification

As documented in the Original ESIA, Benin currently has two overarching issues related to the energy sector in the country:

- Low domestic production;
- Low access to electricity.

1.2.3.1 Low Domestic Production

Benin's national electricity company, the SBEE, has a current installed capacity of approximately 260 MW, however the actual production is significantly lower due to a number of factors, including lack of gas availability, seasonal variations, and prohibitive cost of fuel. Much of the installed capacity is rental or emergency power and none is considered baseload. There are however a number of power plant planned to be developed.

The limited national production has resulted in a high dependence on the import of electricity from neighbouring countries such as Nigeria and Ghana. The reliability of supply is therefore dependent on those countries power generation systems and the transmission connections between the neighbouring countries and Benin. Interruptions in the connection has previously caused widespread black outs.

Since 2006 Benin has experienced an energy crisis with regular widespread load shedding with harmful effects on the economy, including:

- Increased cost of electricity due to the use of generators for the production of electricity.
- Difficulty in the preservation of perishable foodstuff.
- A slowdown and in some cases interruption of activities in both the formal and informal sectors due to a lack of power.

1.2.3.2 Low Access to Electricity

Due to high cost of access to services, the lack of a network and the financial non-profitability of projects, particularly in rural area, there is very limited electrification of areas in the interior of the country. Those areas that have been electrified have very basic networks centred on administrative services and the transmission network is typically disconnected from the national network.

1.2.3.3 Conclusion

The main aim of the project is to increase national production of electricity thereby reduced reliance on neighbouring countries and insuring security of supply. This in turn will improve access to and reduce the cost of electricity for the people of Benin, improving the Beninese economy and reducing poverty.

1.2.4 Project Components

The layout of the Project (red) and the IDB Power Plant (black) are shown in *Figure 1-2* and Figure 1.3.

Figure 1-2. Project Site (showing other existing and planned power plants)

Source: Google Earth with annotations by ERM. Note that coordinates are approximate.

Figure 1-3. Project Layout (Project components in Red; IDB Power Plant shown in Black)

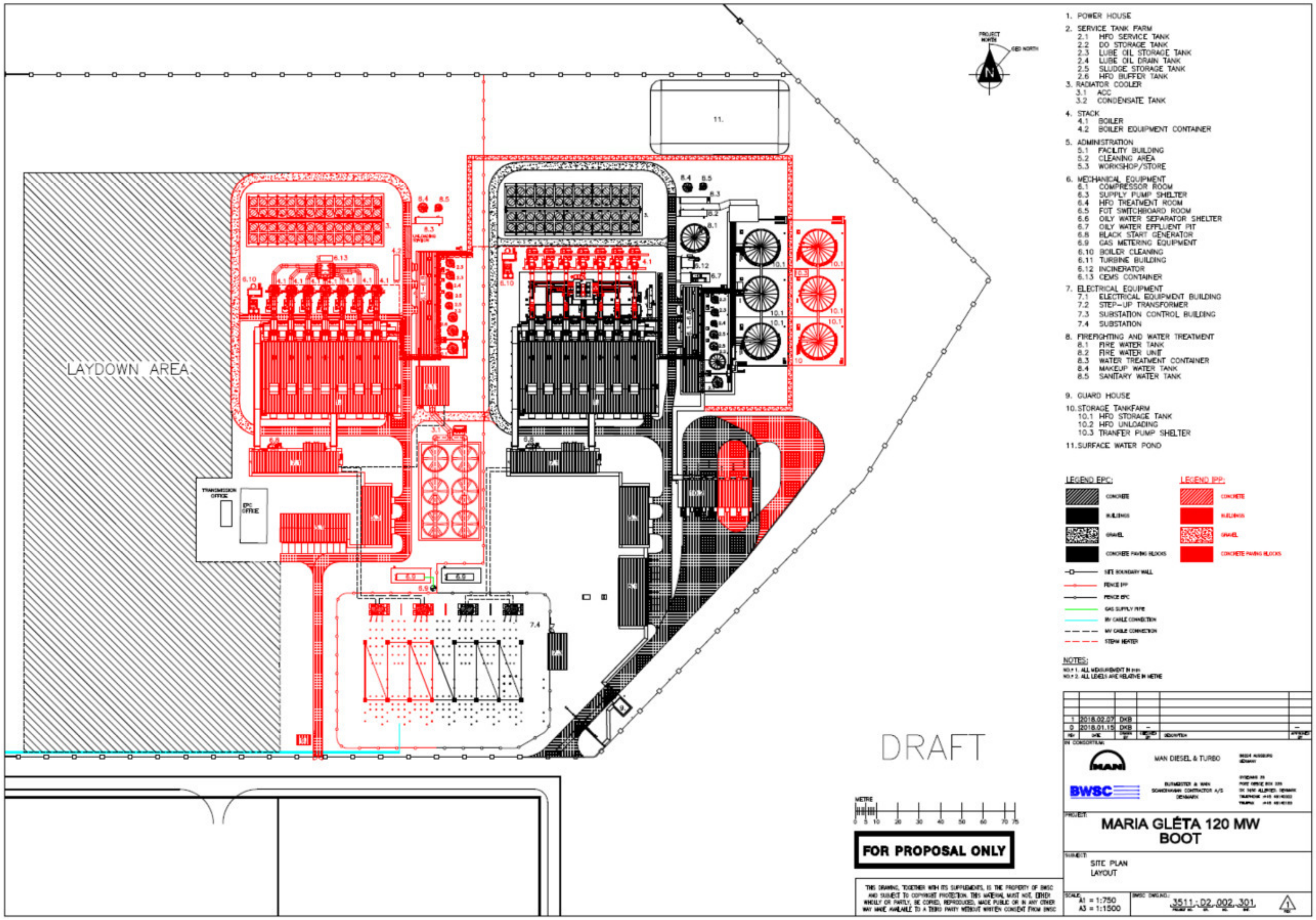
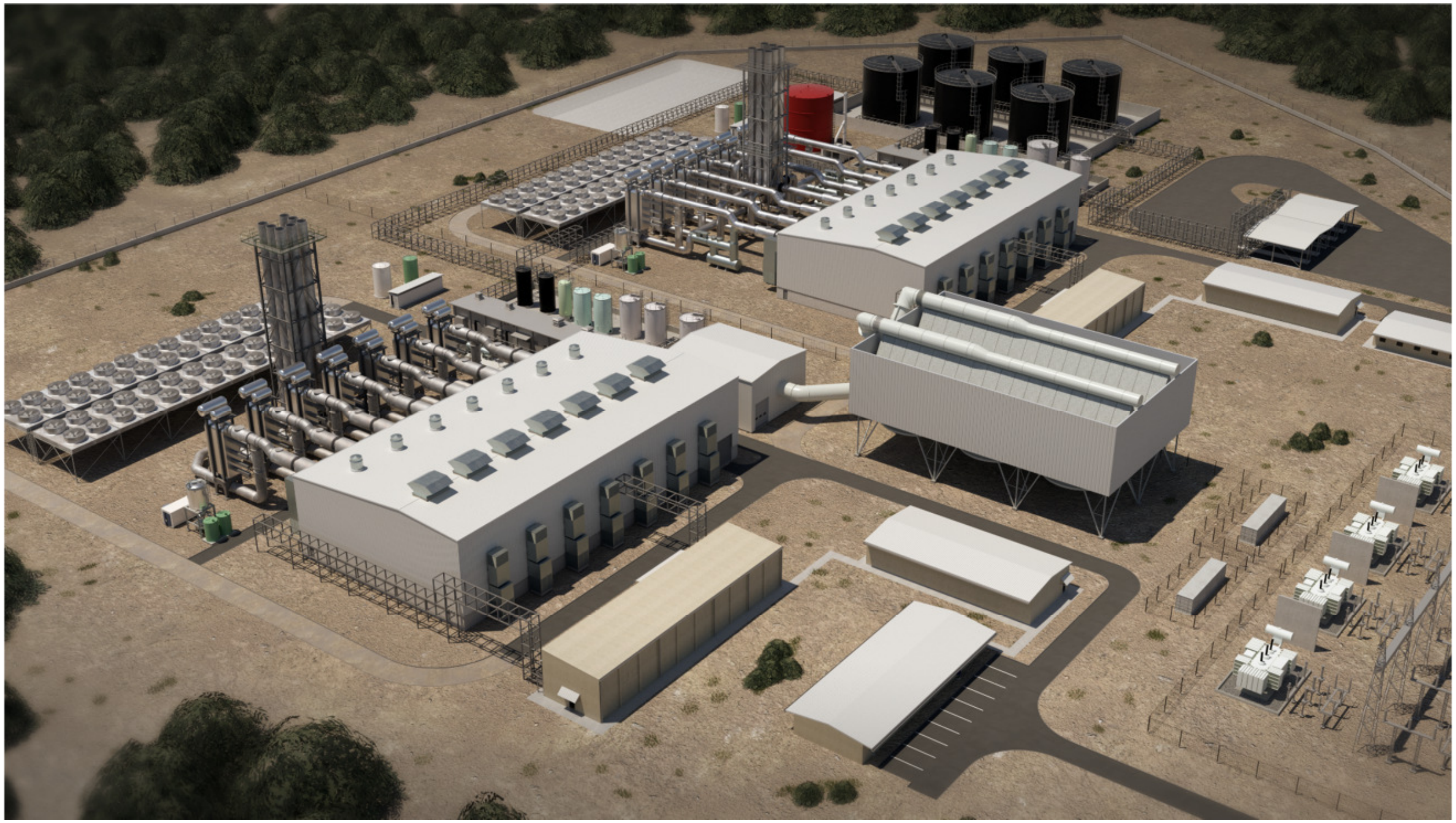


Figure 1-4. 3D-drawing showing both the IDB and the IPP plant, with the IPP plant in the foreground



Source: BWSC 2018

1.2.4.1 Components

The major components of the Project are described in this section.

Power Generation

The power plant will be composed of a main building housing the seven dual fuel reciprocating engines each producing 18.2 MW, which will be connected to seven alternators to produce 127 MW of electricity.

In addition, an 18 MW steam turbine will produce electricity from residual exhaust heat from both the Project and the 127 MW IDB power plant which is currently being built by BWSC next to the future IPP plant.

Evacuation

The IPP power plant will be connected by underground cable to the new 161 kV substation being constructed as part of the IDB project (some upgrades will be required when the IPP power plant is connected). The new 161kV substation will be connected to the existing CEB 161 KV substation located on an adjacent site approximately 400m south of the power plant. From there the power will be exported to the national grid.

The government is considering installation of a new industrial user transmission line dedicated for connection to industrial users. Power from the Project may be evacuated via this line sometime in the future. The industrial user transmission line is not an associated facility as the line may be constructed regardless of whether the Project is built and the Project would be viable without the new line.

Fuel Supply

The Project will ultimately use natural gas as fuel for the plant. Gas will be supplied through connection to the existing connection to the West Africa Gas Pipeline (WAGP) at a location directly adjacent to the site.

WAGP gas supply has been intermittent due to upstream supply shortage and the government is developing a scheme to import and re-gassify natural gas to supplement or replace WAGP gas. The design for the import system is not final but will likely consist of a Floating Storage and Regasification Unit (FSRU) and off-shore mooring at the Port of Cotonou connected to the WAGP system feeding into the existing common gas manifold at Maria Gléta. A Request for Proposal was issued in July 2018 and over 20 companies operating in the gas sector (major oil and utility companies, LNG traders, ship-owners etc.) have declared interest in participating. Bids are expected end October 2018.

The Project will operate using HFO as fuel for approximately the first year of operation until gas supply is stable. HFO will be delivered from existing commercial suppliers with import and storage facilities at the Port of Cotonou. Fuel will be delivered by tanker truck.

Transport of fuel will be over public roads from the Port to the site, via the route indicated in Figure 1.5. At full load, fuel demand will require about 20 return trip truck deliveries per day. Fuel will be transferred to storage facilities that will be built on the Project site.

Figure 1-5. Fuel Truck Transport Route to the Site

Power Generation Specification

The power plant will be designed to operate continuously at a nominal power of 127 MW, with a load factor considered to be 95 percent. The plant will be designed for a minimum lifetime of 25 years or 200,000 hours of operation.

Based on predicted power demand, at the start of operations the plant will not run at full capacity (ie, not all engines will be running) and will ramp up to full generation as per Table 1.4. Based on current information the Project (IPP and IDB) will only run concurrently on HFO for approximately one year before gas is available.

Table 1-4. Calculation of Demand Requirements from the IDB and IPP Plants

	Unit	2020	2021	2022	2023	2024
Net thermal demand	MWh	1 594 153	1 749 000	1 858 847	2 007 617	2 169 237
Less turbine contribution	MWh	103 032	113 937	121 678	132 153	143 489
Demand on engines	MWh	1 491 121	1 635 063	1 737 169	1 875 464	2 025 748
Production per engine	MWh	143 489	143 489	143 489	143 489	143 489
Total engines running	Number	10	11	12	13	14

Note: It is assumed that the IPP Project will only be operational by mid-2020

1.2.4.2 Facilities

Gas Receiving Facility

A gas receiving facility will be installed. At the facility, the pressure of the natural gas will be metered and reduced to the level required by the engines. An emergency valve will be installed to enable supply to be turned off in the case of a technical incident.

High Voltage Substation

The electricity produced by the plant will be evacuated via underground cables to a high voltage substation (to be constructed as part of the IDB project) where it will pass through step-up transformers to increase the voltage of the electricity. The transformers are oil cooled and will be located in an area that is bunded to contain any accidental release of liquids. The electricity will then be evacuated to the national grid via the existing 161 kV Maria Gleta Substation.

Cooling Water System

The technology of the internal combustion engines requires cooling of the engine and lubricating oil. The cooling system is composed of a loop of primary cooling (closed loop cooling) which is cooled by fans.

Lubrication System

The lubrication system will provide necessary lubrication for all mobile parts of the engines. It is composed of a heat exchanger as well as a unit for the treatment of oils, in order to separate the oil from the water and the particles that it would contain. This treatment unit includes a separator as well as a storage tank for the sludge.

Compressed Air System

A compressed air system (compressors, dryers, tanks, and buffer) will be installed to supply:

- Instrument air system, which requires dried, de-oiled, and filtered air; and
- Service air system, which requires filtered and de-oiled air.

The starting air is kept in receivers filled by the starting air compressors.

Exhaust Systems

The engines will be connected to an exhaust system with a 40 m high exhaust stack for the discharge of fumes. There will be one lattice tower stack with 7 flue gas pipes grouped together.

Fire Extinguishing System

One fire extinguishing system will be utilised for both Projects and will include a storage tank of water, pumps, a network of sprinklers, and alarm. The water storage tank will be placed away from areas at risk.

Temporary HFO Storage and Unloading Facility

During the initial phase of operation when it is expected that the plant will operate on HFO, storage of HFO will be required on site. As indicated in Figure 1.3, for efficiency purposes, the 3 x 3,500 m^3 HFO storage tanks will be constructed adjacent to the IDB plant's HFO storage and truck unloading bay. These tanks will be in an area that is bunded.

Backup Diesel Generators

Backup diesel generators of less than 1 MW will enable the start-up of the power plant during shutdown. These will be used only in the case where a black-out occurs.

Ancillary Infrastructure

The site will also include the following facilities:

- Store of spare parts, miscellaneous products, new oils;
- Maintenance workshops;
- Gas storage in cylinders or tanks;
- Reservoirs of reagents for the treatment of water;
- Waste storage containers;
- Laboratory to check the quality of waters (movement and effluents);
- Offices;
- Guard buildings and fencing; and
- Internal roads and parking areas.

Equipment and Materials

The exact equipment inventory to be used will depend upon the Contractor, the application of best practicable means and locational constraints in term of the operational power plant activities.

The following is anticipated:

- Earthworks will be carried out using conventional construction equipment such as excavators, bulldozers, compactors, dump trucks and tipper lorries;
- Concrete may be produced on site using a batching plant;
- Prefabricated structures will be brought to site by lorries and erected using cranes;
- The engines will be brought to site via ship;
- Welding equipment (with appropriate shielding) will be used for tank and pipe construction; and
- Piling, if found to be necessary, will be mainly carried out by crane-mounted rigs using large diameter bored piles.

Water Supply

Water will be utilised by the power plant for the following activities:

- Fire water (raw water);
- Service (maintenance, washing, workshops);
- Sanitary water;
- Feed water for the steam cycle; and
- Topping up of cooling and heating water (demineralized water).

Water requirements are summarised in Table 1.5 and Figure 1.6. Water will be supplied from the IDB Project's two new boreholes to be drilled on site.

A unit for the treatment of incoming waters will be installed on the power plant site in order to provide the various systems with the different qualities of water required. The consumption of chemicals for water treatment shall be limited and stored in approximately 25 litre plastic containers.

The abstracted groundwater will be demineralized through a reverse osmosis process. The demineralized water will be used primarily as a backup in the cooling circuit and as feed water for the steam cycle.

Service water will be treated through the addition of chlorine, pH control and filtration on active carbon.

The service water will be purified by ultraviolet (UV) treatment to drinking quality.

Table 1-5. Water requirements (cubic meter per hour) - as per water balance 13.02.2018

Water Utilisation	Water Type	Gas	Fuel Oil
Boilers (14x large WHRBs)	Demineralized water	1.26	1.26
Water loops supplementation	Demineralized water	0.35	0.35
Fuel Oil Separators	Process water (filtrated)	0.00	0.09
Oil Separators	Process water (filtrated)	0.00	0.04
Service water (washing, turbo, workshop, drinking water)	Process water (filtrated)	0.43	0.43
Steam cycle	Demineralized water	**1.425**	**1.425**
Total treated water consumption		**3.46504**	**3.585**
Water treatment rejection	Raw water	0.64	0.64
Total consumption of well water before treatment (raw water)		**4.105**	**4.225**

Source: BWSC, 2018
Note: 7 x 18V51/60DF + 14 large Waste Heat Recovery Boilers (WHRB)
Large boiler consumption: 1% of nominal steam flow 9,000 kg/h
This information is both for the IDP and IPP Power Plants.

Wastewater

Wastewater discharge will be managed on site as follows:

- Oily water produced on site will be collected and transported to the IDB plant´s effluent water pit and water treatment unit, which has been designed to treat the oily water from both plants. This unit will include an oily water storage tank (50m^3), a sand trap and an oily water separator. An interface agreement between the Project and the IDB plant will be in place to ensure that the Project has direct oversight of the oily water treatment as required. Treated water will be discharged along with clean storm water, treatment will minimise oil content to less than 10 parts per million (10mg/l). Oily water will be treated as follows:
  - Drainage water from power house and power plant area will be collected in pits.

- Water will be pumped from pits to the oily water effluent pit in which primarily oil and water are separated by gravity and by coalescing plates and oil collected by oil skimmers.
- Skimmed oil sent to oil sludge tanks and water to oily water separator unit.
- The unit includes a porous filter element with automatic back flushing, a suction/transfer pump, an oil in water monitor, and automatic controlled changeover valves.
- If the oil content after the separator absorber filter is above the allowed limit the oily water is returned to the oil drain pit via the 3-way valve for recirculation (and re-cleaning).

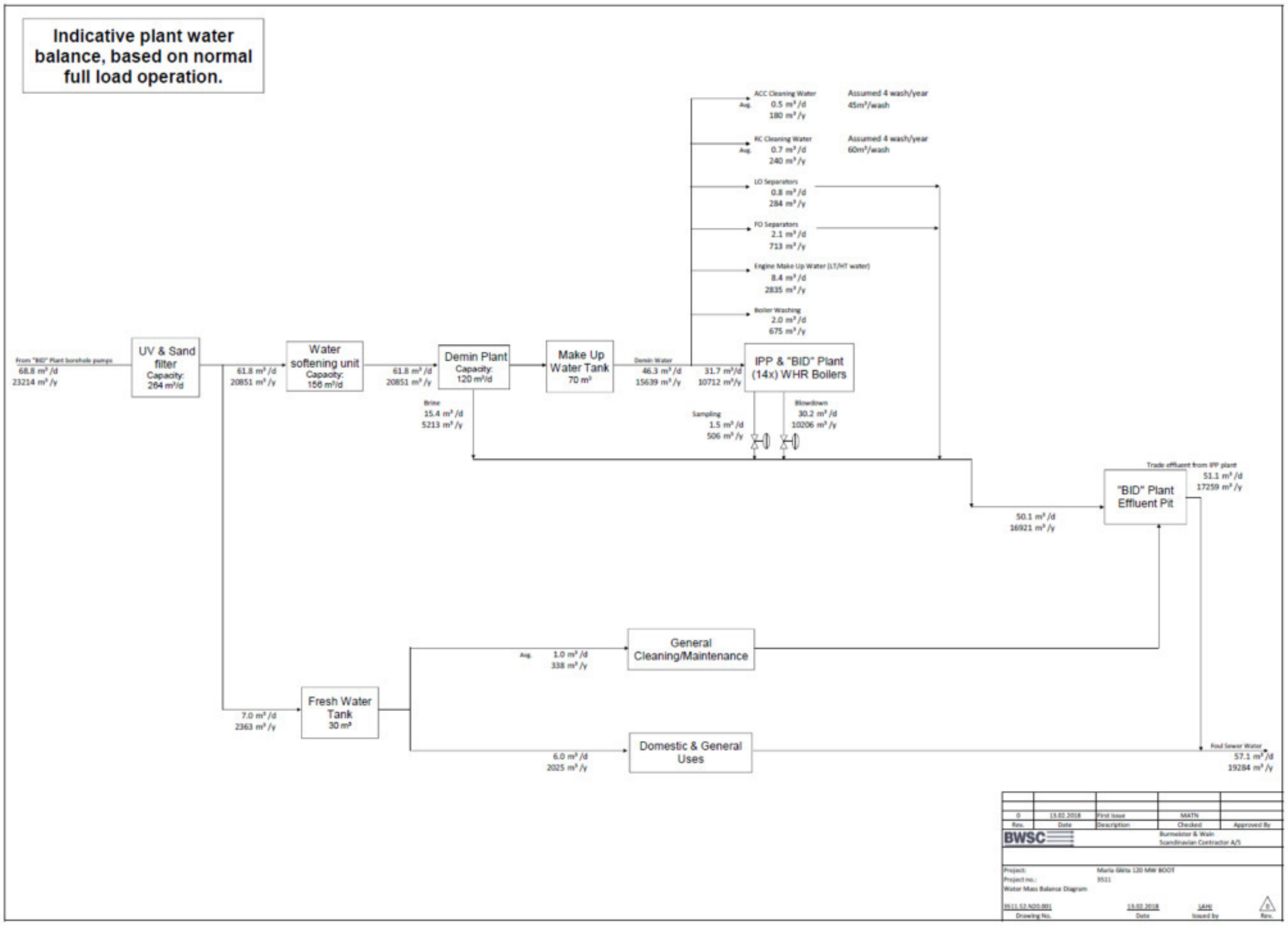
- Water from the demineralised water production unit will not be treated but will be tested to ensure it meets the required legislative standards for the discharge of wastewater (Decree No. 2001-109).
- Sanitary water will be treated on site in a septic tank and soak away pit. Residual sludge will be disposed of in accordance with the regulations governing the collection, disposal, treatment and disposal of waste materials in the Republic of Benin.
- Surface water runoff will be sent through a hydrocarbon separator prior to discharge.

The different water types will be managed in separate systems and not mixed. After treatment as identified above the wastewater was proposed to be discharged into a shallow gutter on the edge of site (in the same way as water is discharged for the existing 80 MW facility which is currently not operational). However a mitigation measure in the Original ESIA was recommended to channel the wastewater to an overgrown watercourse located approximately 1 km west of the site so as not to impact groundwater.

The surface / storm water will be discharged into a new pipe installed under the IDB project, the final discharge of that pipe is into the watercourse approximately 1 km west of the site.

When operating using HFO, an additional potential sources of effluent is anticipated, uncontaminated oil leaks which will be collected and returned to the fuel tanks.

Figure 1-6. Maria Gleta IPP Power Plant Indicative Water Balance



Source: BWSC, 2018

1.2.4.3 CO_2 Emissions

The table below summarises the CO_2 emissions resulting from operation of the Power Plant. This plant will result in the combined CO_2 emissions of 51 948 $KgCO_2/h$ in gas mode and 76 674 $KgCO_2/h$ for full load of HFO in liquid mode.

Table 1-6. Estimated CO_2 Emissions

	125 MWe Net Out				Full Load		
	Gas Mode	Gas Mode	Liquid Mode	Liquid Mode	Gas mode	Liquid Mode	
Engine Rating, El.	18522	18522	18522	18522	18522	18522	
Engine Load	98.3%	91.0%	98.4%	92.5%	100.0%	100.0%	%MCR

Engine Output	18,210	16,846	18,220	17,124	18,522	18,522	kW
Engine Heat Rate	7,965	8,013	8,293	8,303	7,967	8,308	kJ/kWh
SFOC	186.5	187.7	194.2	194.4	186.6	194.6	g/kWh
Energy cons.	145,042,650	134,986,998	151,098,460	142,180,572	147,564,774	153,880,776	kJ/h
Fuel Cons. (42.7MJ/kg)	3,396.8	3,161.3	3,538.6	3,329.8	3,455.8	3,603.8	kgfuel/h
Conversion ratio	3,412	3,412	3,412	3,412	3,412	3,412	kWh/BTU
Energy Cons.	137.5	127.9	143.2	134.8	139.9	145.9	MMBTU/h
CO2 emission p. MMBTU	53.06	53.06	75.10	75.10	53.06	75.10	kgCO2/MMBTU
CO2 emission p. hr	7,294.4	6,788.7	10,755.3	10,120.6	7,421.2	10,953.4	kgCO2/h
Number of units	7	7	7	7	7	7	-
Total Plant CO2 emission	51,061	47,521	75,287	70,844	51,948	76,674	kgCO2/h
Plant Net Output excl. STG	125,000	-	125,000	-	127,150	127,050	kWe
Plant Output incl. STG	-	125,000	-	125,000	136,600	135,000	kWe
	408.5	-	602.3	-	408.6	603.5	
	-	380.2	-	566.8	380.3	568.0	

Source: BWSC, 2018

Greenhouse Gas Emissions

Greenhouse gas emissions have been calculated for both gas and HFO mode, this would be the worst case as 100% engine load and operation time are assumed.

Table 1-7. Estimated GHG Emissions

	Gas Mode	Liquid Mode	Unit
Engine Load	100.00%	100.00%	
Fuel Cons	3 456	3 604	kg/h
Density	0.71	1 010	kg/m3
Fuel Cons	4 854	3.57	m3/h
CO_2	9 600	11 026	kg/h
CH_4	0.18	0.43	kg/h
N_2O	0.05	0.08	kg/h
CO_2e (per unit)	9 620	11 061	kg/h
Total plant CO_2e (7 units)	67 340	77 427	kg/h
CO_2e (Annual)*	589 898.40	678 260.52	t/year

*Assuming 24 hour operation, 365 days per year.
Note the following assumptions:

- Gas assumed to be natural gas
- HFO assumed as Fuel Oil No.5 in API
- Gas density taken for Normal conditions from http://www.unitrove.com/engineering/tools/gas/natural-gas-density
- HFO Density taken from http://www.globalcombustion.com/oil-fuel-properties/
- Emissions calculated using SANGEA software

The Original ESIA indicated that Benin's national emissions were 5,189 000 tonnes of CO_2 equivalents annually (World Bank, 2010). It is reported in the Original ESIA that Benin is a 'weak contributor' to greenhouse gas emissions around the world and emits significantly less CO_2 than industrialised countries (France, Germany, Belgium, The Netherlands). When compared to its neighbours Benin emits less than Nigeria, however slightly more than Ghana and Togo.

As indicated in World Bank (2014) Benin's national emissions have increased and were, as of 2014; 6,318 000 tonnes of CO_2 equivalents annually. (1)

IFC Performance Standard 3 requires that projects emitting more than 25,000 tonnes of CO2 equivalent annually 'quantify direct emissions from the facilities owned or controlled within the physical project boundary, as well as indirect emissions associated with the off-site production of energy used by the project. 'Quantification of GHG emissions will be conducted by the client annually in accordance with internationally recognized methodologies and good practice.'

(1) https://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE?locations=BJ

The Project will therefore be required to quantify direct emissions from the plant and overall GHG emissions annually in accordance with internationally recognised methodologies.

1.2.5 Project Activities

1.2.5.1 Construction

The Project is not yet under construction, however the neighbouring IDB Power Plant is currently in the early stages of construction. A provisional construction development timeline (including construction activities) for the IDB Power Plant is outlined in Table 1.8. It is assumed that although a timeline for the IPP Project has not as yet been developed it would follow the same or a similar timeline.

Table 1-8. Overview Project Timeline & Key Activities

Key Activity	Description	Timeline
Phase 1 Enabling Works	• Fencing • Site access • Site access control • Welfare facilities • Construction power • Road works • Laydown areas • Soil management/ preparation and site levelling • Underground utilities • Excavation of areas under all major foundations • Verification of soil conditions • Initiation of earthworks	Q1
Phase 2 Civil & Building Works	• Excavation for concrete works. • Reinforcement works (pre-bend rebar or onsite bending) • Formworks fabricated on site in an allocated marked area. • Concreting of blinding layer and substructures • Internal roads (excluding final top layer) • Related scaffolding • Power house & Aux buildings	Q2
Phase 3 Mechanical & Electrical Erection	• Mechanical • Steel structures • Main components • Connection piping • Auxiliary systems • Electrical • Elevated floors • Earth wiring • Light & small power • Switchgear	Q3

	• Transformers • Power cabling • Control system • Signal cabling • Substation extension	
Phase 4 Commissioning	Pending	Q4 and Q5

1.2.5.2 Operation

The power plant will be operated on a 24 hour, 7 days a week basis. An Operations and Maintenance (O&M) contractor will be appointed to operate and maintain the power plant. There will be approximately 100 employees on site during operation. These will include plant management and maintenance staff, skilled mechanical and electrical technicians, drivers, medical, quality control, and cleaning staff and a number of experienced plant operators who will operate and maintain the plant, and who are expected to be a mix of expatriate and local staff.

Requirements for water use during construction are included in Section 1.2.4, as well as wastewater production and disposal.

During the first phase of operation the power plant will operate on HFO. It is anticipated that 20 trucks (making return trips) of HFO per day will be required for the operation of the power plant.

1.2.5.3 Decommissioning

Decommissioning is the term used to describe all stages involved in the closure and rehabilitation of the power plant site. The process can generally be categorised into the three key phases as follows:

- Pre decommissioning activities: includes the detailed planning and approvals;
- Decommissioning activities: removal of all infrastructure. Machinery, steel and dismantled materials will be recycled where possible and disposed of at licensed disposal sites; and
- Post decommissioning activities: site survey, close out report and field monitoring as necessary.

It is likely that the project facilities will only be decommissioned once the gas supply has been exhausted, when it is no longer economical to continue operation, or the plant is rendered redundant or is no longer required for various reasons, or is unsafe to operate. As the development process of the site is yet to fully begin, detailed decommissioning plans have not yet been formulated; however, the initial plant life will be designed for 25 to 30 years. Upgrades during the life of the plant can increase the design life to 50 years.

1.2.6 Work Force

The Project is being advanced by staff from the Consortium companies under a joint development agreement. The Project final engineering design and construction will be done by the EPC Contractor engaged for the works.

The Project final engineering design and construction will be done by an Engineering, Procurement, and Construction Contractor (EPC Contractor) engaged for the works. The Project will engage BWSC, the same EPC Contractor as the IDB Power Plant. BWSC is also one of the Project's Consortium members.

In terms of workforce size, the Project estimates that there will be 400 workers engaged in the Project construction. This is assumed to be peak workforce. The workforce will not be housed onsite ie, there will not be a construction worker camp. Workers will stay in private housing.

The Project expects that the workforce will be comprised of a mixture of Beninese and foreign nationals. The Project intends to make efforts to maximise local content in the workforce.

In addition to Project resources, the EPC Contractor will be required to have sufficient staffing resources to manage environmental and social performance. At the IDB Power Plant site, there is currently one EHS manager for the EPC contractor, with six EHS officers. While the staffing levels for the Project are not set, it would be reasonable to assume a similar level of resourcing.

During operations, the Project expects to have a work force of about 100 full-time staff.

1.2.7 Alternatives

The Original ESIA documented the consideration during pre-feasibility of a number of Project alternatives, including the no-go alternative, technology alternatives (related to the different fuels available – coal, natural gas, light fuel and heavy fuel oil).

1.2.7.1 No-go Alternative

The no-go alternative considers the situation where the Project does not go ahead.

Benin currently has low electricity production and limited access to electricity. The development of the Project will allow Benin to secure electricity supply and reduce its dependence on electricity imports from neighbouring countries. In addition, it is anticipated that the country will be able to export electrical energy and thus contribute to the national economy. From a socio-economic point of view, the no-go option would mean opting for the current energy situation in Benin, which is characterized by frequent and sometimes long-term load shedding. Since 2006, Benin has been impacted by a persistent energy crisis with negative impacts on the national economy. The development of the Project will contribute to alleviating this crisis. Domestic power generation will provide easier and cheaper access to energy to support the Benin economy and contribute to poverty reduction.

1.2.7.2 Site Location Alternatives

The Project site location was selected to allow the units to be connected directly to Maria Gléta's existing 161 kV substation. This important electrical node of the CEB network is currently connected by two 161 kV double lines at the Védoko station feeding the cities of Cotonou and Porto-Novo and the Lomé post. Additional modifications are planned and Maria Gléta will then be connected by eight 161 kV lines to the main consumption centres of the CEB network and by the coastal ridge 330 kV to the neighbouring systems within the WAPP. Reliable power evacuation from the new plant will then be possible from the Maria Gleta substation.

This location has the distinct advantage of not having to build a new high tension line for the evacuation of the electrical power produced by the plant.

The following additional advantages were identified:

- The WAGP gas pipeline is located not far from the site.
- The Port of Cotonou is located in close enough vicinity of the site for the transport of HFO as required.

1.2.7.3 Technology Alternatives

Based on the different fuel options a number of different technologies were evaluated for the power generation project, namely:

- A pulverized coal plant;
- A gas turbine power plant in the combined cycle;
- A gas turbine plant in open cycle; and
- Dual-fuel engine based power plant (gas-HFO).

From a fuel cost standpoint, the coal plant provides the lowest total cost of all configurations. However, the cost of investment is very high and there are significant atmospheric impacts associated with the use of coal, and a coal plant would not be possible in the location selected due to the quantities of water required, as such this alternative was not considered further.

The assessment considered the use of gas as the preferred option, however the supply of gas to Benin is currently unreliable and an option where HFO is able to be used as a replacement fuel was required. The use of HFO long-term is however not considered a viable option economically. The engine based power plant was considered to be the best option in this situation as the use of HFO in a gas turbine power plant was not considered viable.

1.2.7.4 Alternatives Summary

The alternatives considered included the no-go, site location and technology alternatives.

The preferred site location is considered ideal for the Project because it allows a direct connection to the existing Maria Gleta 161 kV substation which will allow reliable power evacuation. The location has the advantage of not having to build a new high tension line for the evacuation of the electrical power produced by the plant. There are the added advantages of the WAGP gas pipeline being in close proximity and the location of the Port of Contonou in the vicinity allowing for the import of HFO to the power plant as required.

From an environmental point of view the no-project option will allow no impact to be generated apart from the increasing pressure on the natural resources of the population without access or only partial access to this energy. In terms of fuel source for the power plant, coal is the least preferred option due to the high atmospheric emissions (mainly SO2). Gas is the best solution from an atmospheric emissions perspective. The combustion of HFO generates atmospheric emissions of intermediate importance between the combustion of coal and the combustion of gas.

The preferred alternative is the use of a dual-fuel engine running on gas, with the option to use HFO initially and when gas is unavailable. This option represents the best compromise taking into account the environmental, economic and social aspects.

2. ESIA METHODOLOGY

2.1 METHODOLOGY

The Original ESIA undertaken by Tractebel Engineering S.A. in 2017 was undertaken in terms of Beninese legislation. The necessary ESIA approvals for the Project were given by the Ministry in April 2017.

2.1.1 Baseline Data Collection

The Original ESIA report provides a description of the existing biophysical, biological and socio-economic conditions as a basis against which the impacts of the Project could be assessed. The baseline includes information on receptors and resources that were identified as having the potential to be significantly affected by the proposed Project. The description of the baseline has the following main objectives:

- To identify the key physical, biological and socio-economic resources and conditions in areas potentially affected by the Project;
- To describe, and where possible quantify, their characteristics (ie, their nature, condition, quality and extent);
- To provide data to aid the prediction and evaluation of possible impacts;
- To inform judgements about the importance, value and sensitivity or vulnerability of resources and receptors; and
- To serve as a reference for future monitoring of impacts of the Project.

For the current Project, baseline data collection was obtained from existing sources including previous EIAs, government data, and existing academic research documents.

The baseline data provided in Chapter 4 was sourced largely from the Original ESIA, plus some additional desk-based research. The air and noise baseline descriptions are provided in the relevant impact assessment sections.

Additional primary baseline data were collected by the socio-economic specialist and biological information was visually confirmed when the ERM were onsite. Further detail on the socio-economic baseline data collection method is provided below.

2.1.1.1 Socioeconomic baseline

In April 2017 ESIA data was collected by Tractebel Engineering S.A. through engagement with:

- The Ministry of Water and Energy;
- The Beninese Agency for the Environment (ABE);
- The National Institute of Statistics and Economic Analysis (INSAE);
- The National Geographical Institute (IGN);
- The Health Management Departmental of Atlantique-Littoral;
- Village chiefs ‘ chef de quartier’ in Houeto;
- Land owner members committee;
- Traditional chiefs;
- Field surveys and census with all residents onsite, including individual interviews with members of the general public (Wall Street Engineering consultants); and
- Public consultation.

Certain aspects of the social baseline assessment undertaken as part of the above Original ESIA were identified to be inadequate for the monitoring of key impacts including resettlement-induced livelihood impacts of the Project over time.

The outcomes of the Gap Assessment undertaken in February 2018 resulted in the need for collection of additional baseline data in order to understand the socio-economic components of the site and to comply with the IFC requirement standards for baseline collection. A locally based environmental and social consultancy, Liner Environment, undertook additional socio-economic data collection in April 2018 to supplement the social baseline. This involved engagement with Project Affected Communities (PACs) around the Project site in Togba district such as at CEG Houéto, public health centres, etc. Data was captured against the following topics:

- Essential public infrastructure – number and types of public services available including health infrastructures for primary care, emergency services including fire services and police capacity;
- Community health - including data on birth-rates, HIV occurrence, respiratory diseases, malaria rates and communicable diseases from district health centres and medical centres;
- Demographic data – population size, age and sex per community;
- Economy and livelihoods – employment sectors, unemployment rate, main economic and livelihood activities at the site and site surroundings; and
- Cultural site and religious assets – important historical, cultural and religious sites that were previously located on the Project site and compensated for, and existing sites in proximity to the Project.

Desktop Review

A desktop review was undertaken using materials and data from the following sources:

- Ministry of Environment and Sustainable Development (MCVDD);
- National Institute of Statistics and Economic Analysis (INSAE);
- National Directorate of Forests and Natural Resources (DGFRN);
- Department of Geography and Urban Planning (DGAT) of the University of Abomey-Calavi;
- Benin Environmental Agency (ABE); and
- Abomey-Calavi Town Hall documentation centre.

Reviewed documents provided information on the geographical status, demographic data, social structures of resident ethnic group, habitations, land use and land tenure, economic activities, incomes and living standards of the populations, types of public and social infrastructures, and cultural and religious related information.

Primary Data Collection

During the 2018 data update, primary data collection was obtained from four (4) Focus Group Discussions (FGDs) and eight (8) separate Key Informant Interviews (KIIs). See meeting summary notes Stakeholder Engagement Plan (SEP). The four focus in included:

- On Thursday, March 29, 2018, a focus group discussion was conducted in the Somè Village Chief with the participation of local stakeholders in the context of Maria-Gleta II project.
- On Thursday, March 29, 2018, another focus group discussion was conducted with the Chief of Maria-Gléta with the participation of local stakeholders in the context of Maria-Gleta II project.
- On Thursday, March 29, 2018, a focus group discussion was held in Houèto Village Chief group in Togba district. This was conducted in the residence of with the participation of local stakeholders in the context of Maria-Gleta II project.
- On Saturday, March 31, 2018, a focus group discussion was conducted with the Fifonsi Village Chief with the participation of local stakeholders in the context of Maria-Gleta II project

Table 2-1. Table of Focus Group Discussions

District	Participants	Venue	Date
Togba	Delegation of the MEEM, Mommunity Members and PAPs	CEG Hueto School	17/05/2018
Togba	Consulting team PAPs and other local stakeholders	Somè Village Chief residence	29/03/2018
Togba	Consulting team PAPs and other local stakeholders	CEG Houèto	29/03/2018
Togba	Consulting team PAPs and other local stakeholders	Maria-Gléta Village Chief	29/03/2018
Togba	Consulting team PAPs and other local stakeholders	Fifonsi Village Chief	31/03/2018

These focus group discussions took into account:

- Project Affected Persons (PAPs);
- Community Base Organisation (CBOs);
- Resettlement committee members in charge of PAPs;
- Representative of motorcycle taxi drivers (Mr Hermann GANDAHO);
- President and Vice President of PAPs committee (Mr Coovi HONFOGA and Mr Eugene GANDJO, respectively);
- Local and administrative authorities;
- The Parent Teachers Associations (APE);
- The Director (Mr Sètchédé AWALA) and teachers from CEG Houèto;
- Health workers;
- Heads of various Women's Associations (GF);
- The SBEE Coordinator of the IDB Project (referred to locally in conjunction with the IPP as the Maria-Gleta II Project) (Mr TOKOUDAGBA);
- Both Health Safety and Environment Managers (HSE) of the IDB project (BSWC contractors) and from Benin Power Distribution Company – SBEE (Mr Gratien TIANDO); and
- GMT (BWSC subcontractor).

The figure below illustrates focus group discussion sessions undertaken.

Figure 2-1. Focus Group Discussion Sessions

Focus group discussion at Houèto

Focus group discussion at Somè

Focus group discussion at Maria-Gleta

Focus group discussion at Fifonsi

Source: Liner Environment, March 2018

Key stakeholders engaged with and interviewed included policy makers, technical staff, scientific stakeholders, organized groups, and various social groups (eg, young people, women, motorcycle taxi drivers, PAPs, local authorities, state governed or non-governmental associations' heads). These interviews as well as focus group discussions focused on:

- Whether there was a presence of water wells in communities adjacent to project site, and the reliability of the groundwater for quality and quantity;
- Data pertaining to key social, health and livelihood indicators for each of the villages affected by the Project;
- Understanding Project-induced impacts on the PAPs including changes in access routes to essential local infrastructures (schools, health centres, etc.) and income previously derived from land and/or businesses located in their properties. A copy of PAPs records along with their affected assets were made available to the Project Team for analysis;
- The accurate rate of compensation applied for PAPs with land, property, or both; and
- New concerns raised by communities living in the surrounding environment of the Project.

2.1.2 Specialist Studies

For the Original ESIA specialist technical studies were undertaken for the analysis of potential impacts to air and noise. A socio-economic assessment was also undertaken.

For the Updated ESIA specialist input was obtained for the following aspects:

- Air Quality – full updated specialist study;
- Noise – full updated specialist study;
- Groundwater – specialist review and input;
- Traffic/transportation – specialist review and input; and

- Socio-economic – updated baseline and confirmation of impacts.

2.1.3 Impact Assessment

Impact assessment and development of mitigation measures is an iterative process that commences during the scoping stage and continues throughout the ESIA process. The key objectives of this process are as follows:

- To analyse how the Project may interact with the baseline conditions in order to define, predict and evaluate the likely extent and significance of environmental, social and health impacts that may be caused by the Project.
- To develop and describe acceptable and cost effective mitigation measures that avoid, reduce, control, remedy or compensate for negative impacts and enhance positive benefits.
- To evaluate the predicted positive and negative residual impacts of the Project.
- To develop a system whereby mitigation measures will be integrated with the Project and will be taken forward as commitments. This is achieved through the development of an Environmental Management Plan, included in Chapter 8.

The objectives of the impact assessment process described above may thus be summarised by reference to the following four main steps:

- Prediction of what will happen as a consequence of Project activities;
- Evaluation of the importance and significance of the impact;
- Development of mitigation measures to manage significant impacts where practicable; and
- Evaluation of the significance of the residual impact.

Chapter 6 presents the assessment of impacts, including the detailed assessments associated with the revised air quality and noise specialist studies.

3. LEGAL FRAMEWORK

3.1 INTRODUCTION

The administrative framework applicable to the ESIA Update comprises:

- Laws of the Government of Benin; and
- International Treaties and Conventions potentially relevant to the Project.

3.2 LEGISLATIVE CONTEXT AND INSTITUTIONAL FRAMEWORK IN BENIN

The following subsections provide an overview of Benin's environmental regulations and institutional framework that are of potential relevance to the Project.

3.2.1 Regulatory Framework

3.2.1.1 General framework

In June 1993, Benin adopted a plan of action for the environment which constitutes a part of the overall policy of development of the country. The first application of this plan was the promulgation of the law framework for the environment and the creation of the Benin Agency for the Environment (ABE) responsible for applying effective environmental policy.
The Framework Law on the Environment of 12 February 1999 (Law n°98-030) defines the basis of environmental policy and organises its implementation. It defines the general principles of the management of the environment in the Republic of Benin, the objectives set, as well as the provisions required to achieve these objectives. The Minister is responsible for the development and the implementation of the national environmental policy as well as the coordination of its execution.

The Framework Law on the Environment is a national legal instrument; its main objectives include:

- TITLE I defines the concepts and institutions in charge of the protection of the environment.

- TITLE II defines the methods for the protection of receiving environments such as soils, groundwater, air, and marine and inland waters against any form of degradation, as well as guidance for management of such environments.
- TITLE III contains the provisions for the protection, classification and management of flora and fauna in order to preserve biodiversity.
- TITLE IV, "Pollution and nuisance," describes the main provisions concerning the management of waste, facilities, classes of harmful and dangerous chemicals and noise (see also the Decree of 2001-294).
- TITLE V describes major administrative tools for environmental management. It outlines four key tools:
  - An environmental impact assessment procedure;
  - An environmental audit procedure;
  - A public hearing procedure on the environment; and
  - Emergency plans.

The last two Titles (VI and VII) are respectively devoted to sanctions and final provisions of the law.

3.2.1.2 Environmental Impact Assessment

Decree n° 2015-382 which governs environmental assessment in the Republic of Benin was adopted in July 2015. According to this decree, '*the authorization of any project is subject to an environmental impact study which is subject to the issuance of a certificate of environmental conformity by the Minister.'* The certificate of Environmental Compliance will include implementation of specific conditions for the protection of the environment.
In accordance with the Decree n°2015-382 of 09 July 2015, the EIA report must include at a minimum:

- A detailed description of the Project;
- A 'clear and detailed' inventory of the natural, socio-economic and human environment likely to be affected by the Project;
- An impact analysis, including cumulative impacts of the Project on the environment;
- A comparative analysis of options with justification of choices made regarding the inclusion of environmental concerns, avoidance, mitigation and compensation measures as well as an environmental management plan, which includes monitoring and follow-up activities during and after the implementation of the Project.

Prior to commencement of an EIA, the proponent is required to develop and submit a Terms of Reference (ToR) document which details the EIA requirements to the ABE. Once acceptable, the ToR document is then validated and the EIA can proceed.

Once the EIA Report has been submitted to the authorities, an *ad hoc* working committee reviews the report and may, depending on the scale of the Project, organize a public hearing. The procedure of public hearing is governed by the decree n°2001-190 of 19 June 2001.

The Certificate of Environmental Compliance will be issued once the following has been undertaken:

- The request of the proponent to the Minister;
- The EIA Report; and
- The ABE notice and possible public hearing report, as well as the receipt for payment of expenses.

An ESIA was completed in April 2017 for the construction of two thermal power plants with an overall production capacity of 400MW. Phase A was envisaged for 120MW and Phase B for 300MW to be confirmed by the Ministere de l'Energie, de l'Eau et des Mines (MEEM). The certificate for Environmental Compliance for this Project was issued and approved by ABE in April 2017.

This Updated ESIA is being prepared due to changes in the Project Description and will be reviewed by ABE.

3.2.1.3 Water

Water rights in Benin are regulated under the Water Code and the Public Hygiene Code, promulgated on 21 September 1987.

The Water Code focuses primarily on the protection of water sources and usage. The protection of water addresses issues of water contamination from a public health perspective ie, public roads, residential, commercial, beaches, swimming pools and any activity in question.

Quality of Wastewater

The wastewater decree n°2001-109 of 4 April 2001 sets the quality standards of wastewater. The Project will generate industrial waste water ie, liquid effluents and domestic water ie, storm water.

According to this decree, the release of industrial water must meet the guidelines for industrial water discharge specified in Table 3.1 below.

Table 3-1. Guidelines for Contaminants in Industrial Wastewater

Physico-chemical parameters	The units	Average concentration permitted daily		(B) quantity of contaminant Rejected
		If rejected quantity < B	If rejected quantity > B	
Conventional Parameters				
BDO5	Mg/L	100	30	30 kg/i
My	Mg/L	100	35	15 kg/i
DCO	Mg/L	300	125	100 kg/i
Oils and total fat	Mg/L	100	30	1 kg/i
PH	-	6 < pH < 9 in any time		N/A
Temperature	°C	5°C higher than the temperature of the waters	N/A	
Receptors				
Parameters not-conventional				
Phosphorus1	Mg/L	100	10	15 kg/i
Total nitrogen (NTK)	Mg/L	200	30	50 kg/i

Note that article16 of the decree n°2001-109 stipulates that the operator of a facility is obliged to sample wastewater once per month to verify compliance with the guidelines.

The decree also specifies that domestic sewage may not be discharged into the natural environment unless it has been treated. The guidelines for treatment of domestic sewage are specified in Articles 23 and 24.

3.2.1.4 Waste Management

The type of waste generated during construction and operation of the power plant will include household waste, hazardous and non-hazardous waste as well as the sludge from the treatment of sewage.

The management of solid waste in the Republic of Benin is governed by the Decree n°2003-332 of 27 August 2003. This aims to:

- Prevent or reduce the production of waste;
- Promote waste recovery ie, recycling, reuse, reduce and recovery;
- Coordinate waste disposal; and
- Restrict, monitor and control waste transfer.

The disposal of sewage sludge is governed by decree n°2001-109. This decree prohibits the discharge of sewage into the aquatic environment. The sludge is disposed of in accordance with the regulations relating to the activities of collection, evaluation, treatment and to the elimination of contents of draining in the Republic of Benin.

3.2.2 Air Quality

3.2.2.1 Overview

The Air Quality assessment follows guidelines set out by the World Bank Group in the General EHS Guidelines for air quality and the EHS Guidelines for Thermal Power [2].

The Guidelines for Thermal Power state that the most stringent of either nationally legislated air quality standards or IFC guidelines should be used. As there are legislated air quality standards in Benin, both the Benin and IFC air quality standards have been considered in the assessment.

The legal framework for air quality is separated into two elements: ambient air quality standards and emissions limits for pollutants to the air.

3.2.2.2 Ambient Air Quality Standards

Air quality standards are set at the point below which it is reasonable that there is a negligible risk of harm to exposed people. These standards are set to protect the large majority of the population including the elderly and young children.

Benin

The Benin Air Quality Standards relevant to this study are set out in Table 3.2.

Table 3-2. Benin Air Quality Guidelines

Pollutant	Averaging period	Air Quality Standard (µg/m3)
NO_2	Annual Mean	100
	24-hour maximum	150
SO_2	Annual Mean	80
	24-hour maximum	200
	1 hour mean	1300
PM_{10}	Annual Mean	50
	24 hour maximum	230

Source: Ministere de l'energie, de l'eau et des mines (2017) Projet De Construction De La Centrale Thermique A Moteurs Dual Fuel (Gaz-Hfo) Sur Le Site De Maria-Gleta 2 (400 MW), Quoting: Air quality standards Decree No. 2001-110 of 04 April 2001)

IFC

The IFC air quality guidelines relevant to this study are set out in Table 3.3.

[2] International Finance Corporation (2008) Environmental, Health and Safety Guidelines: Thermal Power

Table 3-3. IFC Air Quality Guidelines

Pollutant	Averaging period	Air Quality Standard (µg/m3)
NO_2	Annual mean	40
	1 hour maximum	200
SO_2	24 hour maximum	125
	10 minute maximum	500
PM_{10}	Annual mean	70
	24 hour mean, not to be exceeded more than 3 times per year	150
$PM_{2.5}$	Annual Mean	35
	24 hour mean	75

Source: IFC (2007) EHS Guidelines: Air Emissions and Ambient Air Quality

3.2.2.3 Emission Limits

Emission limits are set as the maximum permissible concentration of pollutants that can be emitted from the plant. These are included in this report for the purpose of allowing comparison of the predicted impacts with the emission limits.

3.2.2.4 Benin

The emission limits applicable to engines run on gas and on HFO are summarised in Table 3.4.

Table 3-4. Benin Emission Limits for Engines

Pollutant	Emission Limit	Units	Notes
NO_x (Note 1)	325 611	ppm mg/Nm^3 (at 3%O_2 dry, 273K)	
PM_{10}	85	mg/Mj	Operation on liquid fuels

Source: Air quality standards Decree No. 2001-110 of 04 April 2001

Note 1: Emission limits relate to total NO_x emissions, whereas air quality standards refer only to the NO_2 fraction of NO_x. The conversion from NO_x to NO_2 is discussed in *Annex A to the Air Quality Technical Report*.

Note 2: Benin introduced a 50ppm fuel sulphur limit in 2016 for diesel fuels.

IFC

The power plant has a sum total power greater than 50MWthermal and is therefore subject to the emission limits set out in the EHS Guidelines for Thermal Power plants. As the Phase 2 plant is less than 300MWthermal in isolation, and HFO use will be temporary, the emissions limits applicable to the project are the higher threshold emission limits. The emission guidelines applicable to dual fuel reciprocating engines operating on gas and HFO are summarised in Table 3.5.

Table 3-5. IFC Emissions Guidelines for Reciprocating Engines

Pollutant	Emission Limit operating on natural gas 3 – 15 MWth	Units
Gas		
NOx	400 (Dual Fuel engine, undegraded airshed)	mg/Nm3 (at 15%O2 dry, 273K)
HFO		
NOx	2000 (Dual fuel engine, undegraded airshed)	mg/Nm3 (at 15%O2 dry, 273K)
PM	30	mg/Nm3 (at 15%O2 dry, 273K)
SO2	1,170 or use of 2% or less S fuel	% Sulphur

Note 1: Emission limits relate to total NOx emissions, whereas air quality standards refer only to the NO2 fraction of NOx. The conversion from NOx to NO2 is discussed in Annex A to the Air Quality Technical Report (Annex A of this report).

These emission limits are not legally binding, as they are provided by the IFC as guidelines rather than set out in Benin law. However, it is anticipated that, as a minimum, lenders will expect these to be achieved.

3.2.3 Flora and Fauna

With regard to the flora and fauna, the following table summarizes the laws applicable to Benin.

Table 3-6. Applicable Legislation

Legislation	Definition
Act No. 87-014 of 21 September 1987 on the regulation of the protection of nature and the exercise of hunting in the People's Republic of Benin	Definition of protected species and the area of application and the rules and regulations relating to the practice of hunting
Act No. 93-011 of 3 August 1993 on the conditions for the exercise of hunting and tourism of vision in the Republic of Benin	Definition of periods of hunting
Act No. 93-009 of 02 July 1993 on the regime of forests in the Republic of Benin.	Defines the modalities of the management, protection, exploitation of forests, trade and the forest products industry
Act No. 2002-16 of 18 October 2004 on the regime of wildlife in the Republic of Benin	Lays down the basic principles and conditions general protection, management and developer of wildlife Outlines implementation measures for the conservation, development and sustainable use of wild animals, their environments and their biological diversity

3.2.4 Electricity Sector

The governance of electricity is undertaken in terms of the Bénino-Togolais Electricity Code and the International Agreement signed between the Togo and Benin in 1968. This Code ensures supply of electricity for the communities for the production, transportation and of imports/exports of the energy between the two countries.

The International Agreement and Bénino-Togolais Code was revised in 2003 to make provision for independent power producers to produce electricity. However the Electricity Community of Benin (CEB) remains the sole trader of electricity.

3.2.4.1 The Act No. 2006-16 of 27 March 2007 establishing the code of electricity in Benin

The Electricity Code defines the legal framework within which the activities of production, transportation, distribution and importation of electricity are undertaken. It also outlines the structures of the administration and duties of the other stakeholder agencies of the electricity sector.

3.2.5 The Labour Code

The Labour Code is regulated under the decree n°98-004 of 27 January 1998. This Code outlines measures of hygiene, health and safety to be adopted by institutions in order to protect workers.

3.3 LAND ACQUISITION AND RESETTLEMENT

Under Benin law, there are two possible means by which private land in Benin can be acquired. They include:

- Purchase; or
- Compulsory acquisition through the use of eminent domain.

If the land is purchased, an agreement is made which binds the purchaser and the seller. This is known as the willing-buyer/willing-seller principle. The purchaser then has to undertake the registration procedure to obtain title to the land purchased.

For the Project land, agreements could not be reached with all private owners regarding the sale, therefore the land was expropriated by the government in accordance with the following procedure:

- An application was made by the MEEM, the ministry wants to initiate the expropriation process, to the Minister of Land Tenure (ANDF). The Council of Ministers and ANDF issues the relevant permit and a decree that contains the declaration *d'utilite publique* (declaration [of property] for public utility). This designates all the land that is allocated to the Project for use in power generation and serves as the basis for expropriation in the public interest if an agreement cannot be reached with the owners.
- A public disclosure period is then opened, allowing for third parties to make claims against the declaration *d'utilite publique* (DUP).
- An administrative Commission then hears all of the claims in order to determine the indemnity to be paid to the expropriated owners. The Commission appoints an outside appraiser who then files a report on the fair value of the expropriated land.
- If an agreement is not entered into before this Commission, the Commission's opinion together with the expert report is submitted to the court, which sets the final amount of compensation. The Constitution of Benin requires that this amount is set by a civil court.
- After payment of the compensation, the expropriation is ordered by the court. The ownership of the land can only be transferred after compensation is paid to the landowners.
- Once the expropriation decree is issued, notice is given to landowners/occupiers that they have six months to vacate the property.
- The expropriated land must then be used for the project and cannot be resold.

The associated DUP arrêté for Maria Gleta was disclosed in 2009. For seven years the arreté de cessabilité / transfer of land under DUP was renewed annually until resettlement and compensation took place in 2016.

Key associated legislation includes:

- Year 2010 No 2/261 / Dep-Atl-Lit / SG / SPAT.
- Year 2014 No 0218 / Dep-Atl-Lit / SG / SPAT - Amending arrete No.2 / 261 / Dep-Atl-Lit / SG / SPAT of October 22, 2010, relating to the transfer of buildings located in the vicinity of the thermal power station of 90MW at Maria Gleta in the commune of Abomey Calavi.

- Law No 2013-01 of 14 August 2013 which provides the Code on Private and State-owned Land in the Republic of Benin.
- Law No 2017 -15 of 10 August 2017 modifying law No 2013-01 of 14 August 2013.
- Decree 2015-013 of 29 January 2015 on the composition and functioning of survey commissions, and compensation for expropriation for public utility in the Republic of Benin.
- L'Arrete: 2016 2016 No 3263 / MEF / DC / SGM / ANDF / SP of 03 October 2016 relating to the creation, composition, attributions and functioning of the final commission in charge of the compensation and the expropriation of the land for the Maria-Gleta 120 MW thermal power station in the district of Togba.

3.4 INSTITUTIONAL FRAMEWORK

3.4.1 The Environmental Authorities

3.4.1.1 The Department of the framework of life and of sustainable development (MCVDD)

The Department of the framework of life and sustainable development (MCVDD) was created by the decree n°2016-501 di 11 August 2016. The role of MCVDD is to implement the national policy on the environment, habitat and urban planning as well as protection of the natural environment.

3.4.1.2 The Agency Benin for the Environment (ABE)

The Agency Benin for the Environment (ABE) was created by the Decree No. 95-47 of 20 February 1995 on the organization, functions, and operation of the Agency in Benin. The mission of the ABE is defined in the Act No. 98-030 of 12 February 1999, the framework law on the environment in the Republic of Benin. The ABE is the agency for environment and is responsible for the implementation of the environmental policies defined by the Government.

The ABE has two directorates, namely, the directorate of the evaluations and of the environmental integration (DEIE) as well as the directorate of information and the environmental monitoring.

3.4.2 The Authorities of the Energy Sector

3.4.2.1 The Ministry of Energy.

The purpose of the Ministry of the Energy is to develop and implement energy policies. The Ministry participates in the development of legislative and regulatory documents. The Ministry of Energy has oversight of the Directorate General Energy (CEO) and the Beninese Agency of Rural Electrification and Mastery of Energy (ABERME).

3.4.2.2 The Directorate General for Energy (CEO)

In accordance to the provisions of the Decree No. 8/MMEH/DC/SGM/CTRNE/DGE/SA of 28 May 2004, the purpose of the Directorate General for Energy is to liaise with the national government structures regarding the implementation of the policies in the energy sector.

The CEO has for the following functions:

- Initiate and develop correspondence with all the national structures related to energy for implementation of the energy policy;
- Planning regarding energy security; and
- Promotion of all forms of energy under the Department.

3.4.2.3 The Beninese Agency of Rural Electrification and In Mastery of Energy (ABERME).

The ABERME is responsible to implement the policy of in the areas of the rural electrification and the mastery of energy.

3.4.2.4 Actors in the production, transportation and distribution of electrical energy

The actors in the chain of production and distribution of energy products listed below:

- The Electrical Community of Benin (CEB) in charge of the importation, production and transmission of electrical between Benin and Togo, and;
- The Société Béninoise d'Energie Electrique (SBEE) in charge of the distribution of the electrical energy in Benin.

3.5 AFRICAN DEVELOPMENT BANK GUIDANCE MATERIAL

3.5.1 Environmental and Social Risks and Impacts

The African Development Bank Integrated Environmental and Social Impact Assessment (IESIA) Guidelines are used as a systematic process for addressing projects' environmental and social impacts and reflect the scope and content of the Integrated Safeguards System and Operational Safeguards adopted in December 2013.

The Integrated Safeguards System consists of the following interrelated components:

- Integrated safeguard policy statement;
- Operational safeguards;
- Revised Environmental and Social Assessment Procedures; and
- Guidance notes revised Integrated Environmental and Social Impact Assessment (IESIA) guidelines.

The IESIA Guidance notes are presented in three essential components:

- Environmental and Social Assessment Instruments and Outputs;
- Environmental and Social; and
- Guidance on Specific Sectors called Sector Keysheets.

The key objectives of the IESIA Guidance Notes are captured in Box 3.1 below.

Box 3.1. Key objectives of the Guidance Notes

- To provide guidance to Regional Member Countries when undertaking Environmental Impact Assessments for Bank financed projects/programs;
- To provide a system of technical support both for its own staff and for borrowers or clients to cover not only project preparation but also implementation with a new emphasis on monitoring, reporting and supervision;
- To put in place a dynamic and customized resource that can respond to current needs and be adapted to future safeguard implementation challenges faced by Bank staff, in both regional and sector departments, and its borrowers or clients; and
- To offer a basis for capacity building in the Bank and in RMCs with respect to implementing the safeguards.

In addition to the ESIA Guidance Notes, the Bank has adopted five Operational Safeguards (OS) to achieve the goals and optimal functioning of the Integrated Safeguard System. These include:

- Operational Safeguard 1: Environmental and social assessment;
- Operational Safeguard 2: Involuntary resettlement land acquisition, population displacement and compensation;
- Operational Safeguard 3: Biodiversity and ecosystem services;

- Operational Safeguard 4: Pollution prevention and control, hazardous materials and resource efficiency; and
- Operational Safeguard 5: Labour conditions, health and safety

3.6 IFC Performance Standards

The IFC's Environmental and Social Performance Standards define IFC clients' responsibilities for managing their environmental and social risks, specifically:

- *International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012) (the IFC Performance Standards); and*
- *World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).*

Based on a review of the Project, the following IFC Performance Standards were determined to be applicable:

- *Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts*
- *Performance Standard 2: Labour and Working Conditions*
- *Performance Standard 3: Resource Efficiency and Pollution Prevention*
- *Performance Standard 4: Community Health, Safety and Security*
- *Performance Standard 5: Land Acquisition and Involuntary Resettlement*
- *Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources*
- *Performance Standard 8: Cultural Heritage*

Performance Standard 7: Indigenous Peoples was considered but was determined to not apply. There are no indigenous people as defined by the IFC Performance Standards in the Project's area of activity.

The following sector-specific EHS guidelines of the World Bank Group as referenced in the IFC Performance Standards apply:

- *General EHS Guidelines (2007)*
- *EHS Guideline for Thermal Power (2008)*
- *EHS Guideline for Electric Power Transmission and Distribution (2008)*

4. ENVIRONMENTAL AND SOCIAL BASELINE

This Chapter presents the biophysical and social baseline conditions in the Project's Areas of Influence (AoI). The baseline was determined through a review of existing information and observations and interviews conducted during site visits. The objective of the biophysical and social baseline is to establish the characteristics of the existing conditions in the Project's AoI. The baseline serves as the reference point against which changes (impacts) can be predicted and monitored.

4.1 Project Area of Influence

For the purposes of this impact assessment, the definition of the Area of Influence (AoI) encompasses (IFC, 2012):

- *'The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the*

project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

- *Associated facilities are facilities that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.*
- *Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.'*

For the Project, the ***direct*** AoI is the spatial extent of the Project footprint and related facilities on the receiving environment. This encompasses the power plant total surface area (area within the fence line).

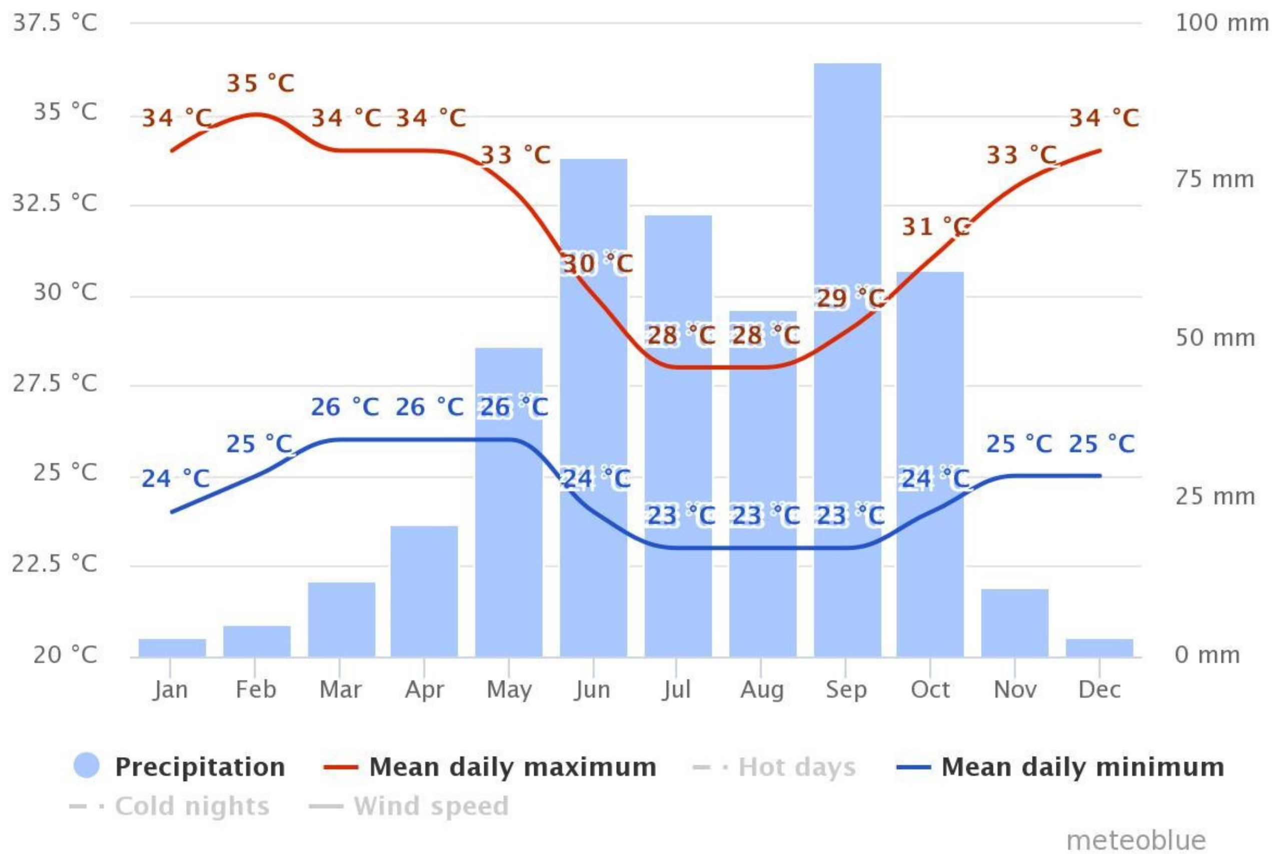
The ***indirect*** AoI encompasses areas potentially affected by cumulative impacts as well as areas that could be impacted indirectly by Project activities. The indirect AoI will differ between various resources and receptors depending on the dependencies. For example, indirect impacts to soils would be likely limited to the immediate areas around the direct footprint. Indirect impact on social resources may, however, extend to nearby communities, which may be affected by the Project. The Indirect Socio-economic AoI includes settlements within the Togba District on a wider radius of the Project site that may be affected by the Project.

4.2 Environmental Baseline

4.2.1 Climatic Conditions

The southern part of Benin, including the Project area, is characterized by high humidity. The highest mean daily maximum temperature of 35 °C occurs in February and the lowest mean daily maximum temperature of 28 °C occurring in July and August. The highest mean daily minimum temperature of 26°C occurs in March, April and May and the lowest mean daily minimum temperature occurs in July, August and September. The dry season occurs between November and March and the wet season between April and October. Figure 4-1 below, shows the summary of average daily minimum and maximum temperatures, as well as the annual amount of rainfall recorded.

Figure 4-1. Average Temperature and Precipitation in Cotonou, Benin

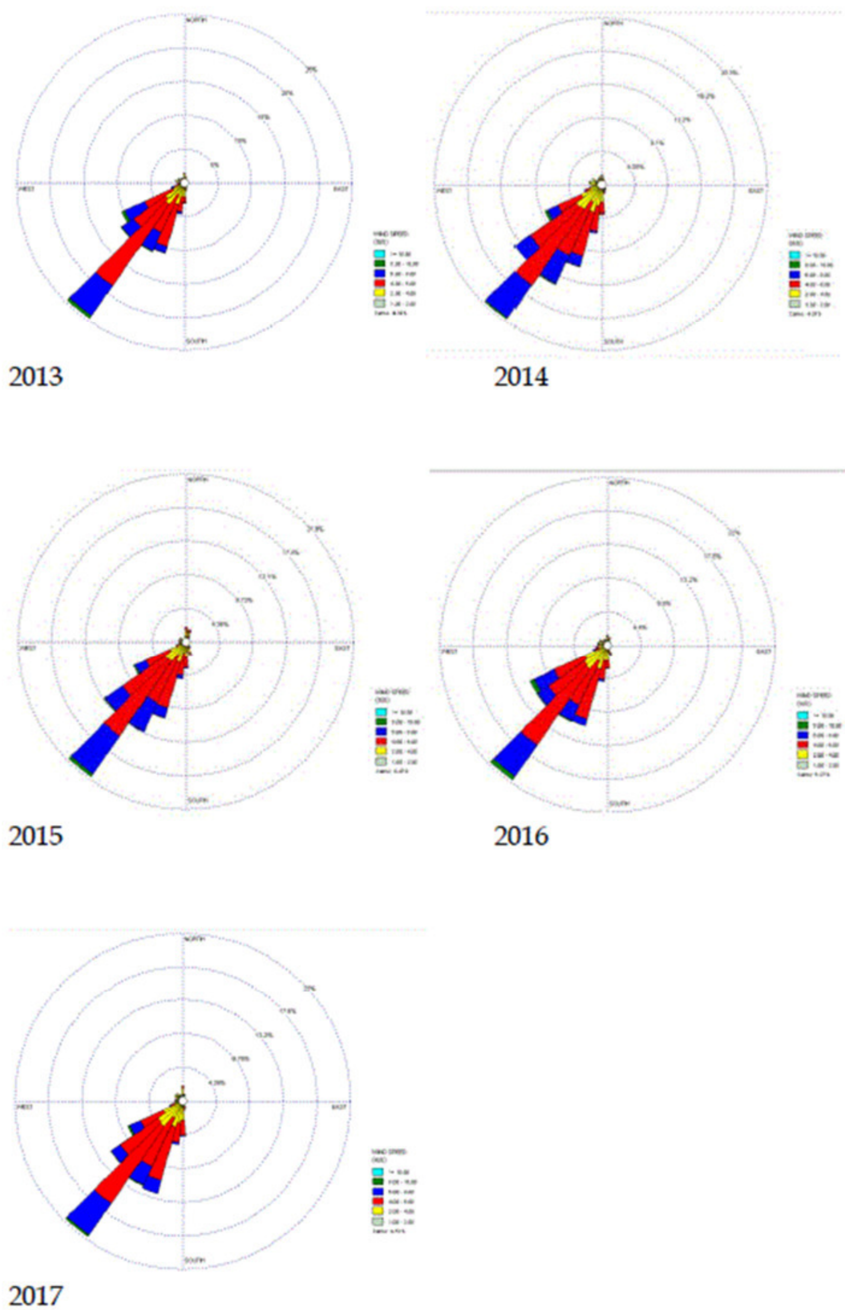


Source: Meteoblue, 2018

4.2.1.1 Wind

The wind rose from 2013 to 2017 is presented in *Figure 4-2* and show that the prevailing wind direction for the indirect AoI is from the southwest, and as is common within the West Africa region, strongly mono-directional from the southwest.

Figure 4-2. Wind Roses



4.2.2 Air Quality

The baseline for ambient air quality within the indirect AoI is dominated by anthropogenic (man-made) sources, principally combustion sources. These tend to be the same sources for both NO_2 and SO_2 and

include road vehicle emissions, fire for heating and cooking, industrial processes, and small scale waste burning.

The baseline for PM_{10} and $PM_{2.5}$ is influenced by both natural sources and man-made sources. In addition to combustion sources, emissions of PM_{10} and $PM_{2.5}$ also arise from diffuse sources such as open ground, vehicles using unpaved roads, industrial activity, waste burning, agriculture, natural dust and regional natural dust transportation.

Further information is provided in the Air Quality impact assessment section in *Chapter 6*.

A site specific baseline study will be shortly undertaken to confirm these baseline conclusions.

4.2.3 Climate Change

4.2.3.1 Greenhouse Gas (GHG) Emissions

Concern over increasing amounts of greenhouse gases in the atmosphere and their potential to influence global climate change has produced a number of initiatives, including the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. The stated objective of the UNFCCC is to achieve stabilisation of the concentrations of greenhouse gases in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Benin Government ratified the UNFCCC in February 2002.

Benin, like most other coastal nations, has a high proportion of the population living along the coast. Half the nation's population lives on the coast and in the city of Cotonou. The coastal location is important to Cotonou's economy but the coastal region is vulnerable to sea-level rise, with potentially catastrophic impacts on the economy, the population and natural systems.

The continued advance of the sea, coastal erosion and the rise in sea level, exacerbated by human activity on the coast, has medium- and long-term consequences that are already threatening vulnerable communities and disrupting the least-protected sensitive ecosystems.

As indicated in World Bank (2014) Benin’s national emissions have increased and were, as of 2014; 6,318 000 tonnes of CO_2 equivalents annually[3].

The climate is changing in the Tropics, as it is in the rest of the world (IPCC 2013). The effects of steadily rising concentrations of greenhouse gases on the climate may be less obvious to tropical residents, however, because they are overlain by considerable natural variability. High natural climatic variability, coupled with the rarity of long-term records in the Tropics, has so far made it difficult to detect the impacts of climate change on natural and human systems (IPCC 2014).

Moreover, the impacts of climate change are expected to interact with those of other, more direct, human impacts, including deforestation, population growth, increased urbanization and pollution, making it difficult to pin down the major drivers of change in any particular case.

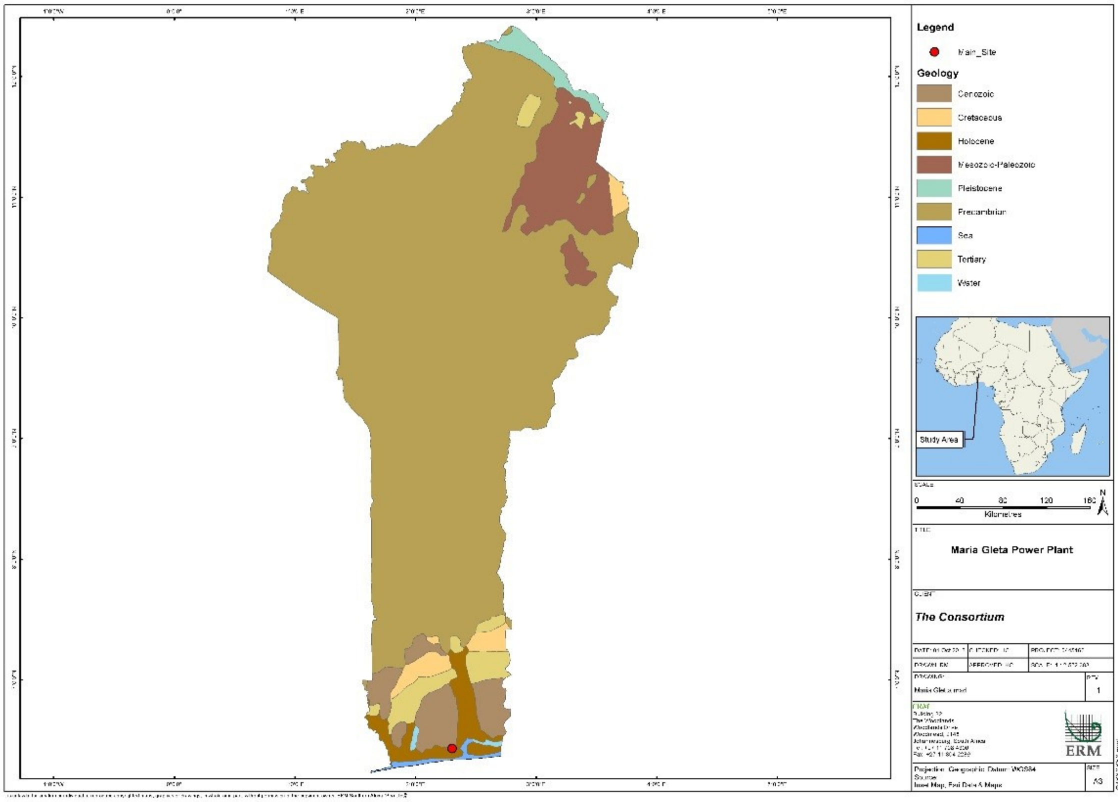
4.2.4 Topography and Geology and Soils

The topography of Benin consists of the coastal region, undulating and uniform central plain. The topographical relief is diverse and comprises low, sandy, and swampy areas, associated with lagoon environment in the coastal region.

The geomorphology of southern Benin is characterised by seven plateaus separated by large rivers and the geological depression of the Lama Forest area. This is formed by sediments deposited over the so-called crystalline basement, which inclines with approximately two percent towards the south. The crystalline basement is surrounded by three sedimentary basins: the coastal basin (meso-Cenozoic) in the south, the Kandi Basin in the north-east (Palaeozoic) and the Precambrian Voltaic Basin in the north-west (Faure et Volkoff, 1996). The project area is located within the coastal sedimentary basin. Figure 4-3 below shows the geological composition of Benin.

(3) https://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE?locations=BJ

Figure 4-3. Geology of Benin



Source: ERM, 2018

The dominant soils within the direct AoI are Dystric Regosols (Rd). Regosols are soils that have no diagnostic horizons or none other than (unless buried by 50 cm or more new material) an ochric A horizon. In practice, Regosols are weakly developed mineral soils in unconsolidated materials that have only an ochric surface horizon.

4.2.5 Hydrology

4.2.5.1 Surface Water

Surface water in the commune of Abomey-Calavi comprises mainly of Lake Nokoué and the coastal lagoon. According to Djihoussi *et al* (2016), aquatic habitats in Lake Nokoué have been profoundly impacted by urbanisation around the lake, resulting in riparian habitats including mangrove vegetation being destroyed on the south and western shoreline of the lake (Djihoussi *et al,* 2016).

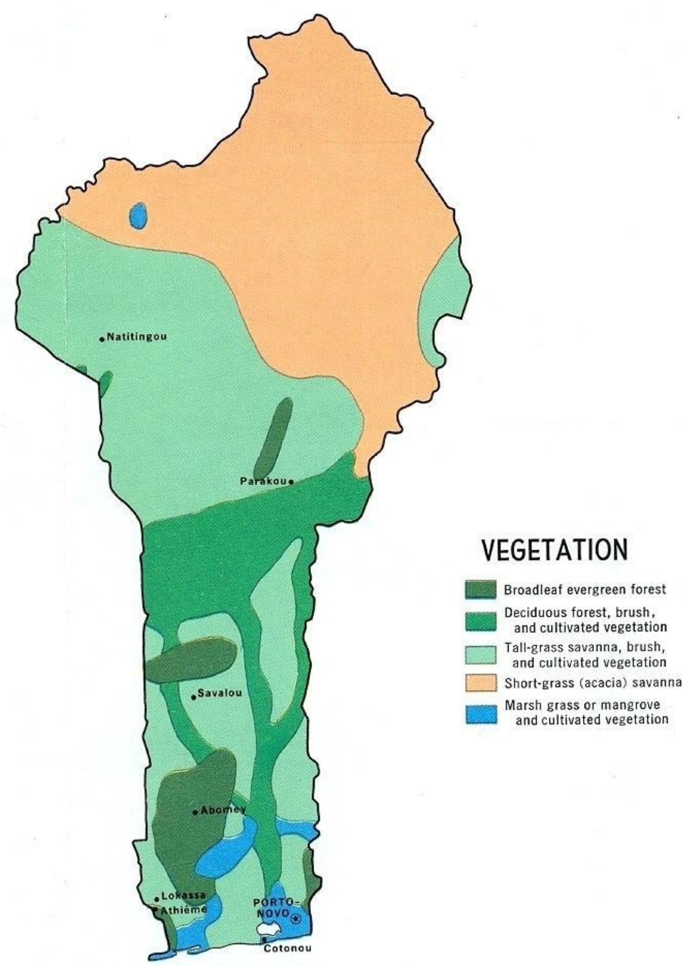
4.2.5.2 Ground Water

The direct AoI is underlain by unconfined aquifers of alluvium and argillaceous sandstone (both generally very porous with high yields) of between 20 and 80m thickness. There are two wells on the site which were drilled to 80m. Information is that the yield of the aquifers ranges from 20 to 1000 m^3/hr.

4.2.6 Flora and Fauna

The indirect AoI is characterised by forest-savannah mosaic consisting of tall grass, brush, fallow fields, oil palm plantations, refer to *Figure 4-4*. Within this broad area there are intermittent semi-evergreen/deciduous forest islands, which extend to the centre-western part of the country (Adomou, 2005).

Figure 4-4. Vegetation map of Benin



Source: http://tendeonline.info/wp-content/uploads/2018/08/vegetation-map-benin-africa.jpg

The forest resources within the indirect AoI are experiencing strong anthropogenic pressure resulting in the loss of vegetation cover for coconut groves and mangroves trees. In addition, the savannah is degraded and dominated by the oil palm and swamps and along the banks of the Lake Nokoué. The remaining forests within the Project Area of Influence include the forest of Baha, Ouèdo and Djigbé.

The Direct Area of Influence is located in a peri-urban environment and as such there are only common species of flora present. No sensitive species were identified during the site visits.

4.2.6.1 Fauna

Commonly observed fauna in the indirect AoI include mice, rats, reptiles (snakes, lizards and tortoises), insects and amphibians in the wetland area.

The avifauna, observed in the Project area is associated with a woody environment and includes *Capucin nonnette*, Raven, Pious, Coucal of Senegal, *Euplecte franciscan*, Monseigneur, Euplecte to Gold back, Martin- Fisher (wetland), Sparrow tisserin, House Sparrow, Brown Souimanga, Tisserins, Black Tisserin, Souimanga, African Merle and African Piapiac.

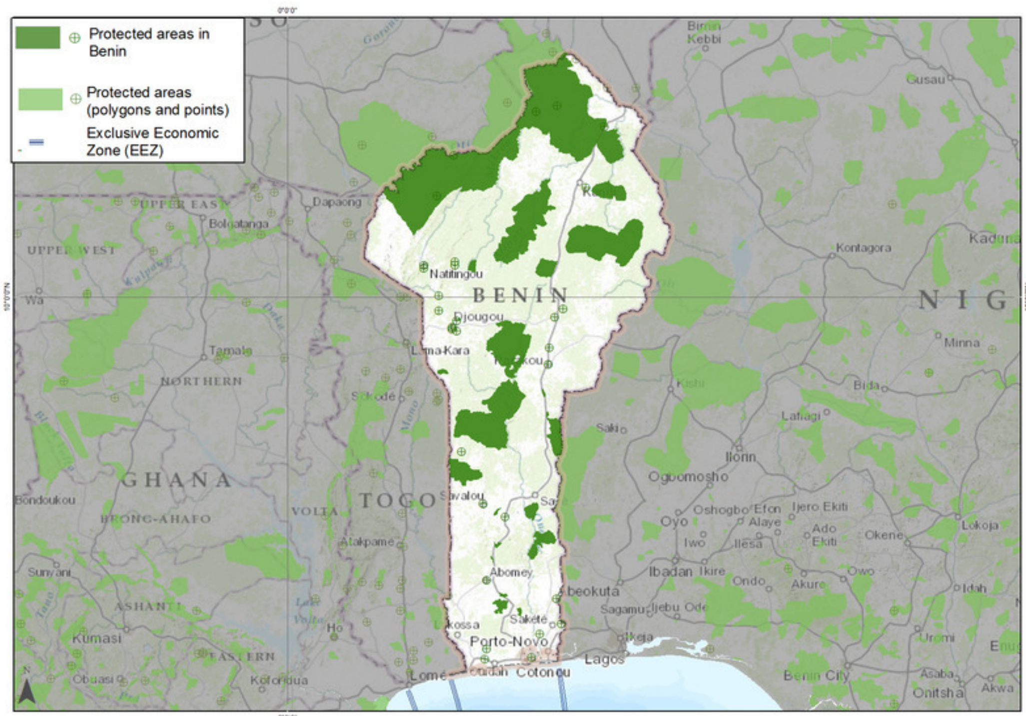
The Direct Area of Influence is located in a disturbed peri-urban environment and as such there are only common species of fauna present. No sensitive species were identified during the site visits.

4.2.7 Protected Areas

PAs defined by the International Union for Conservation of Nature (IUCN), protected areas are geographical spaces that are recognised, dedicated and managed through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values (Vodouhe et al, 2010). About 22.7% of the total land area in Benin is legally protected (CENATEL 1992, FAO 2001b).

The protected areas are shown in *Figure 4-5* below.

Figure 4-5. Protected Areas in Benin



Source: http://www.biodiversitya-z.org/content/benin

The Project is not located in a Protected Area.

4.3 Social Baseline

This section describes the social environment in which the Project is situated.

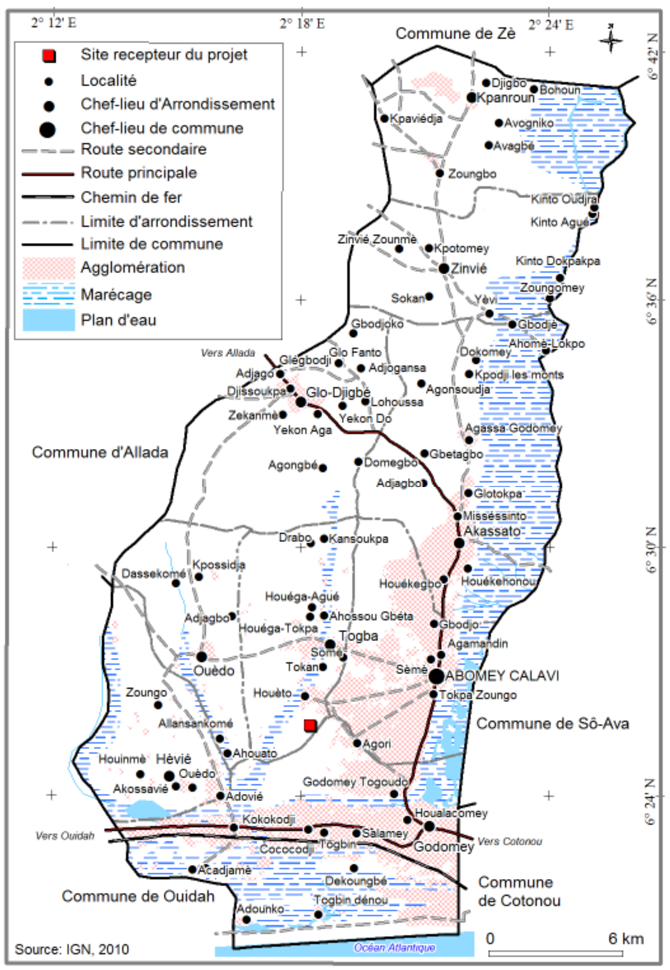
The description provided in this section is based on community, settlement, and household level data collection which was obtained through desktop review of secondary information and primary data collection.

4.3.1 Location and Area of Influence

The Project will be built on a 3ha parcel of land, located within a wider 23.5 ha parcel of land acquired by the government. The government relocated people from the site in 2016 to allow development of the Project. In addition to Project Affected People (PAPs) (Any person who as a results of the implementation of the project loss the rights to own, use or otherwise benefits from a built structures, land (residential or agriculture) perennial or annul crops and tress or any movable or fixed either in part or in full)., there are land owners and users located in the inhabited areas adjacent and near to the Project site and associated infrastructure. These people are referred to as Project Affected Communities (PAC) in this report.

The socio-economic baseline description is focused on the local level. The Project is located within Togba District (*Figure 4-6*), situated in the Commune of Abomey-Calavi.

Figure 4-6. Administrative Boundaries of the Project Site



4.3.2 Administrative Context and Demographic Profile

The Project is located in the commune of Mairie d'Abomey Calavi, within Togba Arrondisement (population of 73,000 in 2013). Six Project-affected villages are located adjacent to the Project site: Ouéga Tokpa, Somé, Houeto, Maria Gleta, Tagbé and Fifoncé.

The Cahier de Village dated February 2016 (*Effectifs de la population des villages et quartiers de ville du Benin - RGPH-4, 2013*) noted that Houeto (the village most impacted by the Project) has 6,816 households with 31,411 people including 15,662 men and 15,749 women. The average household was 4.6 persons.

Houèto area is the largest settlement cluster in terms of population immediately adjacent to the Project site (National Institute of Statistics and Economic Analysis (INSAE/RGPH), 2014). Tokan and Ahossou-Gbéta are jointly second largest with 16,000 inhabitants each (INASE/RGPH, 2014). The smallest village of the district, Drabo, has 3,000 inhabitants (INSAE/RGPH, 2014).

According to the baseline survey in the Original ESIA, 81% of the population in the Direct AoI (referring to the 23.5 ha area where resettlement took place) are aged under 40 years old. 32 PAPs are over 60 years old. About 74% of households lived in their homes on the Project site for more than 10 years, and 13% for over 20 years. The birth rate within the broader area is 36.40%, and the child mortality rate is 54.2 deaths / 1,000 live births (INSAE, 2013). The age distribution of the population on the Project site is indicated in the below table. It is anticipated that this is representative of the age distribution in the broader area. From the information available, the majority of the population within the area is within the young adult age group category. In and out migration fluctuates significantly. One form of migration is related to the arrival of students to the area of Maria-Gleta

Table 4-1. Population Distribution by Age on the Project Site

Age Group	Number
>60	32
40-60	196
20-40	408
10-20	262
<10	289
Total	1181

Source: Data collected during 2017 survey

A full census of PAPs including household compositions and socio-economic information related to gender, age, ethnicity, relationship to land owner, occupation, number of students and pupils and date of first settlement onsite is available.

Data collected in 2018 indicates there are no people residing within the Direct AoI. 2017 survey data suggested there were 1,181 people living on the 23.5ha Project site including 461 pupils and 39 students, it should however be noted that the term 'living' was not defined in the source document and is assumed to refer specifically to people that resided on the land Recent cadastral mapping indicates that this included 395 plots, where 255 plots are vacant.

There are eight public primary schools and a public college within the Houéto settlement. Houèto High School is located adjacent to the northern Project boundary. It has 3,343 students and 207 teachers and administrative staff as of 2017. It is the largest of its kind in the arrondissement catering to students

from 10 to 23 years old. This school is regarded as the largest public space adjacent to the Project site. The interaction between young female students and male workers employed onsite was raised as a concern as a result of the ongoing IDB construction activities. There is also a private "Mondukpè school" located on the site.

Recent findings indicate that the population within the school has decreased in number; the students in the school now number 3,233 for the 2017-2018 academic year. When compared to past trends the population of students within the school has typically always increased. This may be due to the relocation of parents away from the school adjacent to the Project site, as a result of resettlement and the provision of compensation payments. Other comparable colleges exist in the wider Calavi Commune. The neighbouring colleges include a CEG in Tankpé with 1,000 students for secondary education (10 to 18 year of age), and a CEG in Housou Beta with 1,200 students.

4.3.3 Livelihoods and Economy

Farmers, herdsmen and fishermen represent only about 11% of the working population in the commune, according to 2016 data. There is a high degree of urbanisation in the commune. Subsistence family-based agriculture is prevalent. High demand for residential plots in the Abomey-Calavi commune has seen an associated increase in price and scarcity of agricultural land. Some small scale family-based husbandry and breeding of livestock exists as a result of pressure on agricultural land. Agriculture is a prominent activity in the area surrounding the Project site. The crops that are grown within the area are cassava, maize and perennial crops such as banana and oranges.

Agricultural activities are undertaken by 18.2% of working community members, 36% work in the commercial sector. Processing and storage of primary agricultural products is undertaken amongst the residential areas in Houeto village and the wider commune of Abomey Calavi.

Palm oil is also produced, tomato purée preserved, and food milling workshops operated. These are labour intensive activities primarily employing women. Small scale market gardening is also practiced. Raw materials for processing are not available continuously, due to the seasonal nature of crop harvesting. The main marketable products are both food crops and imported products. Food crops are supplied from markets within the municipality and up-country markets, especially during lean/dry seasons.

Cotonou is the main source of imported products supplies. Data from the March 2018 survey show that there are a total of 22 markets throughout all districts.

Women in the direct AoI specialised in the preparation of the traditional mustard afitin (using seed from néré) and transforming cassava into gari. This was often sold to the neighbouring CEG Houeto School amongst other food products. It is reported that the resettlement process has impacted the amount of small business being undertaken around the site, as previously business owners have bought houses and land further afield in the Commune.

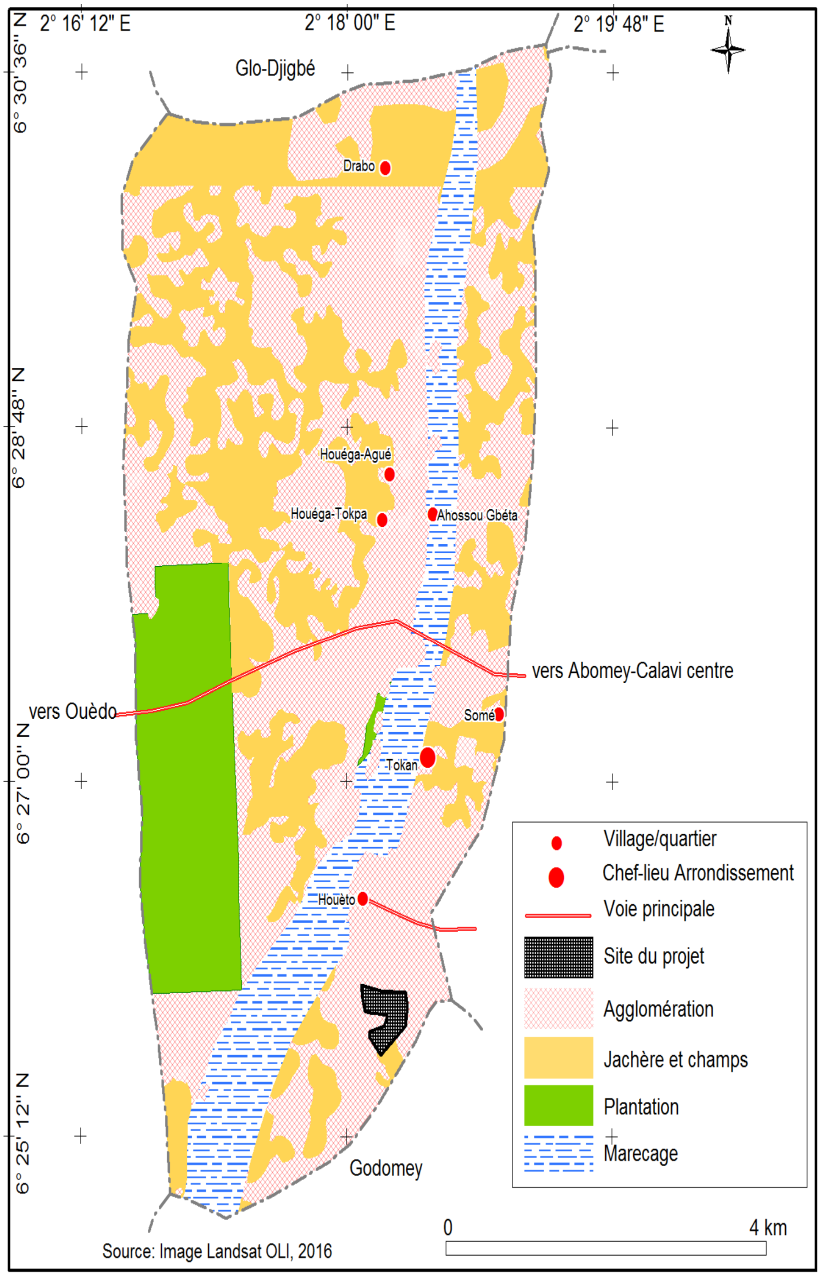
Other dominant economic activities still undertaken in Houèto include commerce, crafts and catering. There are also a group of traditional motorcycle taxi drivers, some state employees, and young people who deal in mobile telephony products (sale of mobile phones, credit for telephones, money transfers via mobile phone, etc.).

The majority of the people within the indirect AoI are bricklayers, tailors, carpenters, welders, and hairdressers. Equipment used by these workers are more or less modernized with diverse features depending on occupation areas. The craftspeople in the community are often poorly educated, lack adequate information and are reluctant to join associations or profit-related association or working groups. Lack of start-up investments upon completion of apprenticeship programmes is often a problem for these trades. The potential for tourism is reported as being low.

No large-scale businesses were reported to have been located onsite. However, the commune and arrondissement in which the Project is located has a plentiful variety of small scale businesses selling various products, artisanal trade, craft and services. These include mechanics, bricklayers, dressmakers, carpenters, welders, and hairdressers. Some inhabitants provide motor-taxi services. About 62 PAPs noted that they carried out an economic activity at or close to their home.

The average income of the population is less than 70,000 FCFA (125 USD). Nationally, the salary of a middle manager employed by the State Government rarely exceeds 150 000 FCFA (268 USD) per month and the minimum wage remains at 40 000 FCFA.

Figure 4-7. Land Uses within the District



4.3.4 Infrastructure

A small church, several small private clinics, and a private school named Mondukpè were located onsite. Several other churches, eight public primary schools, a multitude of private primary and secondary schools and clinics exist in the surrounding area. There are several public services and essential infrastructure located within the surround areas.

The site access will be via a new access road to be built for the IDB Project and will be connected to existing roads. The equipment needed to build the plant will be transported by trucks from the port of Cotonou.

The route followed from the Port will be largely the RNIE1 from Cotonou then RNIE2 in direction of Abomey Calavi. Other than these roads, there are other unpaved roads in the vicinity of the Project site.

It is reported that less than 10% of the local population have access to electricity within the arrondissement of Togba. Energy sources include SBEE, lamps and some families use Oryx gas. Most households use charcoal for cooking.

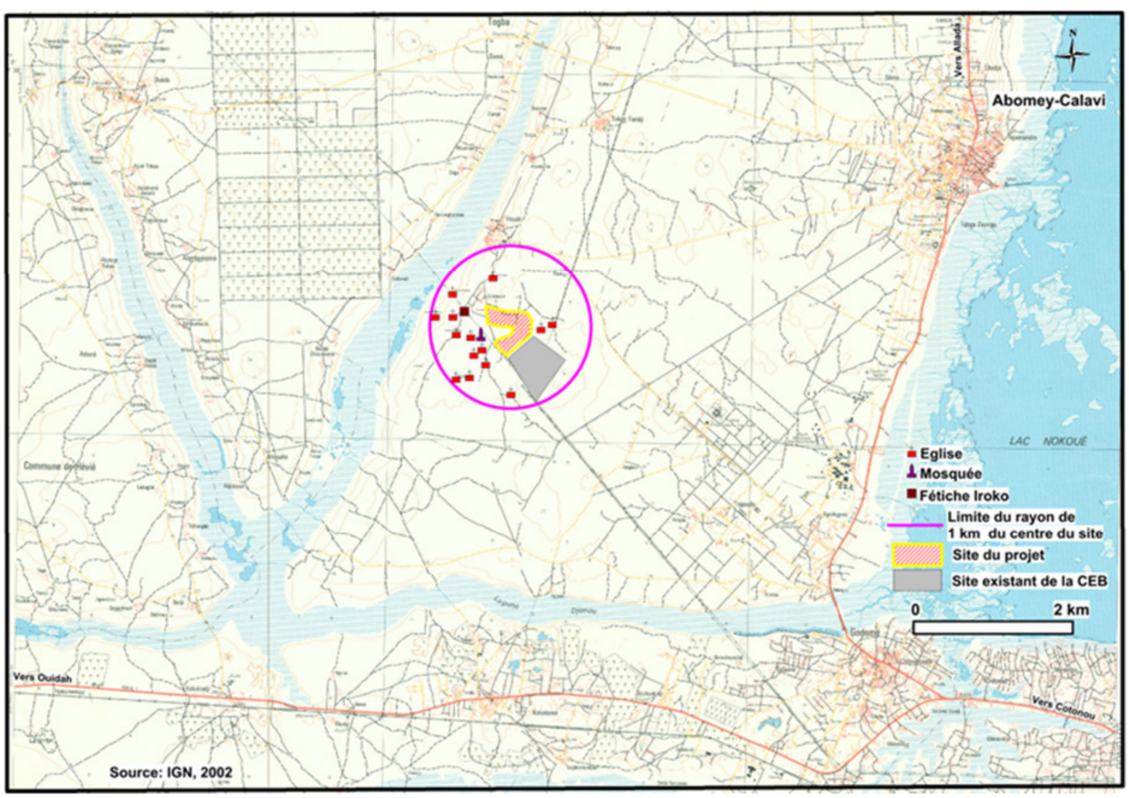
The village of Houèto is not served by the pipes of SONEB *Société Nationale des Eaux du Bénin.* The majority of the population obtains water from traditional wells which are often not covered and not waterproofed inside. The upper water table is reported to be at about 40m below the ground surface. There is also a deeper water table at approximately 60m below the ground surface.

In terms of sanitation, toilets are mostly traditional open pit long drop latrines. There are piles of garbage in various neighbourhoods around the site that remain to be collected. After the rains, water can often stagnate on the roads and around the houses of residents around the Project site for several days.

4.3.5 Cultural Heritage

There are no cultural assets within the direct AoI. Neither is there mention of any graves on the land acquired by the GoB. However, numerous cultural heritage features occur within the west of the AoI. These include churches, mosques and the Iroko shrine. Data from the 2013 population census (INSEA/RGPH, 2013), indicates that the population has reached approximately 32,000 inhabitants, mainly dominated by the ethnic or socio-linguistic group known as *Fon*. The prominent regions within the Indirect AoI are Catholicism, Voodoo, Celestial Christianity, Evangelical Protestantism and Islam. The spatial distribution of the cultural assets within the Indirect AoI are indicated in *Figure 4-8* below.

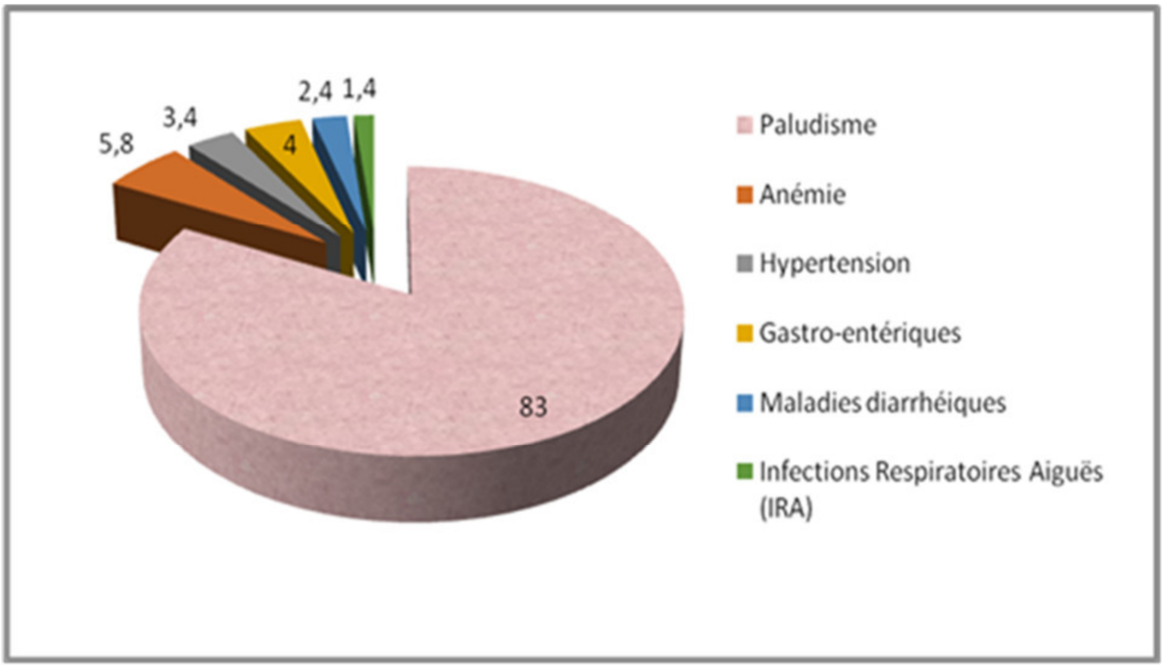
Figure 4-8. Spatial Distribution of Cultural and Religious Assets



4.3.6 Community Health

The most common health issue affecting the community residing in the indirect AoI is malaria (*paludisme*). *Figure 4-9* provides details of the common health conditions affecting the communities within the project surroundings.

Figure 4-9. Prevailing Health Conditions in the Project's Indirect Area of Influence



Supplementary social baseline update report (statistical data from health centres and survey data) - April 2018

Noise and air emissions from the Rental Power Plant 1 backup generators (not part of the IPP project but adjacent to it) has reportedly led to noise disturbance amongst nearby residents and CEG Houèto pupils. It was reported onsite that this has led some pupils to switch schools although this could not verified.

5. IMPACT ASSESSMENT

5.1 Introduction

The Original ESIA was conducted by Tractebel Engineering in 2017 and submitted to the Ministry. The necessary ESIA approvals for the Project were given by the Ministry in April 2017. The ESIA was prepared in accordance with Beninese legislative requirements and provides detail on identified environmental risks and potential associated impacts.

Impacts and risks to the following resources and receptors were assessed:

- Air quality;
- Climate;
- Odour;
- Noise and vibration;
- Soil;
- Groundwater;
- Surface water;
- Fauna;
- Flora;
- Visual; and
- Socio-economics.

The ESIA was undertaken to meet Beninese permitting requirements and assessed a 400 MW power plant. In reality two separate 127 MW power plants (referred to as the IDB and IPP Projects in this report) will be constructed with a shared 18 MW steam turbine (to be constructed as part of the IPP Project). As such this Updated ESIA for the IPP Project presents a consolidated report providing an updated assessment of those impacts no longer valid due to Project Description changes and summarising the impacts assessed in the Original ESIA.

5.2 Key Impacts

The Gap Assessment undertaken identified a number of gaps that would need to be filled in order for the Project to meet international standards, these were largely related to the change in Project design since the undertaking of the ESIA.

It was identified that the following key impacts required additional consideration:

- Air quality – specialist remodel of new Project design.
- Noise – specialist remodel of new Project design.
- Groundwater – groundwater specialist input to determine requirement for additional baseline data gathering and impact assessment.
- Traffic – traffic specialist input to update impact discussion and develop a traffic/transport management plan
- Cumulative Impacts – update to air, noise and traffic based on updated Project Design.

Specialists were identified to undertake the air and noise modelling and provide input into the groundwater and traffic/transportation impacts identified. The following sections provide a detailed updated assessment of the air quality and noise impacts, as well as a description of the social impacts.

5.2.1 Air Quality

The Original ESIA assessed air quality impacts based on the proposed 400 MW Project considered by the ESIA. As previously indicated Phase A was envisaged as a 120 MW plant and Phase A + B as a total of 400 MW. Given the changes in the Project subsequent to the ESIA, re-modelling of air quality

impacts for the proposed facility is necessary to ensure impacts to community health are quantified and abated if necessary.

5.2.1.1 Introduction

Air quality refers to outdoor air. From the perspective of human beings pollutants in air are breathed in and when present above certain concentrations these can lead to negative impacts on health. Air Quality standards and guidelines are set to protect the health of people. As there is an element of cost and benefit when setting these, standards and guidelines can vary between different organisations.

In the general environment there is a ubiquitous baseline arising from natural sources and other human activity. The impact assessment considers the contribution from the project (the Process Contribution – PC), and also the PC added to the baseline (the Predicted Environmental Concentration – PEC). The PC and PEC are then compared to the air quality standards and guidelines to determine the significance of the impacts.

In the first year of operations the plant will utilise Heavy Fuel Oil (HFO). Some gas supply will likely be available, but this will be insufficient to fully supply the plant. When operating on HFO, air quality standards for SO_2 are predicted to be exceeded on a limited number of occasions when using fuel of greater than 0.5% sulphur content. This arises due to emissions from the IPP Project alone, and also when operating in conjunction with the IDB Project.

Monitoring is proposed to be undertaken to allow mitigation measures to be implemented during those periods when elevated concentrations arise. The mitigation is detailed further later.

The pollutants of interest will be:

- Gas:
  - Oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2);
- HFO:
  - NO_x and NO_2;
  - Particulate matter (as PM_{10} and $PM_{2.5}$); and
  - Sulphur dioxide (SO_2)

5.2.1.2 Air Sensitive Receptors and Baseline Conditions

The power plant is situated in a suburban area to the northwest of Cotonou. The surrounding area is suburban, with low density housing and light industry surrounding the site. An illustration of the settlement density of the indirect AoI is provided in *Figure 5-1* below.

Figure 5-1. Power Plant and Settlement Density in Surrounding Area

Ambient air quality in the vicinity of the power plant and at nearby receptors is influenced by factors such as NO_2 and SO_2. The baseline is dominated by man-made sources such as road vehicle emissions, heating and cooking fires, industrial processes, small scale waste burning etc.

In the case of PM_{10} and $PM_{2.5}$ the baseline is influenced by both natural sources and man-made sources. In addition to combustion, sources arise from diffuse sources such as open ground, vehicles using unpaved roads, industrial activity, waste burning, agriculture, and dust emission from local and regional scale due to movement of vehicles on unpaved roads and surfaces.

The baseline for this study is regarded as air pollution that would exist without the presence of the proposed power plants. Professional judgment has been used to identify the likelihood of the airshed being degraded or undegraded for the pollutants of interest.

There is an existing $20MW_e$ power plant adjacent to the Project. This plant is of an old design and inefficient and will not be operated once the Project is operational. Therefore, this does not need to be considered in the baseline or in the cumulative impacts. There are also tentative proposals for a new $20MW_e$ plant adjacent to the Project. This has also not been considered in the cumulative assessment, as this is not anticipated to go ahead when the Project is operational.

The baseline will be confirmed through a site-specific survey that will be conducted in early 2019, well before Project construction commences.

5.2.1.3 Assessment Methodology

An approach that combines impact magnitude with resource/receptor sensitivity is used to determine impact significance. The assessment uses dispersion modelling to identify the increase in air pollutants at ground level attributable to the emissions from the power plant. With due consideration of the baseline, the potential for significant impacts to occur is ascertained.

Identifying Impact Magnitude

As previously indicated the predicted change in ground level concentrations of pollutants from the Project is referred to as the 'Process Contribution (PC)'.

In order to consider the significance of potential impacts, the existing baseline also needs to be taken into consideration. The sum of the PC and the existing baseline is described as the Predicted Environmental Concentration (PEC). The significance of potential impacts, using both the PC and PEC, is determined following IFC guidance as described below.

The IFC General EHS Guidelines state:

"Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that:

Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources.

And:

Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed [ie in an undegraded airshed]".

In practice, the '25% rule' is generally being applied more stringently by lenders.

The IFC also state:

"An airshed should be considered as having poor air quality [degraded] if nationally legislated air quality standards or WHO Air Quality Guidelines are exceeded significantly".

And:

"Facilities or projects located within poor quality airsheds, and within or next to areas established as ecologically sensitive (eg national parks), should ensure that any increase in pollution levels is as small as feasible, and amounts to a fraction of the applicable short-term and annual average air quality guidelines or standards as established in the project-specific environmental assessment."

Using this approach, the PC and PEC are established, and with consideration of the airshed, the overall magnitude is determined. The criteria for ascertaining the magnitude adopted for this project are set out in *Table 5-1*.

Table 5-1. Determination of Magnitude

PC as % of Air Quality Standards (AQS)	Magnitude
Undegraded airsheds where PEC < Air quality standards/guidelines	
<10%	Negligible
10-25%	Small
25-75%	Medium
>75%	Large
Degraded airsheds ie where PEC> Air quality standards/guidelines	
<5%	Negligible

5-10%	Small
10-25%	Medium
>25%	Large

Receptor Sensitivity

Sensitivity for human health within the general population is generally considered 'Medium'. In an assessment, this applies at all sensitive human receptors. As air quality standards are set to protect the most vulnerable individuals in society, there is inherently a margin of safety within air quality standards. 'High' sensitivity would only be applied in a small number of specific cases, such as hospitals with intensive care wards. A 'Low' sensitivity is typically only applied to locations where people are transient, for example agricultural areas or fishing areas.

Determining Significance

Once magnitude of impact and sensitivity of receptor have been characterised, the significance can be identified. Impact significance is determined using the matrix shown in the *Table 5-2* below.

Table 5-2. Impact Significance

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

5.2.1.4 Legal Framework

Overview

The assessment follows guidance set out by the IFC in the General EHS Guidelines for air quality[4] and the EHS guidelines for EHS guidelines for Thermal Power[5]. The IFC Guidelines for Thermal Power Plants state that the most stringent of either nationally legislated air quality standards or IFC guidelines should be used. As there are legislated air quality standards in Benin, these have been considered in the assessment. The legal framework for air quality is separated into two elements: ambient air quality standards and emissions limits for pollutants to air.

[4] International Finance Corporation (2007) Environmental, Health and Safety Guidelines: General EHS Guidelines: Environmental Air Emissions and Ambient Air Quality

[5] International Finance Corporation (2008) Environmental, Health and Safety Guidelines: Thermal Power

Ambient Air Quality Standards

Air quality standards are set at the point below which it is reasonable that there is negligible risk of harm to exposed people. These standards are set to protect the large majority of the population including the elderly and young children.

Benin:

The Benin Air Quality Standards relevant to this study are set out in *Table 5-3*.

Table 5-3. Benin Air Quality Guidelines

Pollutant	Averaging period	Air Quality Standard (µg/m3)
NO_2	Annual mean	100
	24 hour maximum	150
SO_2	Annual mean	80
	24 hour maximum	200
	1 hour mean	1300
PM_{10}	Annual mean	50
	24 hour maximum	230

Source: Ministere de l'energie, de l'eau et des mines (2017) Projet De Construction De La Centrale Thermique A Moteurs Dual Fuel (Gaz-Hfo) Sur Le Site De Maria-Gleta 2 (400 MW), Quoting: Air quality standards Decree No. 2001-110 of 04 April 2001)

IFC:

The IFC air quality guidelines relevant to this study are set out in Table 5-4.

Table 5-4. IFC Air Quality Guidelines

Pollutant	Averaging period	Air Quality Standard (µg/m3)
NO2	Annual mean	40
	1 hour maximum	200
SO2	24 hour maximum	125
	10 minute maximum	500
PM10	Annual mean	70
	24 hour mean, not to be exceeded more than 3 times per year	150
PM2.5	Annual mean	35
	24 hour mean	75

Source: IFC (2007) EHS Guidelines: Air Emissions and Ambient Air Quality

Emission Limits

Emission limits are set as the maximum permissible concentration of pollutants that can be emitted from the plant. These are included in this report for the purpose of allowing comparison of the predicted impacts with the emission limits.

Benin

The emission limits applicable to engines on gas and on HFO are summarised in *Table 5-5.*

Table 5-5. Benin Emission Limits for Engines

Pollutant	Emission Limit	Units	Notes
NO_x (Note 1)	325 611	ppm mg/Nm^3 (at 3%O_2 dry, 273K)	
PM_{10}	85	mg/Mj	Operation on liquid fuels

Source: Air quality standards Decree No. 2001-110 of 04 April 2001

Note 1: Emission limits relate to total NO_x emissions, whereas air quality standards refer only to the NO_2 fraction of NO_x. The conversion from NO_x to NO_2 is discussed in *Annex A to the Air Quality Technical Report*.

Note 2: Benin introduced a 50ppm fuel sulphur limit in 2016 for diesel fuels.

IFC

The power plant has a sum total power greater than 50MW$_{thermal}$, and is therefore subject to the emission limits set out in the EHS Guidelines for Thermal Power Plants. As the Phase 2 plant is less than 300MW$_{thermal}$ in isolation, and HFO use will be temporary, the emissions limits applicable to the project are the higher threshold emission limits. The emission guidelines applicable to dual fuel reciprocating engines operating on gas and HFO are summarised in *Table 5-6.*

Table 5-6. IFC Emissions Guidelines for Reciprocating Engines

Pollutant	Emission Limit operating on natural gas 3 – 15 MWth	Units
Gas		
NO_x	400 (Dual Fuel engine, undegraded airshed)	mg/Nm^3 (at 15%O_2 dry, 273K)
HFO		
NO_x	2000 (Dual fuel engine, undegraded airshed)	mg/Nm^3 (at 15%O_2 dry, 273K)
PM	50	mg/Nm^3 (at 15%O_2 dry, 273K)
SO_2	1,170 or use of 2% or less S fuel	% Sulphur

Note 1: Emission limits relate to total NO_x emissions, whereas air quality standards refer only to the NO_2 fraction of NO_x. The conversion from NO_x to NO_2 is discussed in Annex A to the Air Quality Technical Report.

These emission limits are not legally binding, as they are provided by the IFC as guidelines rather than set out in Benin law. However, it is anticipated that, as a minimum, lenders will expect these to be achieved.

5.2.1.5 Impacts on Air Quality

This *Section* assesses the impacts to air quality arising from activities during the construction and operational phases of the Project.

Construction Phase

Project Activities

The construction of the Project would result in impacts to air quality by two means:

- Increases in road traffic and subsequent exhaust emissions; and
- Emissions of dust and PM_{10} from construction activities and the movement of vehicles over unpaved roads and surfaces.

Impact Significance (Pre-mitigation)

The number of vehicles movements likely to be generated by the scheme fall below screening thresholds set out by the IFC and Institute of Air Quality Management (IAQM) (6), and are therefore considered to result in **Negligible Impacts**.

Unmitigated the project has the potential to result in **Major Negative** Impacts at receptors within 350m of the site boundary. This is due to emissions of dust and PM_{10} from the construction site. Emissions can arise from a variety of sources including: earth stripping; topsoil stockpiling; concrete batching; dust blown from open ground; trackout from vehicles accessing the site; the movement of vehicles over open ground; and material handling.

Mitigation Measures

The following specific mitigation measures will be implemented as appropriate during the construction phase to control emissions of nuisance dust and PM_{10} from construction activities:

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked.
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Avoid site runoff of water or mud.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas.
- Use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays, where possible.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.

(6) The IFC do not specifically set out screening criteria for traffic. However, the IFC do state that operators with fleets of more than 120 heavy goods vehicles should consider low emissions vehicles. The IAQM are prescriptive and state that in an undegraded airshed increases in vehicle number of less than 100 HGVs are unlikely to impact on air quality. Whilst the vehicle fleet in Benin may be somewhat older and therefore more polluting that the UK fleet, in lieu of any other guidelines, these thresholds are used in this assessment.

- Avoid bonfires and burning of waste materials.
- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- Ensure vehicles entering and leaving work sites are covered to prevent escape of materials during transport.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

Residual Impact (Post-mitigation):

Based on the implementation of the proposed mitigation measures during the construction phase, the significance of the impact to dust is expected to reduce to "**Negligible or, at worst, Minor Negative Impact**" post mitigation.

Operation Phase

Project Activities

The proposed Independent Power Producer (IPP) Project is a new 144- MW combined cycle, thermal power generation plant comprising:

- 7 x MAN 18V51/60 DF dual-fuel fired reciprocating engines (each producing 18.2 MW totalling 127 MW) and associated radiator coolers.
- Steam turbine system (producing 18 MW) and associated air-cooled condensers (ACC).
- Associated infrastructure including diesel fuel tanks and offloading station, connection to natural gas supply manifold, connection to power grid sub-station and plant support facilities.

The 144 MW IPP power plant will be built on an approximately 3-hectare piece of land, and would be adjacent to a similar thermal power station (127 MW) currently under construction. For the purpose of this impact assessment, the adjacent 127 MW power plant under construction will be referred to as the IDB power plant because the Islamic Development Bank is one of the main financiers of the power plant (the other financier is the West African Development Bank). The IDB power plant is essentially identical to the IPP power plant in terms of specifications and emissions. The IDB power plant has no steam turbine building and associated ACC. The 18 MW steam turbine and associated ACC listed above will produce electricity from residual engine heat from both the proposed IPP power plant and the adjacent IDB power plant.

Scenarios

There are a number of factors that affect the emissions and impacts from the IPP and in combination with IDB:

- The IPP and IDB plants will operate on HFO for 1 year, and transition to gas when gas become available for year 2 onwards. Of note is that it is expected that some gas will be available in Year 1, but insufficient to be the sole fuel.
- During year 1 the IPP and IDB plants will operate with a maximum of 11 engines as power demand will not be sufficient to require all engines to be operated.

- The IFC emission limits for SO_2 are based upon a fuel sulphur context of 2%. However, fuel with a lower sulphur content will be available, through the blending of fuels and also through the partial use of gas.
- The IPP and IDB plants will have waste heat recovery that will generate steam for a steam turbine. This will lower the emission temperature and exit velocity which will lead to poorer dispersion and higher impacts. Scenarios have been tested with the steam turbine online and offline as a potential mitigation measure.

Several different plant configurations and operational scenarios have been assessed, to investigate the effects of several different plant configurations and operational modes. These are set out in the *Table 5-7.* below.

Table 5-7. Emission Scenarios

Scenario	Plants assessed	Fuel	Number of Engines	Sulphur content	Waste Heat Recovery	NO_x as % of Emission Limit	Notes
1a	Project only	HFO	7	2%	WHR used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
1b	Project only	NG	7	n/a	WHR used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
2a	Project + Phase 1	HFO	14	2%	WHR used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
2b	Project + Phase 1	NG	14	n/a	WHR used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
2c	Project + Phase 1	HFO	14	2%	WHR not used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
3a	Project + Phase 1	HFO	11	1%	WHR used	85% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack, 6 engines Project, 5 engines Phase 1
3b	Project + Phase 1	NG	11	n/a	WHR used	85% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack, 6 engines Project, 5 engines Phase 1

Emissions Data

The parameters used in the modelling are set out in Table 5-8.

Table 5-8. Emissions Parameters

Parameter	Units	Project and Phase 1 Plant					
Number of engines in use		7	7	6	6	5	5
Fuel		Gas	HFO	Gas	HFO	Gas	HFO
Stack height	m	40	40	40	40	40	40
Individual flue diameter	m	1.61	1.61	1.61	1.61	1.61	1.61
Effective flue diameter (1) (2)	m	4.25	4.25	3.94	3.94	3.60	3.60
Emission velocity (2)	m/s	18.9	23.4	18.9	23.4	18.9	23.4
Volume flow rate Actual (2)	Am^3/s	269	333	230	285	192	238
Emission temperature (with WHR)	Celsius	170	170	170	170	170	170
Emission temperature (without WHR)	Celsius	N/A	300				
Emissions							
SO_2	mg/Nm^3	N/A	1130	N/A	1130	N/A	1130
NO_x	mg/Nm^3	400	2000	400	2000	400	2000
PM	mg/Nm^3	N/A	30	N/A	30	N/A	30
SO_2	g/s	N/A	297	N/A	127	N/A	106
NO_x	g/s	102	525	75	383	62	319
PM	g/s	N/A	13.1	N/A	11.2	N/A	9.36

Note 1: The effective diameter is calculated from the combination of individual flue diameters.

Note 2: In scenario 4 the exit velocity is kept constant. The effective diameter and volume flow rate are reduced to reflect the operations with 11 engines, rather than 14 engines.

Note 3: Increasing stack height was not considered a viable mitigation option, due to visual intrusion and the construction cost of the stack

Model Approach and Data

The assessment utilises the USEPA Aermod model. This requires various information, including information on local meteorology. This data, along with a detailed description of the modelling approach is set out in *Annex A*.

5.2.1.6 Results and Impact Significance

This section sets out the full suite of results for all scenarios investigated. The results for the relevant scenarios are set out in this Section.

Results for PM_{10}/$PM_{2.5}$ have not been presented for Scenarios 2c and 3a, as the impacts in 1a and 2a are insignificant so no further consideration of PM_{10}/$PM_{2.5}$ is required.

Table 5-9. Scenario 1a

Basis of AQS	Pollutant	Averaging period	AQS (µg/m³)	Baseline (µg/m³)	PC (µg/m³)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	6.01	6.0%
	NO_2	24 Hour Mean	150	Undegraded	24.5	16%
IFC	NO_2	Annual Mean	40	Undegraded	6.0	15%
	NO_2	1 Hour Mean	200	Undegraded	69.2	35%
Benin	SO_2	Annual Mean	80	Undegraded	57.1	71%
	SO_2	24 Hour Mean	200	Undegraded	**225 (Note 1)**	**113%**
	SO_2	1 Hour Mean	1300	Undegraded	662	51%
IFC	SO_2	24 Hour Mean	125	Undegraded	**225 (Note 1)**	**180%**
	SO_2	10 Minute Mean	500	Undegraded	**947 (Note 1)**	**189%**
Benin	PM_{10}	Annual mean	50	Degraded	0.6	1%
	PM_{10}	24 hour mean	230	Degraded	3	1%
IFC	PM_{10}	Annual mean	70	Degraded	0.6	1%
	PM_{10}	24 hour mean	150	Degraded	2.4	2%
	$PM_{2.5}$	Annual mean	35	Degraded	0.6	2%
	$PM_{2.5}$	24 hour mean	75	Degraded	3	4%

Note 1: IFC and Benin SO_2 air quality standards are exceeded due to Project emissions alone. This is based upon the use of HFO fuel with sulphur content of 2%

Table 5-10. Scenario 1b

Basis of AQS	Pollutant	Averaging period	AQS ($\mu g/m^3$)	Baseline ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	4.29	4.3%
	NO_2	24 Hour Mean	150	Undegraded	13.5	9.0%
IFC	NO_2	Annual Mean	40	Undegraded	4.29	11%
	NO_2	1 Hour Mean	200	Undegraded	28.8	14%

Table 5-11. Scenario 2a

Basis of AQS	Pollutant	Averaging period	AQS (µg/m^3)	Baseline (µg/m^3)	PC (µg/m^3)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	11.2	11%
	NO_2	24 Hour Mean	150	Undegraded	45.3	30%
IFC	NO_2	Annual Mean	40	Undegraded	11.2	28%
	NO_2	1 Hour Mean	200	Undegraded	115	57%
Benin	SO_2	Annual Mean	80	Undegraded	**113 (Note 1)**	**141%**
	SO_2	24 Hour Mean	200	Undegraded	**443 (Note 1)**	**221%**
	SO_2	1 Hour Mean	1300	Undegraded	**1214 (Note 1)**	**93%**
IFC	SO_2	24 Hour Mean	125	Undegraded	**443 (Note 1)**	**354%**
	SO_2	10 Minute Mean	500	Undegraded	**1736 (Note 1)**	**347%**
Benin	PM_{10}	Annual mean	50	Degraded	3	6%
	PM_{10}	24 hour mean	230	Degraded	12	5%
IFC	PM_{10}	Annual mean	70	Degraded	3	4%
	PM_{10}	24 hour mean	150	Degraded	9.6	6%
	$PM_{2.5}$	Annual mean	35	Degraded	3	9%
	$PM_{2.5}$	24 hour mean	75	Degraded	12	16%

Note 1: IFC and Benin SO_2 air quality standards are approached or exceeded due to Project and Phase 1 emissions. This is based upon the use of HFO fuel with sulphur content of 2%.

Table 5-12. Scenario 2b

Basis of AQS	Pollutant	Averaging period	AQS (µg/m^3)	Baseline (µg/m^3)	PC (µg/m^3)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	5.39	5.4%
	NO_2	24 Hour Mean	150	Undegraded	17.1	11%
IFC	NO_2	Annual Mean	40	Undegraded	5.39	13%
	NO_2	1 Hour Mean	200	Undegraded	45.1	23%

Table 5-13. Scenario 2c

Basis of AQS	Pollutant	Averaging period	AQS (µg/m^3)	Baseline (µg/m^3)	PC (µg/m^3)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	6.48	6.5%
	NO_2	24 Hour Mean	150	Undegraded	25.6	17%
IFC	NO_2	Annual Mean	40	Undegraded	6.48	16%
	NO_2	1 Hour Mean	200	Undegraded	99.5	50%
Benin	SO_2	Annual Mean	80	Undegraded	62.6	78%
	SO_2	24 Hour Mean	200	Undegraded	**242 (Note 1)**	**121%**
	SO_2	1 Hour Mean	1300	Undegraded	1040	80%
IFC	SO_2	24 Hour Mean	125	Undegraded	**242 (Note 1)**	**194%**
	SO_2	10 Minute Mean	500	Undegraded	**1487 (Note 1)**	**297%**

Note 1: IFC and Benin SO_2 air quality standards are approached or exceeded due to Project and Phase 1 emissions. This is based upon the use of HFO fuel with sulphur content of 2%. In this scenario the waste heat recovery system is not in use. This increases emission temperature and improves dispersion of emissions reducing impacts compared to Scenario 2a.

Table 5-14. Scenario 3a

Basis of AQS	Pollutant	Averaging period	AQS (µg/m^3)	Baseline (µg/m^3)	PC (µg/m^3)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	9.87	10%
	NO_2	24 Hour Mean	150	Undegraded	39.6	26%
IFC	NO_2	Annual Mean	40	Undegraded	9.87	25%
	NO_2	1 Hour Mean	200	Undegraded	90.5	45%
Benin	SO_2	Annual Mean	80	Undegraded	55.7	70%
	SO_2	24 Hour Mean	200	Undegraded	**215 (Note 1)**	**108%**
	SO_2	1 Hour Mean	1300	Undegraded	496	38%
IFC	SO_2	24 Hour Mean	125	Undegraded	**215 (Note 1)**	**172%**
	SO_2	10 Minute Mean	500	Undegraded	**709 (Note 1)**	**142%**

Note 1: IFC and Benin SO_2 air quality standards are approached or exceeded due to Project and Phase 1 emissions. In this scenario the fuel sulphur content is 1%, and 11 engines are operational (6 Project, 5 Phase 1). This reduces the overall emissions of SO_2, however, impacts remain above the air quality standards. In addition, the smaller plume arising from 11 engines compared to 14 engines results in a lower initial lift due to lower initial momentum and thermal buoyancy. The dispersion before reaching ground level is somewhat less than when operating 14 engines, meaning that the reduction in impacts due to running less engines is not linear with reducing numbers of engines. This scenario demonstrates that fuel with sulphur content of 0.5% is required to achieve SO_2 air quality standards.

Table 5-15. Scenario 3b

Basis of AQS	Pollutant	Averaging period	AQS (µg/m^3)	Baseline (µg/m^3)	PC (µg/m^3)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	5.60	6%
	NO_2	24 Hour Mean	150	Undegraded	17.3	12%
IFC	NO_2	Annual Mean	40	Undegraded	5.60	14%
	NO_2	1 Hour Mean	200	Undegraded	41.5	21%

Operations on HFO

Unmitigated, the operation of the IPP results in **Major Adverse Impacts**, both alone and in combination with IDB.

The air quality impact assessment has identified that under some circumstances there is a risk of air quality standards being approached or exceeded, in particular for SO_2. In this respect it is appropriate to consider options for mitigating these impacts. These mitigation measures can be used in isolation or in combination to reduce impacts:

- Using fuel with a sulphur content below 2% will directly reduce SO_2 emissions. The Project has committed to use of HFO with a sulphur content below 2%. Fuel of this maximum sulphur content is designated in the Project's fuel specification and testing requirements that will form part of the Operations and Maintenance (O&M) contract;
- The engines can be run on a mixture of HFO and gas. This option is feasible as there will be some gas available from the WAGP, even if there is not enough available to run the plant entirely on gas. This would again reduce the overall sulphur content of the fuel;
- Turning off the Waste Heat Recovery improves dispersion (due to higher emission temperature and higher exit velocity) to reduce impacts;
- Reducing the number of engines running will reduce emissions and impacts.

These measures will need to be implemented only during those circumstances when there is a risk of air quality standards being exceeded, due to poor dispersion conditions. Real-time monitoring will also be implemented in order to alert the operators to occasions when these circumstances arise and impacts are at risk of exceeding air quality standards.

Furthermore operation of the plant on gas represents a mitigation measure in its own right, as emissions of SO_2 and PM_{10} will be negligible, and emissions of NO_x greatly reduced.

Mitigated Impacts

When mitigation is implemented on the basis of real-time monitoring, it is anticipated that impacts can be maintained at **Negligible or Minor** at worse.

Operations on Gas

Operating the plant on gas represents a mitigation measure in its own right, as emissions of SO_2 and PM_{10} will be negligible, and emissions of NO_x greatly reduced.

Unmitigated Impacts

Unmitigated, the operation of the IPP result in **Minor Adverse Impacts**, both alone and in combination with IDB.

Mitigated Impacts

Consideration of additional mitigation is not deemed necessary for operations on gas.

5.2.2 Noise

5.2.2.1 Introduction

The Original ESIA assessed noise impacts based on the proposed 400 MW Project considered by the ESIA. As previously indicated Phase A was envisaged as a 120 MW plant and Phase A + B as a total of 400 MW. Numerous scenarios were considered. Given the changes in the Project subsequent to the ESIA, re-modelling of noise impacts for the proposed facility is necessary to ensure impacts to community health are abated.

The full Technical Noise Specialist Report is included in *Annex B*.

5.2.2.2 Acoustic Glossary

The terms ‘sound’ and ‘noise’ tend to be used interchangeably, but noise can be defined as unwanted sound. Sound is a normal and desirable part of life. However, when noise is imposed on people it can lead to disturbance, annoyance and other undesirable effects. Noise is measured and quantified using decibels (dB). The decibel scale is logarithmic, which means that sound levels do not add up or change according to simple linear arithmetic. For example, adding two equal sound sources results in a doubling of sound energy, which gives a combined sound level that is 3 dB higher than the individual levels. Because the human ear is less sensitive to low and high frequencies than mid-frequencies, decibels on the A-weighted frequency scale (dB(A)) were set to correspond with the sensitivity of the human ear. The human ear’s threshold of perception for sound change is considered to be 3 dB, 5 dB is clearly noticeable to the human ear, a 10-dB increase is perceived as a doubling of sound. Noise levels and subjective loudness of common noise sources are presented in *Table 5-16*.

Table 5-16. Noise Levels and Subjective Loudness of Common Noise Sources

Description	Noise Levels, dB(A)	
Space rocket launch at 100 meters; artillery fire at gunner’s position	140	Intolerable
Ship’s engine room; rock concert in front and close to speakers	120	Intolerable
Textile mill; press room with presses running; punch press and wood planers, at operator’s position	100	Very noisy
Next to busy highway, shouting	80	Noisy
Department store, restaurant, speech levels	60	Noisy
Quiet residential neighbourhood, ambient level	40	Quiet
Recording studio, ambient level	20	Very quiet
Threshold of hearing for normal young people	0	Very quiet

Source: Bies et al 2018

Since noise often varies over time, statistical parameters (or metrics) are used to measure and describe noise. For this ESIA study, the main noise metrics used is the LAeq, which is also referred to as the ‘continuous equivalent sound pressure level’. It represents a varying noise level by calculating the constant sound level that would have the same sound energy content over the measurement period. The letter ‘A’ denotes that ‘A-weighting’ has been used and the ‘eq’ indicates that an equivalent level has been calculated.

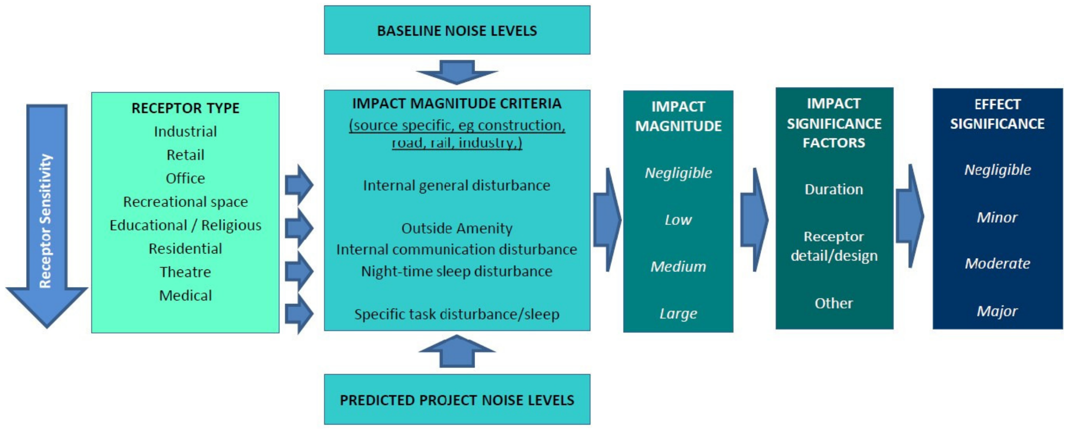
5.2.2.3 Noise Assessment Methodology

An approach that combines *impact magnitude* with *resource/receptor* sensitivity is used to determine impact significance. For noise, however, it is usually possible to predict noise levels quantitatively and compare them against standards that are resource/receptor-specific and inherently take into account resource/receptor sensitivity.

Furthermore, many numerical noise standards are noise source-specific (eg, industrial noise is different from aircraft noise), some refer to baseline levels (ie, allowable increases above baseline),

and there can be a number of other factors that are relevant to determining Impact Significance. Thus, Impact Significance for noise is not determined using a magnitude versus sensitivity matrix, but is instead determined using the process outlined in Figure 5-2. The process for defining noise impacts considers the type of receptor, draws on relevant standards or guidance to determine impact magnitude, and then considers other factors to determine significance.

Figure 5-2. Noise Impact Assessment Process



5.2.2.4 Noise Assessment Criteria

Table 5-17 presents noise guidelines from potential lenders that should not be exceeded at the nearest receptor locations offsite. The IFC/World Bank Group Guidelines state that noise impacts should not exceed the levels in *Table X.3*, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. Decree No. 2001-294 of August 8, 2001 governs the regulation of noise in the Republic of Benin. *Table 5-18* presents ambient noise level standards for general environment in Benin. It should be noted that the daytime period starts at 07:00 hours for IFC and 06:00 hours for Benin.

Table 5-17. IFC/World Bank Group Noise Level Guidelines

Receptor	One Hour LAeq (dB(A))	
	Daytime (07:00-22:00)	Night Time (22:00-07:00)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

LAeq (or Leq) = A-weighted equivalent sound levels over a measurement period, dB(A) = A-weighted decibel.
Source: General Environmental, Health, and Safety (EHS) Guidelines, April 2007 (IFC/World Bank Group 2007)

Table 5-18. Permissible Noise Limits for General Environment in Republic of Benin

	Noise limits in dB(A), L_{Aeq}		
Period	Residential Zone	Commercial Zone	Industrial Zone
06:00 - 13:00 hour (day)	50	50	70
13:00 – 13:00 hour (day)	45	55	70
15:00 – 22:00 hour (day)	50	50	70
22:00 – 06:00 hour (night)	45	55	70

LAeq (or Leq) = A-weighted equivalent sound levels over a measurement period, dB(A) = A-weighted decibel.

Source: Decree No. 2001-294 of August 8, 2001. Noise regulations in the Republic of Benin (Republic of Benin 2001)

Considering the fact that the nearest receptors affected by noise are residential and educational institutions, and because plant operation (load) during the day and at night are expected to be the same, the Project will be designed to target an overall Project plant contribution of 45 dB(A) at the nearest receptors, noting that at worst only a marginal addition to pre-project noise level would occur (<3 dB(A)) as provided in the World Bank noise guidelines. The night time criterion of 45 dB(A) was selected as a design target because it is the most stringent limit in both noise criteria tables above. The IFC/WHO Bank Group noise guidelines and the Benin noise regulations summarized above have been reviewed to establish a suitable set of criteria for the proposed Project (see *Table 5-19*).

For noise assessments, once impact magnitude is established, it is a straight conversion to impact significance, considering duration and receptor detail (see *Table 5-20*).

Table 5-19. Noise Magnitude Criteria for proposed Project

Impact Rating	Noise Levels $L_{Aeq,1\text{-}hour}$ dB(A)			
	Negligible	Small	Medium	Large
Noise Disturbance Impact Magnitude	<40	40-45	>45-50	>50

Table 5-20. Determination of Noise Impact Significance

Impact Magnitude Classification	Impact Significance Factors1	Impact Significance Rating
Negligible	Consider other influencing factors if necessary (duration, sound character, etc.)	Negligible
Small		Minor
Medium		Moderate
Large		Major

[1] Note: Examples of factors that may influence significance, beyond that taken into account in the IFC guidelines (and host country regulations) used to assess impact magnitude, include:

- **Duration of Impact** – For example, a noise source may operate on an intermittent or repetitive basis, for only part of a day or night time period, or on a limited number of days per week, or only during daytime, such that it may be appropriate to downgrade the significance rating.
- **Character of Noise** – Noise of a particularly distinctive character (tonal or impulsive) may be more disturbing than a broadband noise, so it may be appropriate to upgrade the impact significance.
- **Receptor Detail or Design** – Guidelines for noise assessment assumes receptors with openable windows to sensitive rooms overlooking the noise source. This may not always be the case, so that noise impacts on facades that have no windows to noise sensitive rooms (offices, bedrooms, living rooms, etc.) or have upgraded levels of sound insulation (with associated ventilation if necessary to keep windows closed) can often be downgraded.
- **Meteorological Conditions** – Regular occurrence of conditions (usually more than 30 percent of the time) that enhance noise propagation, such as prevailing light stable winds (less than 3 meters per second) and temperature inversions, may warrant upgrading of significance ratings.

Considering the target threshold for this Project is 45 dB(A) at nearby NSRs, the noise impact magnitude for this noise impact assessment were determined as follows:

- Negligible – Predicted noise levels < 40 dB(A)
- Small – Predicted noise level >= 40 dB(A) but <45 dB(A)
- Medium – Predicted noise level >=45 but <50 dB(A)
- Large – Predicted noise level >=50 dB(A).

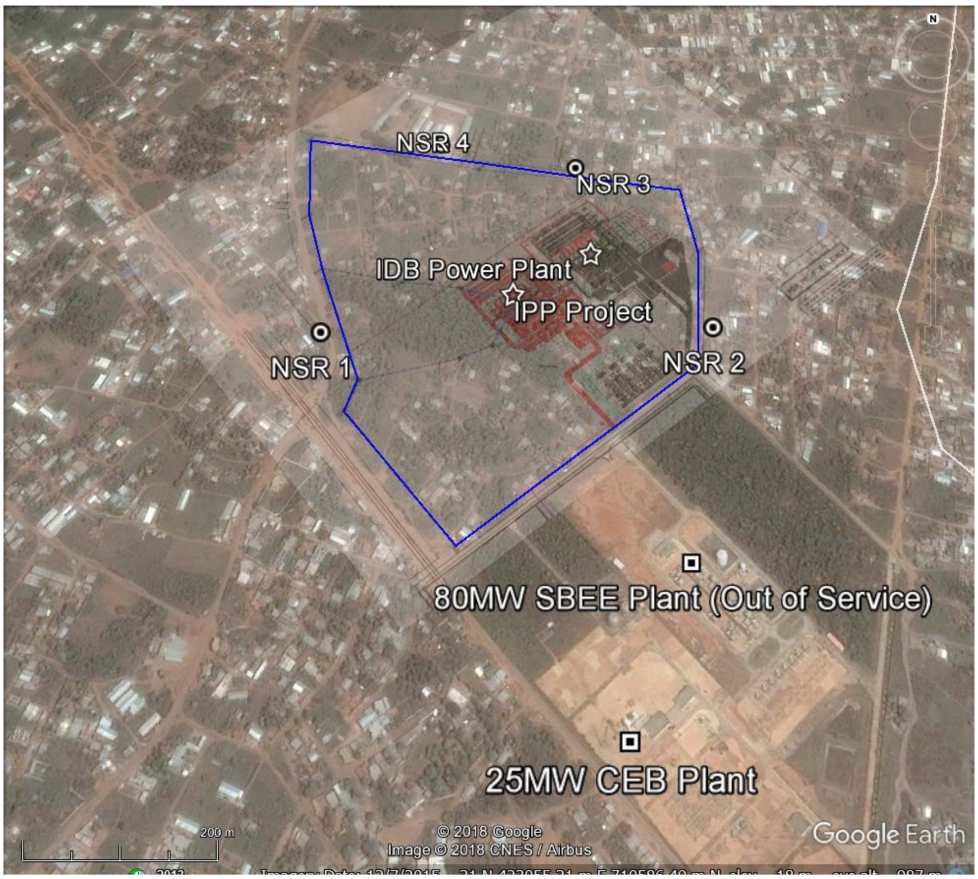
5.2.2.5 Baseline

The Project site is located 20 km away from the city centre of Cotonou in the municipality of Calavi. An industrial area, educational institution and residential area surround the site. The nearest noise receptors affected within the project area are residential and educational institution. The plant operation during the day and night is expected to be the same as such the project noise levels are targeted to not exceed the 45 dB(A) at the nearest receptor. The distances recorded from the nearby receptors is indicated in *Table 5-21* and *Figure 5-3* were recorded for receptors closest to the Project Boundary. A 2.8 perimeter wall would be installed around the Project site.

Table 5-21. Distance and Direction of Receptor Locations from Closest Project Boundary

Receptor ID	Description	Approximate Distance and Direction from Closest Project Boundary (meters)
NSR 1	Residences	45 m south of Project boundary
NSR 2	Residences	15 m east of Project boundary
NSR 3	Residences	10 m north of Project boundary
NSR 4	Educational Institution	40 m north-northwest of Project boundary

Figure 5-3. Proposed Project Site and Nearest Noise Sensitive Receptors



5.2.2.6 Impacts on Ambient Noise during Construction

Sensitive receptors (NSRs) as a result of activities during the construction and operational phases of the Project.

Construction Phase

The main activities that would result to potential increase in noise during the construction phase include site preparation and earthwork activities, internal access road construction, foundation work, material and subassembly delivery, and building/storage tank installation.

Noise from Project construction activities would likely be audible at NSRs located close to the site boundary (ie, residences and a school). Assessing and quantifying these impacts is difficult, because construction activities would occur at various locations around the Project Area, leading to highly variable impacts at any given point. Noise emissions would be localized and would vary with

each phase of construction depending on the construction activity, operating load, length of time the equipment is in use, and the amount of equipment used simultaneously for each phase. Noise levels from the construction activities would be temporary and intermittent, as equipment would be operated on an as-needed basis, mostly during daylight hours. Construction noise impacts were not quantified; however, the maximum potential noise impact at any single residence might be analogous.

Impact Significance (Pre-mitigation)

The use of heavy construction equipment will result to noise increases at the NSRs close to the site boundary. However, because construction activities would be temporary, intermittent, localized, and would occur only during daylight hours, the impact of Project construction noise activities will result in a **"Moderate Negative Impact"** pre-mitigation at the closest NSRs.

Mitigation Measures

To avoid or reduce the potential impacts of noise during Project construction, AIIM will implement construction best management practices, including:

- Develop and implement a grievance procedure in the event of any noise complaints being received.
- Engage potential NSRs (residences, schools, etc.) prior to works commencing to explain schedule, duration, likely impact and contact points if they have a complaint.
- Brief construction workers and machinery operators on the requirement to minimise nuisance from site activities.
- Limit construction works to daytime hours to the extent practicable.
- Use attenuation measures such as silencers (e.g., on engine exhausts) and portable sound barriers around equipment such as generators and hand-held tools, where appropriate.
- Regularly inspect and maintain machinery, equipment and vehicles to ensure they are in good working order.
- Turn off machinery, equipment and vehicles when not in use.
- Ensure construction traffic follow pre-determined routes to access the site to minimise impacts, and where possible, select routes to avoid densely populated areas.
- Use less annoying alternatives to conventional audible reversing alarms (e.g., broadband noise emitting models) that provide a safe system of work.
- Minimize drop height of materials.
- Where feasible and reasonable, avoid metal-to-metal contact on equipment.
- Conduct background noise monitoring prior to operation of the Phase I project to establish the background noise levels prior to the operation of either facility.
- Regular monitoring of the ambient noise levels during construction and operations (at least once per year, focusing on the first years of operation, until results show that there is no evolution).

Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures during the construction phase, the significance of the impact to noise is expected to reduce to "**Minor Negative Impact**" post mitigation.

5.2.2.7 Operation Phase

Project Activities

The proposed Independent Power Producer (IPP) Project (Project power plant) is a new 144- MW combined cycle, thermal power generation plant comprising:

- 7 x MAN 18V51/60 DF dual-fuel fired reciprocating engines (each producing 18.2 MW totalling 127 MW) and associated radiator coolers.
- Steam turbine system (producing 18 MW) and associated air-cooled condensers (ACC).
- Associated infrastructure including diesel fuel tanks and offloading station, connection to natural gas supply manifold, connection to power grid sub-station and plant support facilities.

The Project power plant will be built on a 20-hectare piece of land, and would be adjacent to a similar thermal power station (127 MW) currently under construction. For the purpose of this impact assessment, the adjacent 127 MW power plant under construction will be referred to as the Phase 1 power plant. The Phase 1 power plant is essentially identical to the Project power plant in terms of noise specifications and design, except that the Phase 1 power plant has no steam turbine building and associated ACC. The 18 MW steam turbine and associated ACC listed above will produce electricity from residual engine heat from both the proposed Project power plant and the adjacent Phase 1 power plant.

Scenarios to be modelled for this noise emissions study are as follows:

- Scenario 1: Phase 1 power plant operating at rated power output. Note that noise contribution from the Phase 1 power plant is considered to be part of the existing background level since it would be in operation before the proposed Project power plant (at least a year or more prior).
- Scenario 2: Project power plant operating at rated power output. This scenario assumes structures for the Phase 1 power plant are in-place but not operating.
- Scenario 3: Project power plant and Phase 1 power plant both operating at the same time at rated power output. Details of this scenario is discussed in Section 5.2, Cumulative Impact Assessment.

Figure 5-4 and

Figure 5-5 show 3-D representations of the major noise sources, buildings, storage tanks, and the 2.8-meter perimeter wall for Scenario1 and Scenario 2, respectively. The emission sources for the scenarios are represented as either emitting façades (group of point sources on building walls), emitting roofs (group of point sources on building roof), or individual point sources and depicted as red dots in the 3-D representation of the of the major noise sources. The black dots on the figures represent nearby receptors and the grey line surrounding the Project site is the 2.8-meter perimeter wall.

Figure 5-4. 3-D View of Major Noise Sources, Buildings, and Storage Tanks for Scenario 1

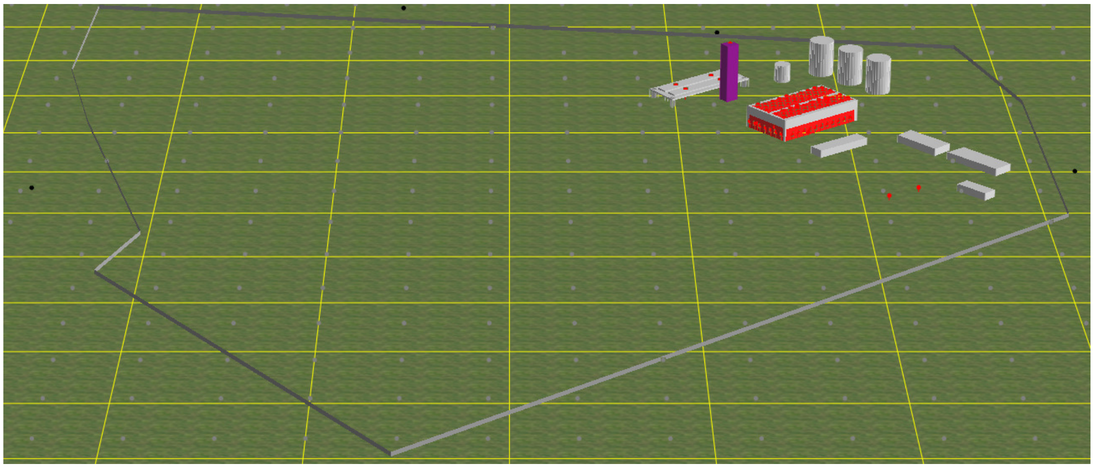
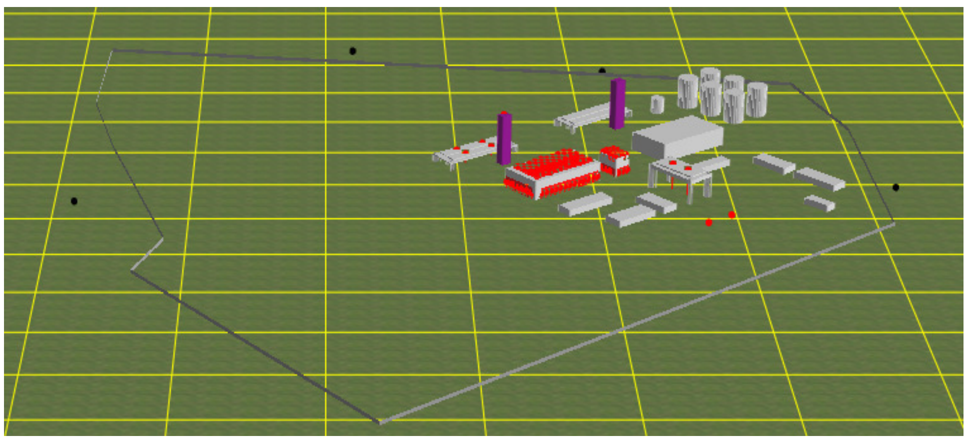


Figure 5-5. 3-D View of Major Noise Sources, Buildings, and Storage Tanks for Scenario 2



Noise Modelling Results and Impact Significance (Pre-mitigation)

Scenario 1 and 2 Impact

The predicted noise levels from the individual operation of Phase 1 power plant (Scenario 1) and Project power plant (Scenario 2) and the significance of the impact on the nearest NSRs are summarised in *Table 5-22 and Table 5-23, respectively*. The predicted noise results as contours for Scenario 1 and 2 are provided in *Figure 5-6 and* Figure *5-7,* respectively. The model results show that operating the Phase 1 power plant alone will result in a **"Negligible Negative Impact"** pre-mitigation at NSR 2 and a **"Minor Negative Impact"** pre-mitigation at NSR 1, NSR 3 and NSR 4. The model results show that operating the Project power plant alone will result in a **"Negligible Negative Impact"** pre-mitigation at all four NSRs.

Table 5-22. Predicted Noise Levels and Impact Significance on Nearby Receptors – Scenario 1

NSR Identifier	Receptor Type	Approximate Distance from Project Boundary (meter)	Predicted Noise Levels, dB(A)	Meets 45 dB(A) Noise Limit? (Yes/No)1	Noise Impact Magnitude[1]	Noise Impact Significance[1]
NSR 1	Residential	45	32.7	Yes	Negligible	Negligible
NSR 2	Residential	15	41.9	Yes	Small	Minor
NSR 3	Residential	10	39.4	Yes	Negligible	Negligible
NSR 4	Educational Institution	40	36.7	Yes	Negligible	Negligible

[1] The 45 dB(A) criterion was selected as a design basis because it is the most stringent limit of the applicable noise guidelines or standards for this Project.

Table 5-23. Predicted Noise Levels and Impact Significance on Nearby Receptors – Scenario 2

NSR Identifier	Receptor Type	Approximate Distance from Project Boundary (meter)	Predicted Noise Levels, dB(A)	Meets 45 dB(A) Noise Limit? (Yes/No)1	Noise Impact Magnitude[1]	Noise Impact Significance[1]
NSR 1	Residential	45	35.5	Yes	Negligible	Negligible
NSR 2	Residential	15	36.8	Yes	Negligible	Negligible
NSR 3	Residential	10	37.9	Yes	Negligible	Negligible
NSR 4	Educational Institution	40	36.9	Yes	Negligible	Negligible

[1] The 45 dB(A) criterion was selected as a design basis because it is the most stringent limit of the applicable noise guidelines or standards for this Project.

Figure 5-6. Predicted Noise Contours for Operation of the Phase 1 Power Plant Only – Scenario 1

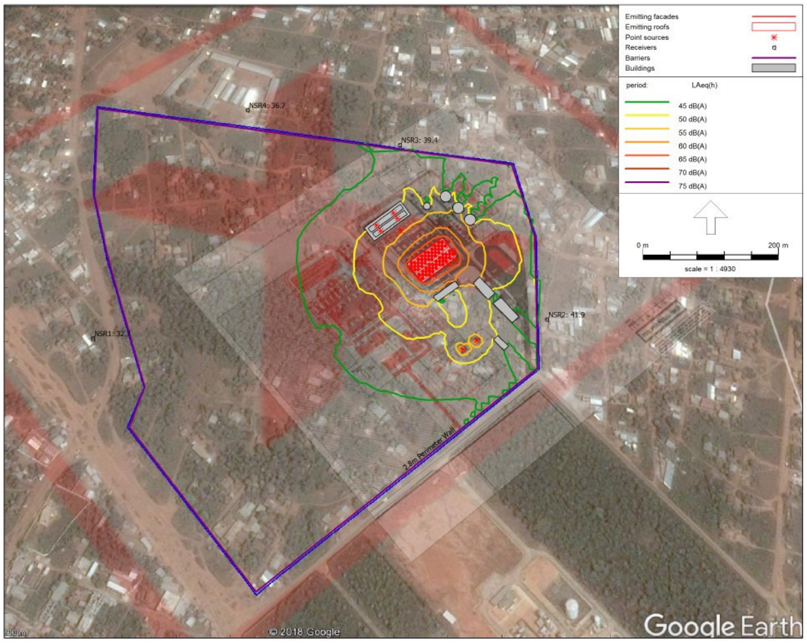
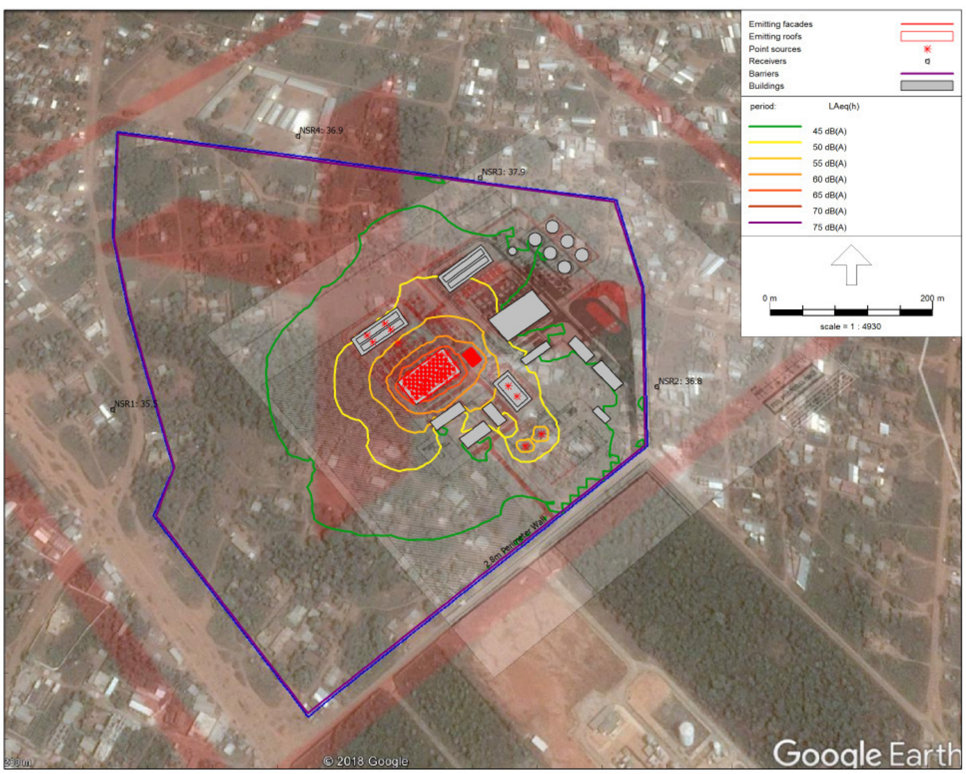


Figure 5.7. Predicted Noise Contours for Operation of the Project Power Plant Only – Scenario 2



It should be noted that the model results described above includes no room for uncertainty or tolerance, so the actual noise contribution from all scenarios could slightly exceed the World Bank 45 dB(A) criteria at nearest receptors, particularly at NSR 2 and 3 (see Noise Specialist Study in *Annex B* for information on accuracy and limitations of the noise prediction method). In addition, noise contribution from the Phase 1 power plant is considered to be part of the existing background level since it would be in operation before the proposed Project power plant (at least a year or more prior). Considering the fact that 'actual' noise contribution from Scenario 1 (ie, Phase 1 power plant only) could exceed 45 dB(A) at nearest receptors (ie, if a few decibels are added to account for uncertainty), the World Bank 3 dB increase above background criteria may be more appropriate for evaluating impacts. In such situations (ie, if background levels exceed 45 dB(A)), noise contribution from the Project power plant is expected to comply with the World Bank + 3dB limit at nearest receptors.

Mitigation Measures for Scenarios 1 and 2

Although the individual operation of the Phase 1 power plant and Project power plant are not expected to cause adverse noise impacts on nearby sensitive receptors, the following mitigation measures will be implemented as part of good industry practice:

- A survey to determine current ambient noise levels at the site will be conducted prior to operation of the Phase 1 power plant and the levels will be used to repeat noise emission modelling and further refine the noise impact study.
- There will be two separate noise monitoring surveys at the four NSRs. The first survey will be conducted just after commissioning of the Phase 1 power plant and the second after commissioning of the Project power plant (ie, both plants operating together; see Scenario 3 in Section 5.2).
- If noise complaints occur from nearby communities during plant operations, consider further mitigation measures such as increasing height of the 2.8-meter perimeter wall at certain locations, particularly at the northern, eastern, and southern project boundary. Other mitigation measures that can be considered include upgrading silencers for exhaust stacks and top ventilation outlets (i.e., silencers with higher dynamic insertion losses).
- To maintain positive community relations, keep the public informed about the operation plans and efforts to minimise noise, and establish procedures for prompt response and corrective action with regard to noise complaints.
- Conduct periodic perimeter noise surveys (e.g. every 2 to 3 years) to be compared with commissioning results to ensure proper noise abatement maintenance standard through the power plant life cycle.
- If exceedances of the applicable noise levels are found during monitoring of the operating plant(s), remedial measures should be implemented with or without complaints from the local residents

Residual Impact (Post-mitigation) for Scenarios 1 and 2

Based on the implementation of the proposed mitigation measures during the operation phase, the significance of the impact to noise for Scenarios 1 and 2 is expected to be **"Negligible Negative Impact"** post mitigation at all NSRs.

5.3 Social Impacts

This section summarises the key social impacts that may result from the Project. The social impacts outlined are detailed in Table 5-24 with the mitigation measures and management actions that will be implemented to avoid, reduce, remedy or compensate for significant adverse impacts and, where practicable, to maximise potential positive benefits and opportunities from the Project.

- Involuntary relocation of 1181 persons from the 20 ha land parcel plus smaller extra parcels discussed above. This could lead to social instability, as the 2017 ESIA identified that 74% of

the population have been resident for longer than 10 years, and nearly 13% are in exceedance of 20 years;

- Disruption of socio-economic activities (agriculture and livestock) undertaken by some PAPs;
- Elderly people (>50 years) will have greater difficulty to resettle and reintegrate in another environment and can be considered particularly vulnerable;
- Risk of students dropping out of school. The youthful demographic structure of the population means that impacts on schools are likely to have a great impact on the overall population;
- More than 400 part time jobs opportunity during construction phase;
- Potential increase in local prices due to migrant workforce;
- Risk of spreading sexually transmitted diseases;
- Risk of increase in traffic related accidents rate as well as health issues due to potential pollution (water, air, noise, etc.);
- Degradation of resident population immediate environment during construction phase as noise level may rise and air quality impaired with dust;
- Risk of groundwater contamination; and
- Relocation of cultural and religious assets.
- PAPs may be involved in land transactions dispute;
- Disruption of both traffic and socio-economic activities while clearing access routes;
- Disruption of socio-economic activities (agriculture and livestock) undertaken by some PAPs.

5.4 Other Impacts

This section reproduces the impacts and risks to the following resources and receptors that were assessed in the Original ESIA:

- Climate Change
- Vibration
- Odour
- Soil
- Groundwater
- Surface water
- Fauna
- Flora
- Visual
- Socio-economics

5.4.1.1 Impacts from Original ESIA

This section provides a summary of the impact assessment and key mitigations as assessed in the Original ESIA.

Table 5-24. Summary of Original ESIA Impact Assessment

	Construction				Operation			
Impact	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance
Climate	Limited emissions of greenhouse gases over a short-term.	No Impact	As per Air Quality mitigations.	No Impact	The Project will result in an increase in Greenhouse Gas emissions during the operational phase of the project and for the life of the operation.	No Impact	• Greenhouse gas emissions mainly occur during combustion of natural gas or HFO. The maintenance of the plant must be carried out correctly to ensure that it does not diminish its performance. • Development of a Monitoring Plan (including greenhouse gas emissions).	No Impact
Odour	No odour anticipated during construction activities.	No Impact	N/A	No Impact	No odour anticipated during construction activities.	No Impact	N/A	No Impact
Vibrations	Vibration from construction related activities unlikely to be felt offsite.	No Impact	N/A	No Impact	Vibrations may occur from both the operation of the power plant and the transport vehicles travelling to and from site.	Moderate	Vibrations • Study on the risk of vibration propagation and implementation of measures vibration attenuation if necessary. • Define a transport route that avoids heavily built-up areas as far as possible.	Minor
Soil	Potential for soil contamination due to: • Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure • Accidental release of stored hazardous material or waste due to improper handling or failure e	Minor	For spill avoidance: • Only using machines and equipment that are in a good working order. • Conduct regular inspections and maintenance of construction machinery in dedicated bunded areas. • Ensure proper systems and equipment for refuelling of construction machinery and equipment (eg, procedures, training of personnel, adequate equipment). • No use of oil containing polychlorinated biphenyls (PCBs). • Design storage areas to be contained to avoid overflow or runoff to the environment. • Develop and implement a Spill Prevention and Response Plan. • Ensure the availability of spill equipment (eg, absorbents, sand). • Training of the relevant workforce to the Spill Prevention and Response Plan. For hazardous material and waste management: • Develop and implement an integrated Waste Management Plan including waste collection, waste management and waste	No Impact	Potential for soil contamination due to: • Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure • Accidental release of stored hazardous material or waste due to improper handling or failure	Moderate	Spill avoidance: • Only using machines and equipment that are in a good working order. • Adequate transport, installation and operation of equipment and machinery containing oil. • Ensure proper systems and equipment for refueling of vehicles (eg, procedures, training of personnel, adequate equipment). • No use of oil containing polychlorinated biphenyls (PCBs). • Design storage areas to be contained to avoid overflow or runoff to the environment. • Develop and implement a Spill Prevention and Response Plan. • Ensure the availability of spill equipment (eg, absorbents, sand). • Training of the relevant workforce to the Spill Prevention and Response Plan. Waste Management: • Develop and implement an integrated Waste Management Plan including waste collection, waste management and waste disposal in order to ensure waste traceability.	Minor

	Construction				Operation			
Impact	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance
			disposal in order to ensure waste traceability. • Develop and implement a Hazardous Materials Management Plan. • Train workforce on waste management and hazardous material management requirements. • Implementation of system for the selective sorting of waste. In particular, hazardous waste (eg. oils and solvents) must be adequately stored to prevent leaks and accidental spills (segregated from non-hazardous waste and stored in bunded areas) • Remove waste to the appropriate disposal facilities where practicable; • Retain effluent from the cement batching plant within a settling sump and not allowed it to drain into water courses. Effluent should be recycled or removed • Confine excess or spilled concrete in the batching plant and work locations and dispose as waste at a licensed landfill site • Restricting access to waste disposal areas; • Develop a waste register.				• Develop and implement a Hazardous Materials Management Plan. • Train workforce on waste management and hazardous material management requirements. • Implementation of system for the selective sorting of waste. In particular, hazardous waste (eg. oils and solvents) must be adequately stored to prevent leaks and accidental spills (segregated from non-hazardous waste and stored in bunded areas). • Remove waste to the appropriate disposal facilities where practicable. • Restricting access to waste disposal areas. • Develop a waste register.	
Groundwater	Potential for contamination of groundwater due to: • Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure • Accidental release of stored hazardous material or waste due to improper handling or failure Depletion of groundwater due to extraction of groundwater for construction activities, this aspect is considered to be of Minor significance as the quantity of water required is limited.	Moderate	For accidental releases: • Same measures as specified for Soils For depletion of groundwater: • Implement water minimization measures. • As practicable, use water from the non-groundwater sources such as lagoon located 5km away instead of groundwater for the watering of the roads, tracks and soil stockpiles, and for machinery washing • Confirm government licensing and permitting requirements for new groundwater abstraction.	Minor	Potential for contamination of groundwater due to: • Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure • Accidental release of stored hazardous material or waste due to improper handling or failure • Discharge of wastewater Depletion of groundwater due to extraction of groundwater for operation activities.	Moderate	For accidental releases: • Same measures as specified for Soils For depletion of groundwater: • Implement water minimization measures. • Monitor surrounding groundwater well levels For discharge of wastewater • Oily water produced on site will be collected and transported to the IDB plant´s effluent water pit and water treatment unit. This unit will include an oily water storage tank (50m^3), a sand trap and an oily water separator. • Water from the demineralised water production unit will not be treated but will be tested to ensure it meets the required legislative standards for the discharge of wastewater (Decree No. 2001-109).	Insignificant

	Construction				Operation			
Impact	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance
							• Surface water runoff will be sent through a hydrocarbon separator prior to discharge. • All sanitary sewage to be contained, managed, separate from other wastewater, and recovered in a temporary septic tank storage and periodically evacuated for offsite disposal by qualified party.	
Surface water	Potential for contamination of surface water due to: • Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure • Accidental release of stored hazardous material or waste due to improper handling or failure • Accidental loss of containment and control of sanitary sewage • Improper management or accidental loss of containment and treatment of storm water runoff	Moderate	For accidental releases: • Same measures as specified for Soils For other discharges: • All sanitary sewage to be contained, managed, separate from other wastewater, and recovered in a temporary septic tank storage and periodically evacuated for offsite disposal by qualified party. • Develop and implement a Storm water Management Plan to specify systems and equipment to minimise, contain, and treat storm water runoff and manage disposal. Management shall include treatment of all contaminated storm water and avoid direct discharge to surface water bodies.	No Impact	Potential for contamination of surface water due to: • Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure • Accidental release of stored hazardous material or waste due to improper handling or failure • Accidental loss of containment and control of sanitary sewage • Improper management or accidental loss of containment and treatment of storm water runoff • Discharge of wastewater	Minor	For accidental releases: • Same measures as specified for Soils For other discharges: • Same as measures specified for groundwater. • Develop and implement a Storm water Management Plan to specify systems and equipment to minimise, contain, and treat storm water runoff and manage disposal. Management shall include treatment of all contaminated storm water and avoid direct discharge to surface water bodies.	Minor
Flora	Permanent vegetation removal will occur during site clearing. The site is located in a disturbed peri-urban area and only common species have been identified onsite (low sensitivity). Informal and/or uncontrolled harvesting of forest products such as wood for fire by workers can indirectly impact habitats.	Minor	• Vegetation clearing shall be limited to areas within the site boundary where it is absolutely necessary. The footprint of ground clearance to be minimized through appropriate pre-planning of ground-clearance activities, transportation routes and use of appropriate excavation and trenching methods. • Areas cleared for construction and not required for buildings, facilities or infrastructure to be re-vegetated or covered with hard standing. • All personnel working for, or on behalf of the Project to be provided with appropriate induction, which shall include communication of environmental sensitivities and required control measures. • Prohibit collection of firewood in the environment.	No Impact	N/A	No Impact	N/A	No Impact

	Construction				Operation			
Impact	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance
			• Meet the needs of the work force in terms of availability of fuel to alleviate the need to find alternate sources.					
Fauna	Disturbance and loss of suitable habitat during site clearing. The site is located in a disturbed peri-urban area and habitat is considered to be of low sensitivity. Illegal hunting may be undertaken by workers. Accidental physical harm to fauna by encounters with Project activities such as vehicle movements.	Minor	For habitat loss: • Habitat loss is mainly due to vegetation clearing. Same measures as Flora to be applied. For illegal hunting: • All workers to be provided with training on environmental sensitivities and controls. • Prohibit hunting by workers • Prohibit possession of illegally hunted fauna by workers For physical harm: • Implement and enforce vehicle speed limits and appropriate use of vehicle lighting, in order to avoid potential impacts on fauna.	Minor	N/A	No Impact	N/A	No Impact
Visual	Negative impact on visual amenity especially for neighbouring public due to presence of construction equipment, activities, and materials (including waste). Area is peri-urban and other power plants are located in the vicinity, visual amenity is not significantly affected.	Minor	• Maintain good housekeeping at the site (eg, appropriate waste management, adequate equipment storage); • Machinery and cranes will not be left in place longer than necessary. • Work sites should to be rehabilitated at the end of the construction phase. In particular, all waste and unused materials must be removed; • Lighting of the construction site to be as unobtrusive as possible, directed down and not directed to residential areas. • The use of masts for site lighting to be avoided as much as possible.	Minor	Negative impact on visual amenity especially for neighbouring public due to presence of the power plant. Area is peri-urban and other power plants are located in the vicinity, visual amenity is not significantly affected.	Moderate	• Adequate housekeeping for the whole operation phase (eg appropriate waste management and adequate equipment storage); • During maintenance activities machinery and cranes will not be left in place longer than necessary; • Lighting of the site to be as unobtrusive as possible directed down and not directed to residential areas; and • The use of masts for site lighting to be avoided as much as possible.	Minor
Socio-economics	The following impacts are considered: • Resettlement; • Employment and the induced economy (positive); • Public health; • Sociocultural. Resettlement related impacts associated with: • Loss of property	Major (due to resettlement)	For resettlement: • Mitigations to address impacts including corrective actions are identified in the Resettlement Reviewt. • Ensure that any additional resettlement for the Project follows the appropriate process and complies with AfDB and IFC requirements, OS 2 and PS 5 respectively For employment of local people:	Major	Positive impacts to the local economy associated with employment of local people including economic benefits and job and skills training Operational and maintenance activities onsite and offsite by Project workers Interaction of Project workers with the general public	Positive	• Recruit to the extent possible, local people and local goods and services. The necessary training will be provided in order to enable local people access to the different positions and that the work can be carried out safely (training on the safety measures to be inherent to each position). For worker health and safety:	

	Construction				Operation			
Impact	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance
	• Disruption or loss of livelihood activities • Disruption of social systems Positive impacts to the local economy associated with employment of local people including economic benefits and job and skills training. Public Health: • Potential for accidents and injury from accidents • Potential for worker or public health issue from spread of disease • Potential for accident and injury to members of the public from vehicles or emissions Accidental damage to unidentified cultural heritage resources		• Recruit to the extent possible, local people and local goods and services. The necessary training will be provided in order to enable local people access to the different positions and that the work can be carried out safely (training on the safety measures to be inherent to each position). For worker health and safety: • Develop and implement a worker Health and Safety Plan in compliance with national regulations and international good practice. • Provide workers with the appropriate personal protective equipment as well as the training necessary in relation to the levels of health and safety risk related to the work to be undertaken. • Develop and implement an Emergency Preparedness and Response Plan • Develop and implement a worker grievance mechanism. For community health and safety: • Recruit a local NGO for educational and communication information actions on sexually transmitted infections, communicable diseases and HIV • Sensitize the workers and the population on the risks and transmissions of contagious and sexually transmitted diseases, especially if there is a large influx of workers, with respect for cultural and religious specificities. • Deploy awareness boards on communicable diseases on site as part of a sensitization campaign for construction workers • Develop Worker Code of Conduct for all workers directly related to the project. For Traffic: • Develop and implement a Traffic Management Plan in compliance with national regulations and international good practice. The plan should address both on-site and off-site project-related transportation activities including:		Potential for accident and injury to members of the public from vehicles or emissions		• Develop and implement a worker Health and Safety Plan in compliance with national regulations and international good practice. • Provide workers with the appropriate personal protective equipment as well as the training necessary in relation to the levels of health and safety risk related to the work to be undertaken. • Develop and implement an Emergency Preparedness and Response Plan • Develop and implement a worker grievance mechanism. For community health and safety: • Develop Worker Code of Conduct for all workers directly related to the project. Overall transportation impacts: • Prepare a detailed Traffic Management Plan. Worker road safety: • Provide a safe transportation programme to assist workers to travel securely and reliably between their residence and their workplace. As part of this programme, consider providing employee buses for workers who live beyond walking distance. Safety of road users: • Identify key pedestrian crossing locations along the fuel haul route, and construct pedestrian improvements, such as crosswalk markings and signage; • Ensure all drivers are qualified, trained to drive their vehicles safely, and have required licenses; • Install speed-monitoring devices and/or speed governors on all Project vehicles; • Maintain all vehicles to international requirements; • Maintain road and safety-related signage; and • Community information sessions around road safety and Project related road usage.	

	Construction				Operation			
Impact	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance
			• As part of the Traffic Management Plan, provide safe transportation programme to assist workers to travel securely and reliably between their residence and their workplace. As part of this programme, consider providing employee buses for workers who live beyond walking distance For transport activities on or near the site: • Limit the speed of vehicles active on the site via a road safety policy. • Clearly demarcate the site. • Regularly water the roads, tracks and area of work in order to reduce dust. • Cover trucks carrying dusty materials. • As a component of the Traffic Management Plan and in accordance with the Stakeholder Engagement Plan, inform the population of the inherent risk on site. • Deploy appropriate signage within and around the site to control traffic For transport activities off site: • Undertake a public road safety campaign in the proximity of the site and transport routes • Prior to the start of construction undertake road survey to check condition of roads which are planned to be used during construction. Post construction rehabilitate degraded sections of public roads caused directly by the use of heavy construction vehicles. For cultural resources: • Confirm that any cultural heritage resources including sacred sites were properly handled during the resettlement process as indicated by ANDF (documentary evidence). • Prior to site clearance, ensure that authorisation and procedures (regulated and traditional) are followed for removal or relocation of cultural resources (including any graves).					

	Construction				Operation			
Impact	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance	Description	Pre-mitigation Significance	Mitigations	Post-mitigation Significance
			• Develop and implement a Chance Finds Procedure. • Train workers on sensitivity and procedures for protection of cultural heritage resources. • Ensure that cultural heritage specialist is available to support management with any chance finds of cultural heritage resources.					

The Gap Assessment identified two other aspects requiring additional input and consideration. These were:

- Impact to groundwater due to abstraction; and
- Impacts related to traffic/ transportation,

the latter particularly related to the transportation via truck of HFO during the first phase of operation.

5.4.1.2 Groundwater

The Gap Assessment identified a lack of information regarding the source of water required for Project activities and limited assessment of the impacts associated with potential groundwater abstraction.

The Project has confirmed that the quantities of water as provided in *Table 5-25* will be utilised during operation (of both the IDB and IPP Project combined) and will be sourced from two boreholes to be drilled on site.

Table 5-25. Water requirements (cubic meter per hour) - as per water balance 13.02.2018

Water Utilisation	Water Type	Gas	Fuel Oil
Boilers (14x large WHRBs)	Demineralized water	1.26	1.26
Water loops supplementation	Demineralized water	0.35	0.35
Fuel Oil Separators	Process water (filtrated)	0.00	0.09
Oil Separators	Process water (filtrated)	0.00	0.04
Service water (washing, turbo, workshop, drinking water)	Process water (filtrated)	0.43	0.43
Steam cycle	Demineralized water	1.425	1.425
Total treated water consumption		**3.46504**	**3.585**
Water treatment rejection	Raw water	0.64	0.64
Total consumption of well water before treatment (raw water)		**4.105**	**4.225**

Source: BWSC, 2018
Note: 7 x 18V51/60DF + 14 large Waste Heat Recovery Boilers (WHRB)
Large boiler consumption: 1% of nominal steam flow 9,000 kg/h
This information is both for the IDP and IPP Power Plants.

The Original ESIA indicates that the site is underlain by unconfined aquifers of alluvium and argillaceous sandstone (both generally very porous with high yields) of between 20 and 80m thickness. There are two wells on the site which were drilled to 80m. Information is that the yield of the aquifers ranges from 20 to 1000 m^3/hr. Based on this, the anticipated groundwater requirements for the Project (<4.5 m^3/hr) are negligible and should not adversely impact the availability of groundwater or the ability of the local population to access it.

5.4.1.3 Traffic/Transportation

Introduction

The Project would generate three types of transportation impacts: increased traffic congestion and delay, road infrastructure degradation, and increased transportation safety risks. The sections below describe these impacts. Implementation of the traffic management measures listed in the Original ESIA, as well as in the Project's general Traffic/Transportation Management Plan (see *Annex E*) would reduce the Project's potential impacts on traffic congestion, road infrastructure degradation, and transportation safety.

Traffic Congestion and Delay

The estimated 80 truck round-trips associated with Project construction would comprise a small share of existing traffic volumes, particularly on major roads such as the RNIE 1 and RNIE 2 in Cotonou (see Figure 1.5 for an indication of the locations of these roads). Worker trips could result in larger traffic volumes during peak periods (ie, shift changes), although these trips would be distributed over a wider area than deliveries from Cotonou.

During the first phase of Project operation, HFO deliveries for both power plants could result in up to 40 truck round-trips between the Port and the Project Site per day. These trips would not occur during peak travel hours and the impact would be temporary as this would not occur when the Project operates on gas.

Overall, truck round-trips associated with Project construction and operation would have a negligible impact on traffic congestion in Cotonou. During construction, worker trips could generate some additional traffic delays on local roads northwest of the RNIE 2. These impacts would be similar to those already experienced as a result of construction of the IDB Power Plant.

Road Infrastructure Degradation

The anticipated volume of heavy truck traffic would result in incrementally faster wear and deterioration of roads. On paved roads and highways within Cotonou, this incremental increase would not likely be measurable. Along the dirt roads northwest of RNIE2, wear from trucks would likely be noticeable. However as previously indicated the access route from the RNIE2 will be upgraded as part of the IDB project. As a result, overall road degradation associated with Project construction and operation would be minimal.

Transportation Safety Risks

The anticipated increase in truck volume would lead to additional transportation safety risks. This would particularly be true in areas northwest of the RNIE 2, due to the location of buildings close to the road and the intensive use of roads and road edges for pedestrian travel, bicycles, and parking.

RNIE 1, RNIE 2 and the roads within Cotonou are built for high traffic volumes and large vehicles. Traffic safety concerns are less central, but remain important due to the variety of vehicles and pedestrians travelling on the roads within the city, and the gap in driving skills between professional truck drivers and ordinary vehicle operators.

The Traffic/Transport Management Plan consolidates these requirements and is included in *Annex E*.

5.5 Cumulative Impact Assessment

5.5.1 Overview

The Original ESIA was based on the proposed 400 MW Project considered by the ESIA. Cumulative effects for the actual and planned Project since the preparation of the ESIA were not evaluated in sufficient detail. This updated Cumulative Impact Assessment has been undertaken in accordance with the IFC's good practice handbook (GPH), 'Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets' (IFC, August 2013), which was also published following the preparation of the ESIA.

Inputs from specialists were obtained regarding cumulative impacts for the following aspects:

- Noise; and
- Air Quality.

5.5.2 Objectives

The objectives of the Rapid Cumulative Impact Assessment (RCIA) process, adopted and described in the IFC GPH are:

- To determine if the combined impacts of the Project, other projects and activities, and natural environmental and social drivers will result in a Valued Environmental and Social Component (VEC)

condition that may put the sustainability of a VEC at risk (ie, exceed a threshold for VEC condition which is an unacceptable outcome).

- To determine what management measures could be implemented to prevent an unacceptable VEC condition; this may include additional mitigation of the Project being assessed, additional mitigation of other existing or predictable future projects, or other regional management strategies that could maintain VEC condition within acceptable limits.

5.5.3 Other Developments Considered

Although there are currently other power plants adjacent to the site, the only Project considered in the cumulative assessment is the IDB power plant as the other existing plants are anticipated to be decommissioned with the exception of the 20MW CEB plant which will remain. However this plant is thermally inefficient, and it is anticipated that it will be operated infrequently, if at all, when the new IDB and IPP power plants are commissioned.

5.5.4 Cumulative Impacts

Prior to the discussion of potential cumulative impacts it should be noted that a number of plans will be developed and implemented by the Project to mitigate potential impacts identified in the Original ESIA, as well as the updates in the Supplemental ESIA. The details regarding mitigation commitments can be found in the ESMP (*Chapter 8*).

5.5.5 Findings

The findings of the RCIA concluded that the potential for cumulative impacts exists to the following VECs:

- Air quality;
- Noise;
- Groundwater; and
- Traffic.

These issues were also identified during stakeholder engagement undertaken for the Project (for the Original ESIA and the 2018 update). Of specific importance for cumulative were issues around noise.

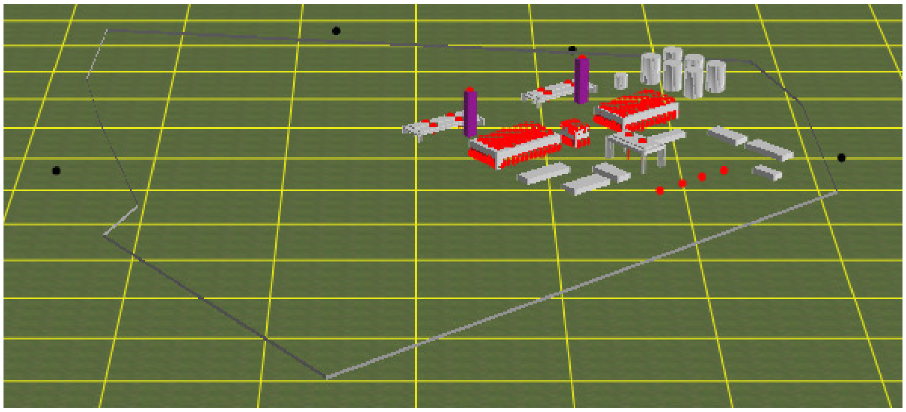
The impacts associated with these VECs is considered in *Chapter 5* of this report and mitigation measures have been proposed to address Project impacts identified.

Cumulative effects of usage of groundwater and traffic impact due to the operation of the IDB and IPP Projects concurrently are also discussed above, as the details provided by the Contractor were for the operation of both power plants together. Construction phase cumulative impacts related to traffic are not considered as the construction of the power plants will not occur concurrently.

5.5.6 Noise

The cumulative scenario (Scenario 3) designed for the study involves the simultaneous operation of the Phase 1 power plant and the Project power plant. *Figure 5-7* show a 3-D representation of the major noise sources, buildings, storage tanks, and the 2.8-meter perimeter wall for Scenario 3. Similar to Scenarios 1 and 2 describe above, the emission sources for Scenario 3 are represented as either emitting façades (group of point sources on building walls), emitting roofs (group of point sources on building roof), or individual point sources and depicted as red dots in the 3-D representation of the of the major noise sources. The black dots on the figure represent nearby receptors and the grey line surrounding the site is the 2.8-meter perimeter wall.

Figure 5-7. 3-D View of Major Noise Sources, Buildings, and Storage Tanks for Scenario 3



5.5.6.1 Impact Description

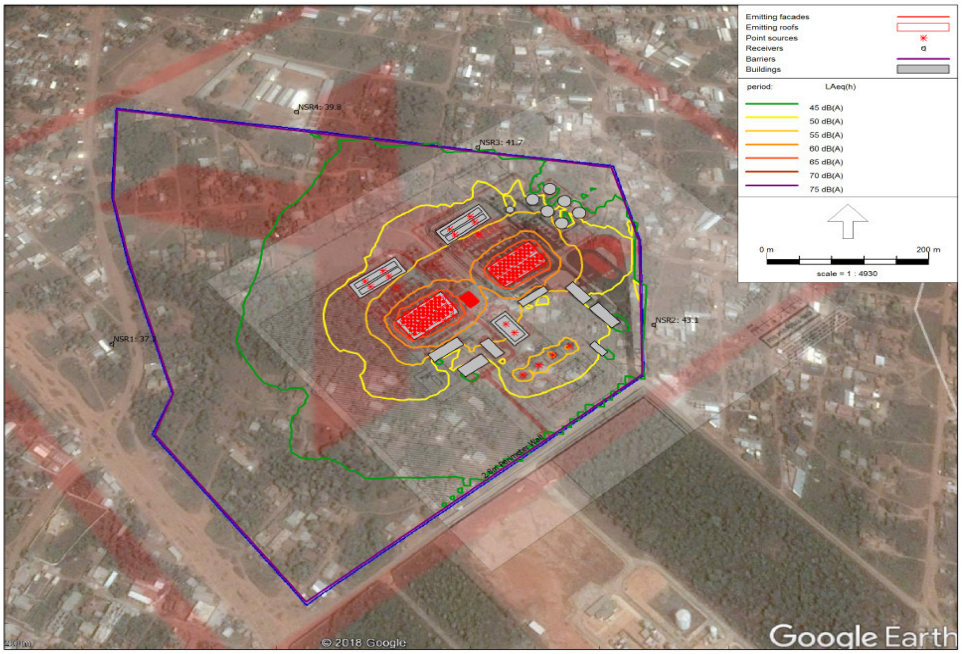
The predicted noise levels from the Phase 1 and Project power plants (Scenario 3) and the significance of the impact on the nearest NSRs is summarised in Table 5-26. The predicted noise results as contours for Scenario 3 is provided in Figure 5-8. The model results show that operating the Phase 1 and Project power plants together will result in a **"Negligible Negative Impact"** pre-mitigation at NSR 1 and NSR 4 and a **"Minor Negative Impact"** pre-mitigation at NSR 2 and NSR 3.

Table 5-26. Predicted Noise Levels and Impact Significance on Nearby Receptors – Scenario 3

NSR Identifier	Receptor Type	Approximate Distance from Project Boundary (meter)	Predicted Noise Levels, dB(A)	Meets 45 dB(A) Noise Limit? (Yes/No)[1]	Noise Impact Magnitude[1]	Noise Impact Significance[1]
NSR 1	Residential	45	37.2	Yes	Negligible	Negligible
NSR 2	Residential	15	43.1	Yes	Small	Minor
NSR 3	Residential	10	41.7	Yes	Small	Minor
NSR 4	Educational Institution	40	39.8	Yes	Negligible	Negligible

[1] The 45 dB(A) criterion was selected as a design basis because it is the most stringent limit of the applicable noise guidelines or standards for this Project.

Figure 5-8. Predicted Noise Contours for Simultaneous Operation of the Phase 1 and Project Power Plants – Scenario 3



5.5.6.2 Mitigation Measures for Scenario 3

The same mitigation measures for Scenarios 1 and 2 will be implemented as part of good industry practice.

5.5.6.3 Residual Impact (Post-mitigation) for Scenarios 3

Based on the implementation of the proposed mitigation measures during the operation phase, the significance of the impact to noise for Scenario 3 is expected to be **"Minor Negative Impact"** post mitigation at NSR 2 and 3. At NSR 1 and 4, the impact significance is expected to be **"Negligible Negative Impact"** post mitigation.

5.5.7 Air Quality

The Air Quality Assessment considered cumulative impacts arising from IDB and IPP power plants throughout as it is known that these power plants will operate alongside one another. The adjacent $20MW_e$ plant is not expected to be in use when IDP and IPP are operational, and the proposed new $20MW_e$ plant is not expected to go ahead when IPP and IDP Projects are operational. Furthermore, the existing 80MWe plant adjacent will be decommissioned. On this basis, no cumulative assessment is required above and beyond the assessment of IDB and IPP already considered.

6. SUMMARY OF IMPACTS

Table 6-1. Summary of Impacts below provides a summary of all construction and operation phase impacts. This table is a consolidation of the impacts assessed in the Original ESIA as well as those modified/reassessed for the Updated ESIA.

Table 6-1. Summary of Impacts

	Construction		Operation	
Impact	Pre-mitigation	Post mitigation	Pre-mitigation	Post mitigation
Air Quality	Major	Minor – Negligible*	Major (HFO)	Minor (HFO)
			Minor (Gas)	Minor (Gas)
Climate	No Impact	No Impact	No Impact	No Impact
Odour	No Impact	No Impact	No Impact	No Impact
Noise	Moderate	Minor	Negligible	Negligible
Vibration	No Impact	No Impact	Moderate	Minor
Soil	Minor	No Impact	Moderate	Minor
Groundwater	Moderate	Minor	Moderate	No Impact
Surface water	Moderate	No Impact	Minor	Minor
Flora	Minor	No Impact	No Impact	No Impact
Fauna	Minor	Minor	No Impact	No Impact
Visual	Minor	Minor	Moderate	Minor
Socio-economic	Major	Major	Positive	Positive

Note: * IPP plant operating alone ie, not in conjunction with the IDB plant.

7. STAKEHOLDER ENGAGEMENT

7.1 Original Engagement

Public consultations were undertaken as required by Beninese law, which details the requirements for environmental and social impact studies in Benin. According to law, the implementation of the ESIA must be carried out with the participation of the populations concerned through consultation and public hearings, in order to gather their opinions on the project. A public consultation was held on 17 May 2014 at the local CEG Hueto School. About 80 people attended including members from MEEM, local land owner committee members, land owners onsite and in the general area, and the ESIA consultants. Minutes were taken and an attendance register completed. The main queries and concerns reported by the stakeholders were:

- Desire to sell land for those partially impacted by Project land take;
- Queries related to the valuation and compensation process; and
- Noise and vibrations associated with the start-up of the existing power plant.

Table 7-1. Table of Focused Group Discussions

District	Participants	Venue	Date
Togba	Delegation of the MEEM, Community Members and PAPs	CEG Hueto School	17/05/2018
Togba	Consulting team PAPs and other local stakeholders	Somè Village Chief residence	29/03/2018
Togba	Consulting team PAPs and other local stakeholders	CEG Houèto	29/03/2018
Togba	Consulting team PAPs and other local stakeholders	Maria-Gléta Village Chief	29/03/2018
Togba	Consulting team PAPs and other local stakeholders	Fifonsi Village Chief	31/03/2018

Socio-economic studies took place, during which stakeholders were identified and various engagements took place, including with Beninese authorities such as the Ministry of Water and Energy and ABE; and national institutions such as the National Institute of Statistics and Economic Analysis (INSAE), the National Geographical Institute (IGN) and the departmental of health for the region of Atlantique-Littoral. The different services were consulted separately.

Local level engagement was undertaken in key impacted villages surrounding the project site, including Ouéga, Tokpa, Somé, Houeto, Maria Gleta, Tagbé and Fifoncé. Individual level consultations were also held, such as with the Chief of the district of Houèto, members of the committee of land owners, chiefs of traditional worship institutions and members of the wider Project Affected area. Field surveys were conducted as part of the comprehensive census of residents on the site on the basis of the list of structures and impacted parcels developed by the consultancy Wall Street Engineering Group. A number of individual interviews were undertaken with the local population during these surveys.

Engagement also took place during the Resettlement Action Plan (RAP) Process. Although there is no formally documented resettlement engagement process for the Project, disclosure procedures were in place during key stages of the process between 2009 and 2016. The issuance of the Expropriation Decree was disclosed in the Project area, and public input, including grievances, was solicited.

The government body responsible for the expropriation process, Agence National Domain Foncier (ANDF), notified the Mayor and the Chef d'Arrondissement (CA) of the declaration d'utilite publique (DUP), who then disseminated the information to the Chefs de village and Chefs de quartier. When consulted onsite in

April 2018, the CA noted that PAPs felt informed on project progress. Information points were provided onsite and relevant information regarding PAPs displayed publicly.

The Government-led resettlement process includes the establishment of a PAP Committee. SBEE also initiated a resettlement dispute strategy, which led to the setting up of this PAP / local operations monitoring committee to act as the intermediate between the PAPs and institutional stakeholders for the resettlement process and related activities. For the Maria Gléta site this was referred to as the Comité des 20ha or Comité des expropriés. This association or committee engaged with an Inter-ministerial Commission which was formed to lead the expropriation process under ANDF. The committee reportedly consisted of 17 -22 elected locals including community leaders, women's representation, local authorities such as the village chief, and was consulted on a monthly basis. Many meetings with the State were held, to the extent that PAPs reported business activities suffering as a result. PAPs interviewed noted that grievances were also sent to the ministerial committee, although rarely responded to.

Negotiation sessions for land acquisition began in November 2016 and payments to PAPs were made on 1 December 2016. Minutes from these minutes indicate a good level of communication between the Project and PAPs in the latter stages of the resettlement process. Commencement of land clearance and construction was publicised on the radio and via the above-mentioned public meeting. It was recorded that complaints were received during ESIA consultation, such as the PAP Committee not providing written records of engagement undertaken on behalf of the PAPs.

There are no records of a standard complaint form used by SBEE or ANDF during the engagement process, however it was reported that a complaint management mechanism was in place.

7.2 Updated Engagement from 2018

The Chef d'Arrondissement (CA), met with during the April 2018 fieldwork, noted that PACs generally feel informed regarding the project development. The SBEE representatives manage the relationship with the local CA for dissemination of project updates to the PAPs and PACs. The Project has also identified a local NGO Racine to sensitise PACs in the area neighbouring the Project and to communicate project updates.

The head teacher of the adjacent college noted that engagement was sufficient, and that on average, informal project progress updates were received on a monthly basis.

During the fieldwork, which also included a representation of teachers, it was suggested that the level of formal engagement should be increased to every two or three months. The suggested forums for engagement included: social media and mobile phone alerts (eg, WhatsApp) with the CA and Chef de Village from key impacted villages; radio and television announcements; face to face visits with key stakeholders; and a formal forum to register grievances.

Given that the Project area is in an urbanised environment, traditional village level structures such as local associations are not common for the immediate PACs, rather existing at the higher commune level. However, during the fieldwork it was suggested that the Project could consult with associations within the PAC, such as Association de developpement de l'arondissement who could act as a useful focal point, and with Association des parents et des élèves (APE) of CEG Hueto School.

A formal grievance mechanism for the construction and operational phases of the Project remains to be established, alongside appointment of an allocated community liaison officer. A grievance procedure has been developed for implementation as part of the Stakeholder Engagement Plan (see *Annex D*).

The following key issues were raised by PAC engaged with in April 2018 for the Project to consider:

- Priority local employment;
- Construction of 24 classrooms as planned for the CEG Houeto;
- A health centre and the rehabilitation of the Tankpè-Houèto road;
- Electrification of all impacted villages;
- Donation of a pharmacy;
- Compensation for PAPs from the additional 20-meter land strip;
- Compensation for PAPs located in the buffer areas;

- Immediate closure of abandoned wells;
- Construction of essential community infrastructures (eg, schools, health centres);
- Rehabilitation of access roads to Tanmè, Tankpè and Houèto villages;
- Erection of CEG Houèto perimeter wall;
- Recruitment of local labour; and
- Electrification over 20 km as planned by the IDB Project.

During the lenders site visit in August 2018 the following stakeholders were met with:

- Headteacher of CEG Houèto;
- Chef d'Arrondissement (CA) from Togba et local population members;
- Managing Director of l'Agence Béninoise pour l'Environnement (ABE); and
- Managing Director of l'Agence Nationale du Domaine et du Foncier (ANDF).

The key issues raised were as follows:

- AfDB representatives requested clarification on the steps to obtain a Certificate of Environmental Compliance (CCE) in Benin, the role and responsibility of the Benin Environment Agency, and the content and specificities of the new decree, n° 2017-332 of 06 July 2017, on the organization of Environmental Assessment procedures in Benin.
- Queries raised regarding specific topics such as: E&S monitoring of the site; waste management mechanisms; criteria for recruiting local labour; the issue of sensitizing residents and workers about security measures and sexually transmitted diseases. Maria Gleta's project coordinator noted that all these issues are being adequately managed.
- HSE management and PPE use onside was reported as good.
- Positive feedback from community regarding security and noise following the completion of a wall construction around the school perimeter.
- Reported that no compensation has been paid to PAP on the 20m of land between the wall and the project site.
- The Land Ministry ANDF explained the grievance mechanism that is in place, although no evidence of this engagement has been made available.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Overview

8.1.1 Purpose

The purpose of this Environmental and Social Management Plan (ESMP) is to provide a consolidated summary of the Project's environmental and social (E&S) commitments. This document thus describes the relative responsibilities of the Developer (also referred to as Consortium/Project) and the Contractor, thereby providing assurance that E&S mitigation, management and monitoring measures in the ESIA are accounted for and are being implemented and provides a framework for compliance auditing and inspection programs.

8.1.2 Scope

The scope of this ESMP comprises the activities to be undertaken as part of the Project and demonstrates how design-based risk assessment and ESIA activities are to be considered and implemented.

The management and monitoring controls set out in the ESMP are directly applicable to all Project personnel of the Developer and engineering, procurement and construction (EPC) and operations and maintenance (O&M) Contractor (full-time, part-time, temporary and seconded staff, etc.). The Contractor (which includes its sub-contractors) is required to develop and implement management sub-plans that align with this ESMP. These sub-plans are referred to as the Contractor Construction/Operation Implementation Plans (the Contractor CIPs/OIPs) throughout this document.

This ESMP is intended to address all aspects of sustainability, as addressed in the IFC Performance Standards. As such, it encompasses consideration of environment, social, occupational health and safety, and labour and working conditions. For the sake of simplicity, the acronym E&S (for environmental and social) is used throughout this document, but this acronym should be interpreted as including community relations, community health safety and security, labour and working conditions and other IFC sustainability aspects.

8.1.3 Structure

This Chapter includes the following sub-sections:

- Overview of Roles and Responsibilities;
- ESMP Implementation – Describes the key aspects of ESMP implementation;
- Commitments Register – This includes all Environmental and Social Mitigation and Management Measures identified in the Original ESIA and subsequent E&S documentation; and
- Appendices: Two topic-specific management plans (sub-plans), containing management and monitoring controls that build upon the management, mitigation and monitoring measures set out in the Updated ESIA.

These Appendices are as follows:

- Construction Occupational Health and Safety Plan; and
- Construction Emergency Preparedness and Response Plan (EPRP).

The following construction phase Contractor CIPs will be required to be developed:

- Traffic Management Plan;
- Spill Prevention and Response Plan;
- Integrated Waste Management Plan;
- Hazardous Materials Management Plan;
- Storm water Management Plan; and
- Monitoring Plan (wastewater, air emissions and waste generation).

The following operation phase Contractor OIPs will be required to be developed:

- Environmental Monitoring Plan (wastewater, air emissions, waste generation)
- Environmental Training Program
- Integrated Waste Management Plan
- Storm water Management Plan
- Hazardous Materials Management Plan
- Spill Prevention and Response Plan
- Traffic Management Plan (framework plan attached in *Annex E*)
- Stakeholder Engagement Plan (including formal Grievance Mechanism) (draft plan attached in *Annex D*)
- Local Content Plan
- Code of Conduct provisions for Security personnel
- Community Health Safety and Security Plan (to address the interaction of workers with PAC and particularly with young female students at the adjacent college)
- Recruitment and Employment Procedure
- Occupational Health and Safety (OHS) Plan
- Emergency Preparedness and Response Plan (EPRP)

8.2 Overview of Roles and Responsibilities

8.2.1 Overarching Responsibilities

The overarching responsibilities for the implementation of the ESMP are defined below for the Developer and the Contractor (referred to as Contractor or O&M Contractor) as the key Project entities.

8.2.1.1 Developer

The Developer (in this case the Consortium) has ultimate responsibility for overall Project delivery and E&S governance. This includes assurance that the Contractor aligns with the Developer ESMS and the Developer ESMP. This includes undertaking formal and informal audits/checks of the Contractor's activities and performance as part of the ESMS to evaluate E&S performance throughout construction. The Developer is the primary custodian of stakeholder engagement for the Project through the appointment of a Community Liaison Officer.

It is essential that the Developer collaborates with the Developer of the IDB plant to ensure that all mitigations and enhancement measures are undertaken in a coordinated manner.

8.2.1.2 Contractor

The Contractor (comprising the EPC Contractor and its sub-contractors) has overall responsibility for the construction of the entire Project and implementing applicable E&S management and monitoring controls, as per this ESMP and its own CIPs/OIPs. The Contractor is responsible for the management of worker grievances and will provide field support as necessary to the Developer Community Liaison Officer with regard to stakeholder engagement activities. The Contractor is primarily responsible for the implementation of monitoring controls, including sampling of environmental media.

8.2.2 Overarching Roles

The following E&S management roles are relevant for the implementation of the ESMP:

- Developer Director responsible for HSE.
- Developer Community Liaison Officer – reports to the Developer Director responsible for HSE.

- Developer Manager responsible for HSE - reports to the Developer Director responsible for HSE, interfaces with the Contractor Manager responsible for HSE, communicates and interacts with government bodies.
- Contractor Manager responsible for HSE – reports to and interfaces with Developer Manager responsible for HSE, communicates and interacts with government bodies, security teams, field engineers, field supervisors, contract administrators, commercial service providers, human relations managers and relevant industrial entities.

8.3 ESMP Implementation

8.3.1 Environmental and Social Management System

An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by Developer, and involves engagement between the Developer, its Contractor, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders. A Framework ESMS has been developed and is attached in *Annex C*.

8.3.2 Training, Competency and Awareness

The Developer will evaluate the performance of the Contractor's training activities during audits. Initially, based on the ESMP and then on an annual basis, the Developer requires the Contractor to carry out a training needs analysis and report any competency gaps or training needs. The analysis will identify options for internal capacity building and training of existing staff, and/or recruitment of additional personnel with relevant skills. The Contractor will allocate resources or training courses as necessary.

As part of establishing the construction contract, the Developer must communicate its competency expectations and training requirements to the Contractor. A detailed description of Contractor competency and training procedures must be provided in the Contractor's CIPs/OIPs.

In general, the Contractor's approach should comprise analysis of competency needs (for the specific project), effective recruitment to ensure alignment with those needs, and ongoing training to maintain and enhance the competency of hired staff.

All necessary training will be provided as part of the Contractor's induction training (to provide general awareness) and job-specific training as necessary.

The site induction will ensure that all personnel acknowledge the Project policies, organisational structure, job description requirements, regulations, site specific induction and health, safety and environmental awareness training.

All Project personnel involved in construction activities will be provided with toolbox training that outlines the specific management and monitoring controls included in the Developer ESMP and the Contractor CIPs/OIPs. Attendance records for all training will be kept for evaluation during the Developer's and third party audits.

8.3.3 Management of Change

The Developer recognizes that changes are inevitable and initiated during the course of project development and execution, and that these changes may or may not have a significant impact upon environment, community, safety, integrity, cost or schedule. Notwithstanding the severity or magnitude of the change, the processes for managing changes will be according to this document.

Change Management Procedures are developed to ensure that changes are properly reviewed and approved by persons with the required expertise prior to implementation, to eliminate workplace hazards that could lead to injuries, equipment damage, production losses, Project reputational impact or environmental impact. Also, that there is accountability for proper change implementation.

Change Management review procedures will address both permanent and temporary changes. Temporary change reviews and approvals will specify the duration of the change and will require review if an extension is required. Temporary changes are to be considered in the same manner as permanent changes.

Effective management of change will underpin every element of the planned Developer ESMS including but not limited to:

- Maintaining the planned ESMS;
- Review of environmental and social risks and aspects;
- Changes in compliance requirements;
- Changes in resources, roles and responsibilities, and related management and assurance of competency;
- Communications, consultation and stakeholder engagement;
- Changes emerging from the ongoing detailed design process and operational control; and
- Emergency Preparedness and Response.

As per the ESMS a detailed Change Management Procedure should be developed in order to effectively manage changes associated with the above.

An effective way of managing change during the construction phase is the development of method statements.

8.3.3.1 Method Statements

The Contractor must compile and provide Method Statements to the Developer/Site Manager for approval prior to the commencement of construction activities. Method statements will be required for specific activities that are deemed or identified to pose a risk to the environment and/or which require site specific detail beyond that contained in the ESMP or when requested by the Developer/Site Manager.

A Method Statement is a dynamic document in that modifications are negotiated between the Developer and the Contractors project management teams, as circumstances unfold. Changes to, and adaptations of, Method Statements can be implemented with the prior consent of all parties. All Method Statements will form part of the ESMP documentation and are subject to the terms and conditions contained within the ESMP.

Note that a Method Statement is a starting point for understanding the nature of the intended actions to be carried out and allows for all parties to review and understand the procedures to be followed in order to minimise risk of harm to the environment.

A Method Statement describes the scope of the intended work in a step-by-step description, in order for the Developer/Site Manager to understand the Contractors intentions. This will enable them to assist in devising any mitigation measures, which would minimise environmental impact during these tasks.

For each instance where it is requested that a Method Statement is submitted, the format must clearly indicate the following:

- What - a brief description of the work to be undertaken;
- How - a detailed description of the process of work, methods and materials;
- Where - a description/sketch map of the locality of work (if applicable);
- When - the sequencing of actions with due commencement dates and completion date estimates;
- Who – The person/s responsible for undertaking the works described in the Method Statement; and
- Why – a description of why the activity is required.

8.3.4 Performance Monitoring, Evaluation and Reporting

8.3.4.1 Monitoring, Measurement, Analysis and Evaluation

As per the planned Developer ESMS, the Developer will require the Contractor to monitor its own E&S performance to ensure compliance with the Project standards throughout construction.

Where a non-compliance is detected, or monitoring results are outside of the expected range, the results will be immediately reported to the Developer. A non-compliance report will be issued by the Contractor

documenting the outcome of the steps taken, in consultation with the Developer. Specific roles for undertaking E&S monitoring will be further elaborated in the Contractor CIPs/OIPs as necessary.

8.3.4.2 Audits

The Developer will review audits undertaken by the Contractor and other parties as described below.

Contractor Audits

The Contractor is required to undertake audits and inspections of its own management systems, plans and procedures used to manage and mitigate environmental and social risks. The Contractor audits will address effectiveness and compliance against the Project standards. Contractor audit reports are to be provided to the Developer upon completion. A corrective action plan will be drafted to address all non-compliances.

Third Party Audits

Third party audits will also be conducted, including the following:

- Audits by local, national and sectoral authority regulators to ascertain compliance with national legislation, sectoral requirements and Project permit approval conditions; and
- Periodic environmental and social audits by the Lenders or by Lenders' representatives. Such audits will be undertaken in accordance with the predetermined protocol agreed between the Developer and the Lenders. Findings will be reported to the Contractor and the Developer.

Non-Compliance and Corrective Actions

The analysis of the non-compliances identified during monitoring and audits is crucial for the identification of corrective actions that are to be implemented. Incidents and non-compliances relating to construction activities and E&S management within the site boundary will be reported to the Developer and managed by the Contractor.

The Contractor is required to establish procedures for incident reporting, investigation, corrective/ preventative action and resolution. Any incident reporting requirements, to either the Beninese environmental and sectoral authorities or the Lenders, will be managed by the Developer.

8.3.5 Financial Estimation for Implementation

The implementation of mitigation measures will either be the responsibility of the EPC/O&M Contractor, in which case it will be taken into account in the contract costs, or the responsibility of the Developer. Estimated costs are included in Tables 8.1 and 8.2.

Table 8-1. Consolidated Mitigation and Monitoring Measures - Construction Phase

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
I1	Environmental and Social Performance Management	All activities with an environmental or social aspect	Various impacts on environmental and social resources and receptors	• Establish, maintain and implement an Environmental and Social Management System (ESMS) reflecting international good practice and ensuring compliance with the established Project Standards, and Lender requirements. ESMS to include risk management procedures, monitoring and audit procedures. • Provide induction training for all Project personnel (covering HSE construction and site management good practice). • Implement audit plan.	Internal and external audits of ESMS	ESMS documentation	Audits as specified in ESMS	Overarching ESMS to be developed and implemented prior to construction	Benpower	Internal cost
					Internal and external audits of ESMS	ESMS documentation and demonstration of implementation including training record Evidence of audits	Audits as specified in ESMS	ESMS to be developed and implemented prior to construction ESMS implementation to be maintained over the construction period	EPC Contractor (BWSC) to prepare Project-specific ESMS	Included in EPC Contractor (BWSC) cost
I2	Air Quality	Emission of air pollutants from construction machinery and equipment and construction vehicles Emission of particulate matter from transport of friable construction materials.	Negative impact on air quality	For overall management: • Train workers on requirements and those specific to their role (eg, drivers, mechanics). • Implement a grievance mechanism for public complaints. For air pollutants: • Define the desired technical specifications for construction machinery in order to respect international air quality standards. • Ensure regular maintenance of construction machinery and transport trucks to ensure optimal combustion and limit pollutant emissions. • Use low-sulphur fuel oils to limit SO_2 emissions. • Shut down machines and equipment when not in operation. • Ensure exhaust gasses from diesel driven plant does not discharge directly at the ground or into a work place. • Exhaust gasses from generators, plant or vehicles operating near closed buildings must be led out of the area to protect the staff. For particulate matter: • Enforcement of speed limitations on construction site and around residential areas. • Unsealed roads to be kept damp with a water bowser. • Establish speed limits on unsealed roads. • Trucks carrying spoil and or friable construction material to be covered. • Cover, seed or fence stockpiles to prevent wind whipping.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Weekly visual inspections of machinery, equipment and vehicles to verify performance Track records of public complaints related to air quality and particulate matter	Training records Inspection records Equipment and vehicle maintenance records Number of dust and air quality related complaints	Inspections as specified For complaints, investigate and resolve as they arise	Throughout construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
				• Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas. • Use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays, where possible. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate. • Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate. • Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). As general mitigation measures: • Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. • Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site. • Avoid bonfires and burning of waste materials. • Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable Ensure sand and other aggregates are stored in bunded areas, out of the wind, and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place, such as: (i) ensuring that bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and (ii) ensuring vehicles entering and leaving work sites are covered to prevent escape of materials during transport.						
I3	Climate	Emission of greenhouse gasses from construction machinery and equipment and construction vehicles	Greenhouse gas emissions	• Define the desired technical specifications for construction machinery in order to respect air quality standards. • Ensure regular maintenance of construction machinery and transport trucks to ensure optimal combustion and limit pollutant emissions. • Shut down machines and equipment when not in operation.	Weekly visual inspections of machinery, equipment and vehicles to verify performance Track and record greenhouse gas emission (using as option a surrogate measurement such as fuel use)	Inspection records Greenhouse gas emission volumes	Inspections as specified Report greenhouse gas emissions monthly	Throughout construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
I4	Noise and Vibrations	Emissions of noise from construction machinery and equipment and construction vehicles Emissions of noise from other construction activities (eg, piling, drilling, welding, cutting)	Noise impacts on the public in particular people living, working or otherwise at locations near the site	For overall management: • Notify public of schedule of works including periods of high noise. • Consult people at noise sensitive receptors (such as nearby residences, schools, places of worship) to develop schedule of work to avoid impacts as feasible. • Implement a grievance mechanism for public complaints. • Train workers on requirements to minimise noise. As general mitigation measures: • Use modern equipment and machinery as far as reasonably practicable. • Establish measures to limit the transmission of noise between source and sensitive receptors (eg, temporary earth mounds). • Plan works for daytime periods (6 AM to 6 PM) and limit construction activities at night). • Provide for construction "rest periods" during which activities are temporarily stopped. • Operate equipment as far as reasonably practicable in the quietest mode and switch-off unused equipment. • Place noisy equipment (compressors, generators, pumps) away from sensitive receptors • Enforce vehicle speed limits. • Use attenuation measures such as silencers (e.g., on engine exhausts) and portable sound barriers around equipment such as generators and hand-held tools, where appropriate. • Ensure construction traffic follows pre-determined routes to access the site to minimise impacts, and where possible, select routes to avoid densely populated areas. • Use less annoying alternatives to conventional audible reversing alarms (eg, broadband noise emitting models) that provide a safe system of work. • Minimize drop height of materials. • Where feasible and reasonable, avoid metal-to-metal contact on equipment.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Weekly visual inspections of machinery, equipment and vehicles to verify performance Periodic measurements of noise levels at locations on site, at the site boundary, and at noise sensitive noise receptors Track records of public complaints related to noise	Records of notifications and consultations related to noise Training records Inspection records Equipment and vehicle maintenance records Number of noise related complaints	Inspections as specified For complaints, investigate and resolve as they arise	Throughout construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost
I5	Soils	Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure Accidental release of stored hazardous material or waste due to	Contamination of soil	For spill avoidance: • Only using machines and equipment that are in a good working order. • Conduct regular inspections and maintenance of construction machinery in dedicated bunded areas. • Ensure proper systems and equipment for refuelling of construction machinery and equipment (eg, procedures, training of personnel, adequate equipment). • No use of oil containing polychlorinated biphenyls (PCBs). • Design storage areas to be contained to avoid overflow or runoff to the environment. • Develop and implement a Spill Prevention and Response Plan.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Weekly visual inspections of waste and hazardous material storage areas Weekly visual inspections of	Management plan documentation and demonstration of implementation including training record Inspection records Incident records	Inspections as specified For incidents, investigate and resolve as they arise	Management plans to be developed prior to construction Management plan implementation to be maintained over the construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost. Monitoring by Contractor staff

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
		improper handling or failure		• Ensure the availability of spill equipment (eg, absorbents, sand). • Training of the relevant workforce to the Spill Prevention and Response Plan. For hazardous material and waste management: • Develop and implement an integrated Waste Management Plan including waste collection, waste management and waste disposal in order to ensure waste traceability. • Develop and implement a Hazardous Materials Management Plan. • Train workforce on waste management and hazardous material management requirements. • Implementation of system for the selective sorting of waste. In particular, hazardous waste (eg. oils and solvents) must be adequately stored to prevent leaks and accidental spills (segregated from non-hazardous waste and stored in bunded areas) • Remove waste to the appropriate disposal facilities where practicable; • Retain effluent from the cement batching plant within a settling sump and not allowed it to drain into water courses. Effluent should be recycled or removed • Confine excess or spilled concrete in the batching plant and work locations and dispose as waste at a licensed landfill site • Restricting access to waste disposal areas; • Develop a waste register.	spill response equipment					
I6	Groundwater	Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure Accidental release of stored hazardous material or waste due to improper handling or failure Extraction of groundwater for construction activities	Contamination of groundwater Depletion of groundwater availability	For accidental releases: • Same measures as specified for Soils For depletion of groundwater: • Implement water minimization measures. • As practicable, use water from the non-groundwater sources such as lagoon located 5km away instead of groundwater for the watering of the roads, tracks and soil stockpiles, and for machinery washing • Confirm government licensing and permitting requirements for new groundwater abstraction.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Weekly visual inspections of waste and hazardous material storage areas Weekly visual inspections of spill response equipment Measure groundwater well water levels and track and report groundwater consumption	Management plan documentation and demonstration of implementation including training record Inspection records Incident records Well water levels and water quantity used Number of groundwater related complaints	Inspections as specified Groundwater well monitoring monthly For incidents, investigate and resolve as they arise	Verify permitting requirements prior to installation of water extraction Other actions over construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost Well installation and monitoring, equipment and operating costs are included in EPC Contractor costs

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
					Track records of public complaints related to groundwater use					
I7	Surface Water	Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure Accidental release of stored hazardous material or waste due to improper handling or failure Accidental loss of containment and control of sanitary sewage Improper management or accidental loss of containment and treatment of storm water runoff	Contamination of surface water	For accidental releases: • Same measures as specified for Soils For other discharges: • All sanitary sewage to be contained, managed, separate from other wastewater, and recovered in a temporary septic tank storage and periodically evacuated for offsite disposal by qualified party. • Develop and implement a Storm water Management Plan to specify systems and equipment to minimise, contain, and treat storm water runoff and manage disposal. Management shall include treatment of all contaminated storm water and avoid direct discharge to surface water bodies.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Weekly visual inspections of waste and hazardous material storage areas Weekly visual inspections of spill response equipment Weekly visual inspection of sanitary sewage and storm water management systems.	Management plan documentation and demonstration of implementation including training record Inspection records Incident records Records of sanitary sewage disposal	Inspections as specified For incidents, investigate and resolve as they arise	Management plans to be developed prior to construction Management plan implementation to be maintained over the construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost Sanitary sewage and storm water management systems and operating costs should be included in EPC Contractor costs
I8	Flora	Vegetation removal during site clearing Informal and/or uncontrolled harvesting of forest products such as wood for fire by workers	Some vegetation removal at site will be permanent Uncontrolled harvesting of forest product could reduce vegetation cover and indirectly effect habitats, allow infestation of alien invasive species, and/or create	• Vegetation clearing shall be limited to areas within the site boundary where it is absolutely necessary. The footprint of ground clearance to be minimized through appropriate pre-planning of ground-clearance activities, transportation routes and use of appropriate excavation and trenching methods. • Areas cleared for construction and not required for buildings, facilities or infrastructure to be re-vegetated or covered with hard standing. • All personnel working for, or on behalf of the Project to be provided with appropriate induction, which shall include communication of environmental sensitivities and required control measures. • Prohibit collection of firewood in the environment. • Meet the needs of worker force in terms of availability of fuel to alleviate the need to find alternate sources.	Daily visual inspections to verify implementation and effectiveness of mitigation measures	Inspection records Measure and report size of areas cleared and areas revegetated	Inspections as specified Report status of clearing and revegetation annually	Other actions over construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
			the risk of oil erosion.							
I9	Fauna	Disturbance and loss of suitable habitat during site clearing Illegal hunting by workers Accidental physical harm to fauna by encounter with Project activities such as vehicle movements	Some habitat removal at site will be permanent Depletion of natural fauna population	For habitat loss: • Habitat loss is mainly due to vegetation clearing. Same measures as Flora to be applied. For illegal hunting: • All workers to be provided with training on environmental sensitivities and controls. • Prohibit hunting by workers • Prohibit possession of illegally hunted fauna by workers For physical harm: • Implement and enforce vehicle speed limits and appropriate use of vehicle lighting, in order to avoid potential impacts on fauna.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Track and record incidents related to interaction with natural fauna	Inspection records Measure and report size of areas cleared and areas revegetated Training records Measure and report size of areas cleared and areas revegetated	Inspections as specified Report status of clearing and revegetation annually	Other actions over construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost
I10	Visual Impacts	Presence of construction equipment, activities, and materials (including waste)	Negative impact on visual amenity especially for neighbouring public	• Maintain good housekeeping at the site (eg, appropriate waste management, adequate equipment storage); • Machinery and cranes will not be left in place longer than necessary. • Work sites should to be rehabilitated at the end of the construction phase. In particular, all waste and unused materials must be removed; • Lighting of the construction site to be as unobtrusive as possible, directed down and not directed to residential areas. • The use of masts for site lighting to be avoided as much as possible.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Track records of public complaints related to visual amenity	Inspection records Number of visual amenity complaints	Inspections as specified For complaints, investigate and resolve as they arise	Over construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost
I11	Resettlement and Land Acquisition	Displacement of people and property from the site	Loss of property Disruption or loss of livelihood activities Disruption of social systems	• Mitigations to address impacts including corrective actions relating to livelihood restoration, are identified in the Resettlement Review. If possible measures relating to livelihood restoration will be targeted at IPP project-specific affected peoples. • Ensure that any additional resettlement for the Project follows the appropriate process and complies with IFC and AfDB requirements, particularly Operational Safeguards 2.	Monitoring as per the recommendations of the Resettlement Review including plan for livelihood restoration Documentation of grievances received and actions/responses	As described in the Resettlement Review	As described in the Resettlement Review	As described in the Resettlement Review	Benpower SA and Government of Benin	Cost for actions dependant on final programme. Livelihood restoration involving training and support by NGO estimated at $50,000
I12	Cultural Heritage	Site clearing and excavation activities	Accidental damage to unidentified cultural heritage resources	• Confirm that any cultural heritage resources including sacred sites were properly handled during the resettlement process as indicated by ANDF (documentary evidence). • Prior to site clearance, ensure that authorisation and procedures (regulated and traditional) are followed for removal or relocation of cultural resources (including any graves). • Develop and implement a Chance Finds Procedure.		Documentation of specialist confirmation	Once-off	Prior to construction	Initial verification by Benpower SA	$2,000

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
				• Train workers on sensitivity and procedures for protection of cultural heritage resources. • Ensure that cultural heritage specialist is available to support management with any chance finds of cultural heritage resources.	Daily visual inspection of work activities including site clearing and excavation to detect presence of cultural heritage resources	Chance Finds Procedures documentation and demonstration of implementation including awareness training records Inspection records	Inspections daily during any clearing or excavations	Continuous	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost
I13	Employment of Local People	Some portion of the construction work force will be filled with local people depending on skill requirements	Positive impacts to the local economy associated with employment of local people including economic benefits and job and skills training	• Recruit to the extent possible, local people and local goods and services. The necessary training will be provided in order to enable local people access to the different positions and that the work can be carried out safely (training on the safety measures to be inherent to each position).	Employment and training records	Number and percent of local people employed	Ongoing	Throughout the construction phase	Benpower SA to set local recruitment targets for Contractor	Benpower SA and EPC (BWSC)
I14	Worker Health and Safety and Community Health and Safety	Construction activities onsite and offsite by Project workers Interaction of construction workers with the general public	Potential for accidents and injury from accidents Potential for worker or public health issue from spread of disease	For worker health and safety: • Develop and implement a worker Health and Safety Plan in compliance with national regulations and international good practice. • Provide workers with the appropriate personal protective equipment as well as the training necessary in relation to the levels of health and safety risk related to the work to be undertaken. • Develop and implement an Emergency Preparedness and Response Plan • Develop and implement a worker grievance mechanism. For community health and safety: • Recruit a local NGO for educational and communication information actions on sexually transmitted infections, communicable diseases and HIV • Sensitize the workers and the population on the risks and transmissions of contagious and sexually transmitted diseases, especially if there is a large influx of workers, with respect for cultural and religious specificities. • Deploy awareness boards on communicable diseases on site as part of a sensitization campaign for construction workers • Develop Worker Code of Conduct for all workers directly related to the project and address the following aspects: ○ Respect for local residents and customs; ○ Zero tolerance of bribery or corruption; ○ Zero tolerance of illegal activities;	Daily visual inspection of work activities and worker health and safety performance Tracking and reporting systems for incidents and injuries	Health and Safety Plan documentation and demonstration of implementation including training record Health and safety performance indicators such incident rates Community health indicators such as disease rates Number of public complaints related to community health and safety	Ongoing	Management plans to be developed prior to construction Management plan implementation to be maintained over the construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost Health and safety systems, equipment and monitoring staff should be included in Contractor costs Monitoring by Contractor staff

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
				○ No alcohol and drugs policy during working time or at times that will affect ability to work; ○ Description of disciplinary measures; ○ Specific requirements for security staff.						
I15	Public Safety	Project-related use of public roads for transportation On and offsite construction traffic	Potential for accident and injury to members of the public from vehicles or emissions	• Develop and implement a Traffic Management Plan in compliance with national regulations and international good practice. The plan should address both on-site and off-site project-related transportation activities including: ○ Routes to be used for construction traffic along with the estimated numbers of traffic movements, speeds and times of travel; ○ How existing road development plans have been taken into account in the identification of routes and road restoration measures; ○ Procedures to reduce the exposure of Project and non-Project road users (whether in vehicles or on foot) and populations along the route from the hazards of road-related accidents; ○ Procedures to reduce the exposure of populations along the route to nuisance and disturbances due to traffic; and ○ Details of audits and reviews of the components of the project transport system. ○ As part of the Traffic Management Plan, provide safe transportation programme to assist workers to travel securely and reliably between their residence and their workplace. As part of this programme, consider providing employee buses for workers who live beyond walking distance. For transport activities on or near the site:		Evidence of training and education programs (eg, road safety campaign)	Ongoing	Road safety programme to be developed prior to construction and implemented throughout construction Road survey to be undertaken prior to construction	Benpower SA to implement road safety programme Benpower SA to work with Government on road improvements and rehabilitation	Road safety programme approximately $2,000 Road survey and any road rehabilitation dependant on routes for transport and to be covered by Benpower

	Environmental/Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
				• Limit the speed of vehicles active on the site via a road safety policy. • Clearly demarcate the site. • Regularly water the roads, tracks and area of work in order to reduce dust. • Cover trucks carrying dusty materials. • As a component of the Traffic Management Plan and in accordance with the Stakeholder Engagement Plan, inform the population of the inherent risk on site. • Deploy appropriate signage within and around the site to control traffic For transport activities off site: • Undertake a public road safety campaign in the proximity of the site and transport routes • Prior to the start of construction undertake road survey to check condition of roads which are planned to be used during construction. Post construction rehabilitate degraded sections of public roads caused directly by the use of heavy construction vehicles.	Record and track speeding incidents	Traffic Management Plan documentation and demonstration of implementation including training record Traffic safety performance indicators such accident rates Community safety indicators such as accident rates Number of public complaints related to traffic	Ongoing	Management plans to be developed prior to construction Management plan implementation to be maintained over the construction period	EPC Contractor (BWSC)	Included in EPC Contractor (BWSC) cost

Table 8-2. Consolidated Mitigation and Monitoring Measures - Operation Phase

	Environmental /Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
I16	General Environmental and Social Issues	All activities with an environmental or social aspect	Various impacts on environmental and social resources and receptors	• Establish, maintain and implement an Environmental and Social Management System (ESMS) reflecting international good practice and ensuring compliance with the established Project Standards, and Lender requirements. ESMS to include risk management procedures, monitoring and audit procedures. • ESMS to include the following procedures and plans: ○ Environmental Monitoring Plan (wastewater, air emissions, waste generation) ○ Environmental Training Program ○ Integrated Waste Management Plan ○ Storm Water Management Plan ○ Hazardous Materials Management Plan ○ Spill Prevention and Response Plan ○ Traffic Management Plan (details provided below) ○ Stakeholder Engagement Plan (including formal Grievance Mechanism) ○ Local Content Plan ○ Code of Conduct provisions for Security personnel ○ Community Health Safety and Security Plan (to address the interaction of workers with PAC and particularly with young female students at the adjacent college) ○ Recruitment and Employment Procedure ○ Occupational Health and Safety (OHS) Plan • Provide induction training for all Project personnel (covering HSE construction and site management good practice). • Implement audit plan.	Internal and external audits of ESMS	ESMS documentation and demonstration of implementation including training record Evidence of audits	Audits as specified in ESMS	ESMS to be developed and implemented prior to operation ESMS implementation to be maintained over the operation period	O&M Contractor (BWSC)	Included in O&M Contractor (BWSC) costs
I17	Air Quality	Emission of gaseous pollutants from operation of the power plant	Negative impact on air quality	• Establish air quality baseline prior to operation, based on the results the current Air Quality report and results will be reviewed and updated if necessary; • Develop a Monitoring Plan for air emissions, including real-time monitoring during HFO operations to ensure compliance with air quality standards; • Ensure the control of the exhaust gas for the following parameters: NO_2, SO_2, PM_{10}, CO, temperature, temperature and velocity, during commissioning plant and then at least once a year; and	Levels of gaseous pollutants and locations around the Project site	Monitoring plan documentation	One time	Baseline survey and monitoring plan to be conducted prior to operation	Benpower SA to undertake baseline survey and develop monitoring plan	Baseline survey and study $25,000

	Environmental /Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
				• Assign joint responsibility for implementation of the air quality management measures to senior management and the contractor. During operations using HFO, when meteorological conditions are such that air quality standards are at risk of being exceeded as determined from air quality monitoring: • Using fuel with a sulphur content below 2% will directly reduce SO2 emissions. The use of HFO with a sulphur content below 2% has been committed to by the Project and included in the Project's fuel specification and testing requirements (these will form part of the Operations and Maintenance (O&M) contract). • The engines can be run on a mixture of HFO and gas. This option is feasible as there will be some gas available from the WAGP, even if there is not enough available to run the plant entirely on gas. This would again reduce the overall sulphur content of the fuel; • Turning off the Waste Heat Recovery improves dispersion (due to higher emission temperature and higher exit velocity) to reduce impacts; • Reducing the number of engines running will reduce emissions and impacts.	Real time monitoring of levels of gaseous pollutants at locations around the Project site during HFO operations as specified in the ESIA Annual monitoring of gaseous pollutants at exhaust stack and at locations around the Project site	Compare levels of gaseous pollutants to limits set in applicable EHS Guideline Records of non-compliances and associated investigations and corrective actions Number of air quality related complaints	Ongoing monitoring during HFO operations Annual monitoring during natural gas operations	Throughout the operation phase	O&M Operator (BWSC)	Continuous monitoring system $50,000 Annual stack and ambient air quality monitoring $25,000
I18	Climate	Operation and the use of equipment and machinery	Greenhouse gas emissions	• Greenhouse gas emissions mainly occur during combustion natural gas or HFO. The maintenance of the plant must be carried out correctly to ensure that it does not diminish its performance. • Development of a Monitoring Plan (including greenhouse gas emissions).	Maintenance of power plant as specified by manufacturer Calculated annual greenhouse gas emissions and report as specified in ESIA	Maintenance records Quantity of GHG emitted	Ongoing maintenance as required Annual calculation	Throughout the operation phase	O&M Operator (BWSC)	Routine maintenance cost included in O&M Contractor (BWSC) cost GHG calculation in operating cost

	Environmental /Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
I19	Noise and Vibrations	Emissions of noise from power plant machinery and equipment and operational vehicles	Noise impacts on the public in particular people living, working or otherwise at locations near the site	Vibrations • Study on the risk of vibration propagation and implementation of measures vibration attenuation if necessary. • Define a transport route that avoids heavily built-up areas as far as possible. Noise: • Baseline noise monitoring to be conducted prior to operation of the Phase 1 power plant and the results utilised to update the noise specialist report. • To maintain positive community relations, keep the public informed about the operation plans and efforts to minimise noise, and establish procedures for prompt response and corrective action with regard to noise complaints. • Ensure all mechanical equipment, particularly the gas engines and generators, steam turbines and generators, boiler feed water pumps, etc. are maintained in accordance with manufacturer's specifications. • A 2.8 m perimeter wall will be constructed (included in current design). • If noise complaints occur from nearby communities during plant operations, consider further mitigation measures increasing the height of the 2.8-meter perimeter wall at certain locations, particularly at the northern, eastern, and southern project boundary. Other mitigations measures that can be considered include upgrading silencers for exhaust stacks and top ventilation outlets (i.e. silencers with higher dynamic insertion losses). • Develop an Ambient Noise Monitoring Plan (particularly at Noise Sensitive Receptors). • Workers should use hearing protection devices when required. • The use of individual earmuffs in the engine hall shall be a standard practice. • If exceedances of the applicable noise levels are found during monitoring of the operating plant(s), remedial measures should be implemented with or without complaints from the local residents	Conduct two separate noise monitoring surveys at the four identified Noise Sensitive Receptors. The first survey should be conducted just after commissioning of the IDB power plant and the second after commissioning of the Project power plant (ie, both plants operating together).	Noise levels compared to applicable standards	As indicated	Prior to operation as indicated	Benpower SA	Two surveys each at $$25,000 ($ 50,000)
					Track records of public complaints related to air quality Conduct annual noise surveys at perimeter and noise sensitive receptors to be compared with commissioning results to ensure proper noise abatement maintenance standard throughout plant operations	Records of notifications and consultations related to noise Number of noise related complaints Number of noise standards exceedances Equipment and vehicle maintenance records	Ongoing	Throughout the operation phase	O&M Contractor (BWSC)	Annual noise survey included in O&M Operator (BWSC) costs
I20	Soils	Accidental release of hydrocarbons from equipment or vehicles due to improper handling or	Contamination of soil	Spill avoidance: • Only using machines and equipment that are in a good working order. • Adequate transport, installation and operation of equipment and machinery containing oil.	Daily visual inspections to verify implementation and effectiveness	Management plan documentation and demonstration of implementation including training record	Inspections as specified For incidents, investigate and	Management plans to be developed prior to operation	O&M Contractor (BWSC)	Control equipment and on-going costs should be included in O&M Contractor (BWSC) costs

	Environmental /Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
		failure Accidental release of stored hazardous material or waste due to improper handling or failure		• Ensure proper systems and equipment for refueling of vehicles (eg, procedures, training of personnel, adequate equipment). • No use of oil containing polychlorinated biphenyls (PCBs). • Design storage areas to be contained to avoid overflow or runoff to the environment. • Develop and implement a Spill Prevention and Response Plan. • Ensure the availability of spill equipment (eg, absorbents, sand). • Training of the relevant workforce to the Spill Prevention and Response Plan. Waste Management: • Develop and implement an integrated Waste Management Plan including waste collection, waste management and waste disposal in order to ensure waste traceability. • Develop and implement a Hazardous Materials Management Plan. • Train workforce on waste management and hazardous material management requirements. • Implementation of system for the selective sorting of waste. In particular, hazardous waste (eg. oils and solvents) must be adequately stored to prevent leaks and accidental spills (segregated from non-hazardous waste and stored in bunded areas). • Remove waste to the appropriate disposal facilities where practicable. • Restricting access to waste disposal areas. • Develop a waste register.	of mitigation measures Weekly visual inspections of waste and hazardous material storage areas Weekly visual inspections of spill response equipment Track waste disposal	Inspection records Incident records Waste disposal records	resolve as they arise	Management plan implementation to be maintained over the operation period		Monitoring by O&M Contractor (BWSC) staff
I21	Groundwater	Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure Accidental release of stored hazardous material or waste due to improper handling or failure Extraction of groundwater for operational activities	Contamination of groundwater Depletion of groundwater availability	For accidental releases: • Same measures as specified for Soils. For depletion of groundwater: • Implement water minimization measures. • Monitor surrounding groundwater well levels. For discharge of wastewater • Oily water produced on site will be collected and transported to the IDB plant´s effluent water pit and water treatment unit. This unit will include an oily water storage tank (50m^3), a sand trap and an oily water separator. • Water from the demineralised water production unit will not be treated but will be tested to ensure it meets the required legislative standards for the discharge of wastewater (Decree No. 2001-109). • Surface water runoff will be sent through a hydrocarbon separator prior to discharge.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Weekly visual inspections of waste and hazardous material storage areas Weekly visual inspections of spill response equipment Track groundwater well water levels and	Management plan documentation and demonstration of implementation including training record Inspection records Incident records Well water levels and water quantity used Number of groundwater related complaints	Groundwater well monitoring monthly For incidents, investigate and resolve as they arise	Monitoring to be undertaken throughout operation	O&M Contractor (BWSC)	Well installation and monitoring, equipment and operating costs should be included in O&M Contractor (BWSC) costs Monitoring by O&M Contractor (BWSC) staff

	Environmental /Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
				• All sanitary sewage to be contained, managed, separate from other wastewater, and recovered in a temporary septic tank storage and periodically evacuated for offsite disposal by qualified party.	track and report groundwater consumption Track records of public complaints related to groundwater use Weekly visual inspection of IDB plants effluent water pit and treatment unti. Monthly monitoring of wastewater quality					
I22	Surface Water	Accidental release of hydrocarbons from equipment or vehicles due to improper handling or failure Accidental release of stored hazardous material or waste due to improper handling or failure Accidental loss of containment and control of sanitary sewage Improper management or accidental loss of containment and treatment of storm water runoff	Contamination of the aquatic environment	For accidental releases: • Same measures as specified for Soils. For other discharges: • Same as specified for wastewater discharge for groundwater. • Develop and implement a Storm water Management Plan to specify systems and equipment to minimise, contain, and treat storm water runoff and manage disposal. Management shall include treatment of all contaminated storm water and avoid direct discharge to surface water bodies.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Weekly visual inspections of waste and hazardous material storage areas Weekly visual inspections of spill response equipment Weekly visual inspection of sanitary sewage and storm water management systems.	Management plan documentation and demonstration of implementation including training record Inspection records Incident records Records of sanitary sewage disposal	Inspections as specified For incidents, investigate and resolve as they arise	Management plans to be developed prior to operation Management plan implementation to be maintained over the operation period	O&M Contractor (BWSC)	Sanitary sewage and storm water management systems and operating costs should be included in O&M Contractor (BWSC) costs Monitoring by O&M Contractor (BWSC) staff
I23	Visual Impacts	Presence of the Power Plant.	Negative impact on visual amenity especially for neighbouring public	• Adequate housekeeping for the whole operation phase (e.g. appropriate waste management and adequate equipment storage); • During maintenance activities machinery and cranes will not be left in place longer than necessary; • Lighting of the site to be as unobtrusive as possible directed down and not directed to residential areas; and • The use of masts for site lighting to be avoided as much as possible.	Daily visual inspections to verify implementation and effectiveness of mitigation measures Track records of public complaints	Inspection records Number of visual amenity complaints	Inspections as specified For complaints, investigate and resolve as they arise	Throughout the operational phase	O&M Contractor (BWSC)	Monitoring by O&M Contractor (BWSC) staff

	Environmental /Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
					related to visual amenity					
I24	Employment of Local People	Some portion of the operational work force will be filled with local people depending on skill requirements	Positive impacts to the local economy associated with employment of local people including economic benefits and job and skills training	• Recruit to the extent possible, local people and local goods and services. The necessary training will be provided in order to enable local people access to the different positions and that the work can be carried out safely (training on the safety measures to be inherent to each position).	Employment and training records	Number and percent of local people employed	Ongoing	Throughout the operational phase	O&M Contractor (BWSC)	O&M Contractor (BWSC) staff
I25	Worker Health and Safety and Community Health and Safety	Operational and maintenance activities onsite and offsite by Project workers Interaction of Project workers with the general public	Potential for accidents and injury from accidents Potential for worker or public health issue from spread of disease	For worker health and safety: • Develop and implement a worker Health and Safety Plan in compliance with national regulations and international good practice. • Provide workers with the appropriate personal protective equipment as well as the training necessary in relation to the levels of health and safety risk related to the work to be undertaken. • Develop and implement an Emergency Preparedness and Response Plan • Develop and implement a worker grievance mechanism. For community health and safety: • Develop Worker Code of Conduct for all workers directly related to the project and address the following aspects: ○ Respect for local residents and customs; ○ Zero tolerance of bribery or corruption; ○ Zero tolerance of illegal activities; ○ No alcohol and drugs policy during working time or at times that will affect ability to work; ○ Description of disciplinary measures; ○ Specific requirements for security staff.	Daily visual inspection of work activities and worker health and safety performance Tracking and reporting systems for incidents and injuries	Health and Safety Plan documentation and demonstration of implementation including training record Health and safety performance indicators such incident rates Community health indicators such as disease rates Number of public complaints related to community health and safety	Ongoing	Management plans to be developed prior to operation Management plan implementation to be maintained over the operation period	O&M Contractor (BWSC)	Health and safety systems, equipment and monitoring staff should be included in O&M Contractor (BWSC) costs Monitoring by O&M Contractor (BWSC) staff
I26	Public Safety	Project-related use of public roads for transportation On and offsite operational traffic	Potential for accident and injury to members of the public from vehicles or emissions	Overall transportation impacts: • Prepare a detailed Traffic Management Plan that identifies: ○ the routes that will be used for Project operational traffic, along with the estimated numbers of traffic movements, speeds and times of travel; ○ the programme of road restoration measures that are likely to be required once fuel oil shipments have ceased; ○ how existing road development plans have been taken into account in the identification of routes and road restoration measures; ○ procedures to reduce the exposure of Project and non-Project road users (whether in vehicles or on foot) from the hazards of road-related accidents; and ○ details of audits and reviews of the components of the project transport system.	Record and track speeding incidents Track records of public complaints due to road traffic	Management plan documentation and demonstration of implementation including training record Number of road traffic complaints Maintenance records Number of speeding incidents	Ongoing For complaints, investigate and resolve as they arise	Management plan to be developed prior to operation Management plan implementation to be maintained over the operation period	Benpower SA to work with Government of Benin on road restoration	Road restoration requirements dependent on final route and condition of roads once fuel oil shipments have ceased.

	Environmental /Social Component	Activity generating the impact	Potential impact	Mitigation Measures	Monitoring Measures	Performance Indicators	Frequency	Timing	Action Owner	Cost
				• Fuel transportation plan to be developed and included in the contracts with the fuel service provider. This plan should include the following: ○ Emergency response plan for dealing with accidents and fuel spills, including reporting requirements; ○ Driver training requirements; ○ Monitoring requirements. Worker road safety: • Provide a safe transportation programme to assist workers to travel securely and reliably between their residence and their workplace. As part of this programme, consider providing employee buses for workers who live beyond walking distance. Safety of road users: • Identify key pedestrian crossing locations along the fuel haul route, and construct pedestrian improvements, such as crosswalk markings and signage; • Ensure all drivers are qualified, trained to drive their vehicles safely, and have required licenses; • Install speed-monitoring devices and/or speed governors on all Project vehicles; • Maintain all vehicles to international requirements; • Maintain road and safety-related signage; and • Community information sessions around road safety and Project related road usage.						
I27	Unplanned Event	Loss of containment of natural gas from pipeline, facilities or ancillary equipment	Potential for accident and injury to members of the public due to an incident relating to loss of containment (eg, fire/explosion)	• Complete recognized process of hazard analysis process (eg, HAZOP, FMEA, SIL, LOPA) for the Power Plant.	Safety risk profile	Documented hazard analysis on site and demonstration of implementation including training record	One time	Process to be undertaken prior to operation	Benpower SA	$50,000

9. ENVIRONMENTAL AND SOCIAL MONITORING PLAN

In order to ensure the effectiveness of the mitigation measures monitoring requirements are indicated in the commitment tables in *Chapter 8*, these are summarised below.

9.1 Construction Monitoring

At a minimum the following will be monitored during construction:

- Daily visual inspections to verify implementation and effectiveness of mitigation measures, including:
  - work activities including site clearing and excavation to detect presence of cultural heritage resources; and
  - work activities and worker health and safety performance.
- Weekly visual inspections of:
  - machinery, equipment and vehicles to verify performance;
  - waste and hazardous material storage areas;
  - spill response equipment;
  - sanitary sewage and storm water management systems.
- Grievance mechanism – track public complaints and responses/actions;
- Track and record greenhouse gas emission (using as option a surrogate measurement such as fuel use);
- Periodic measurements of noise levels at locations on site, at the site boundary, and at noise sensitive noise receptors;
- Measure groundwater well water levels and track and report groundwater consumption;
- Track and record incidents related to interaction with natural fauna;
- Monitoring as per the recommendations of the Resettlement Review including plan for livelihood restoration;
- Employment and training records; and
- Record and track speeding incidents.

9.2 Operation Monitoring

At a minimum the following will be monitored during operation:

- Internal and external audits of ESMS;
- Grievance mechanism – track public complaints and responses/actions;
- Real time monitoring of levels of gaseous pollutants at locations around the Project site during HFO operations as specified in the ESIA;
- Annual monitoring of gaseous pollutants at exhaust stack and at locations around the Project site;
- Calculated annual greenhouse gas emissions and report as specified in ESIA;

- Conduct two separate noise monitoring surveys at the four identified Noise Sensitive Receptors. The first survey should be conducted just after commissioning of the IDB power plant and the second after commissioning of the Project power plant (ie, both plants operating together);
- Conduct annual noise surveys at perimeter and noise sensitive receptors to be compared with commissioning results to ensure proper noise abatement maintenance standard throughout plant operations;
- Daily visual inspections to verify implementation and effectiveness of mitigation measures, including:
  - work activities and worker health and safety performance;
- Weekly visual inspections of:
  - machinery, equipment and vehicles to verify performance;
  - waste and hazardous material storage areas;
  - spill response equipment;
  - sanitary sewage and storm water management systems.
- Regular monitoring of wastewater discharge quantity and quality;
- Monitor surrounding groundwater well levels;
- Employment and training records;
- Tracking and reporting systems for incidents and injuries; and
- Safety risk profile.

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ANNEX A. AIR QUALITY STUDY

CONTENTS

EXECUTIVE SUMMARY

The Project involves the installation and operation of a new thermal power generation plant in Maria Gleta, near Cotonou, Benin. The power plant will comprise a new natural gas-fired 144 MW_e combined-cycle, thermal power generation plant made up of the following:

- Seven (7) dual-fuel reciprocating engines each producing 18.2 MW_e for a total of 127 MW (MAN Group 18V51/60 DF units are specified); and
- Steam turbine system producing 18 MW_e.

A similarly designed 127 MW_e plant (Phase 1) is being constructed adjacent to the plant and waste heat from that plant will also be used to power the steam turbine system.

An impact assessment has been undertaken using dispersion modelling to predict the impacts on air quality due to the operation of the plant operating alone and in combination with the adjacent Phase 1. The Project will use Heavy Fuel Oil (HFO) for a period of time (approximately one year) while the supply of natural gas to the plant is put in place.

Three scenarios were investigated. The first scenario investigated the Project operating alone. The second, the Project operating in conjunction with Phase 1. The third considered the actual emissions rather than assuming emission limits, and considered the effect of lower sulphur fuel. In all three scenarios complex chemistry was used, as nitrogen dioxide was a key consideration.

The long-term operation of the Project and Phase 1 using gas as the fuel is not expected to result in air quality standards being exceeded. When operating on HFO the NO_2 air quality standards are predicted to be achieved, albeit that the baseline has not been monitored. When using HFO with sulphur content of greater than 0.5%, the SO_2 air quality standards are predicted to be exceeded. Therefore, mitigation measures are recommended.

The baseline has not been monitored and some of the assumptions used in the model may under some circumstances be worse than those used in the NO_2 model. On this basis, it is recommended that during HFO operations, real-time monitoring is undertaken to verify the findings of the model and ensure that exceedances do not arise.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Project involves the installation and operation of a new thermal power generation plant in Maria Gleta, near Cotonou, Benin. The Project proponent is a joint venture comprising:

- Burmeister & Wain Scandinavian Contractor (BWSC);
- African Infrastructure Investment Managers (AIIM);
- Enterprise Power (En/Power); and
- Investment Fund for Developing Countries (of Denmark) (IFU).

The power plant will comprise a new natural gas-fired 144 MW_e combined-cycle, thermal power generation plant made up of the following:

- Seven (7) dual-fuel reciprocating engines each producing 18.2 MW_e for a total of 127 MW (MAN Group 18V51/60 DF units are specified); and
- Steam turbine system producing 18 MW_e.

A similarly designed 127 MW_e plant is being constructed adjacent to the plant and waste heat from that plant will also be used to power the steam turbine system.

For the purposes of this report, the following references are used:

- The Project plant is referred to as the 'Project'.
- The similarly designed plant currently under construction is referred to as the 'Phase 1.'

The operation of the Project will results in emissions to air from engine exhaust. These emissions have the potential to adversely affect ambient air quality. This Air Quality Impact Assessment (AQIA) evaluates the potential impacts and ascertains the need for mitigation.

The AQIA considers cumulative impacts:

- Impacts from the Phase 1 project are considered, as it is known that the Project and Phase 1 will operate concurrently;

- There is an existing 20MW_e power plant located adjacent to the site. Cumulative impacts form this plant have not been considered. This plant is of an old design and is inefficient. It is therefore expected that this plant will not be used when the Project and Phase 1 are operational as these offer greater efficiency and lower running costs;

- There are proposals for an additional 20MW_e plant adjacent to the Project. However, these plans are highly tentative and given that the Project and Phase 1 will have generating capacity spare, this has not been included as it is not reasonably foreseeable that this plant will go ahead.

The AQIA also considers impacts of the operation of the Project using Heavy Fuel Oil (HFO) as the fuel. The Project plant will use HFO for a period of time (approximately one year) while the supply of natural gas to the plant is put in place.

1.2 SCOPE OF WORK

This report describes the AQIA for the Project. It covers both Project-related emissions as well as cumulative emissions.

The assessment involved creating an inventory of emission sources based on the equipment proposed. Cumulative impacts considered the Project and Phase 1. The potential impacts have been predicted using computer-based dispersion modelling, and with consideration of the existing baseline environmental conditions. The significance of potential impacts has been determined by comparing outputs of dispersion modelling to air quality standards set out in Benin laws and regulation and in the requirements of international lenders, specifically the *IFC Performance Standards on Environmental and Social Sustainability (2012)* (the IFC Performance Standards) and the related World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

The pollutants of interest for the study are those that would be the most significant in terms of emission amounts and importance in terms of environmental effects:

- When the Project is operating on natural gas as fuel:
    - Oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2)
- When the Project is operating on HFO as fuel:
    - NO_x and NO_2;
    - Particulate matter (as PM_{10} and $PM_{2.5}$); and
    - Sulphur dioxide (SO_2)

1.3 REPORT STRUCTURE

The report is organised as follows:

- Section 2: Methodology
- Section 3: Technical Limitations and Assumptions
- Section 4: Baseline Conditions

- Section 5: Results
- Section 6: Real-Time Monitoring
- Section 7: Conclusions

2 METHODOLOGY

2.1 LEGAL AND POLICY FRAMEWORK

2.1.1 Overview

The assessment follows guidance set out in the following:

- World Bank Group General EHS Guidelines (section on air quality)[1] ; and
- EHS Guidelines for Thermal Power[2].

The guideline for thermal power state that the most stringent of either nationally regulated air quality standards or the applicable EHS Guideline should be used. As there are regulated air quality standards in Benin, these have been considered in the assessment.

Note that the legal framework for air quality is separated into two aspects:

- Ambient air quality standards; and
- Emissions limit.

2.1.2 Ambient Air Quality Standards

Air quality standards are set at the point below which it is reasonable that there is negligible risk of harm to exposed people. These standards are set to protect the large majority of the population including the elderly and young children.

Benin

The Benin air quality standards relevant to this study are set out in *Table 2.1*.

Table 2.1 Benin Air Quality Guidelines

Pollutant	Averaging period	Air Quality Standard (μg/m^3)
NO_2	Annual mean	100
	24 hour maximum	150
SO_2	Annual mean	80
	24 hour maximum	200
	1 hour mean	1300
PM_{10}	Annual mean	50
	24 hour maximum	230

[1] World Bank Group General Environmental, Health and Safety Guidelines (2007)

[2] World Bank Group Environmental, Health and Safety Guidelines for Thermal Power (2008)

Source: Ministere de l'energie, de l'eau et des mines (2017) Projet De Construction De La Centrale Thermique A Moteurs Dual Fuel (Gaz-Hfo) Sur Le Site De Maria-Gleta 2 (400 MW), Quoting: Air quality standards Decree No. 2001-110 of 04 April 2001)

World Bank Group EHS Guidelines

The applicable World Bank Group air quality guidelines relevant to this study are set out in *Table 2.2*.

Table 2.2 IFC Air Quality Guidelines

Pollutant	Averaging period	Air Quality Standard (µg/m^3)
NO_2	Annual mean	40
	1 hour maximum	200
SO_2	24 hour maximum	125
	10 minute maximum	500
PM_{10}	Annual mean	70
	24 hour mean, not to be exceeded more than 3 times per year	150
$PM_{2.5}$	Annual mean	35
	24 hour mean	75

Source: World Bank Group General EHS Guidelines (2007) (section on Air Emissions and Ambient Air Quality)

2.1.3 *Emission Limits*

Emission limits are set as the maximum permissible concentration of pollutants that can be emitted from the plant. These are included in this report for the purpose of allowing comparison of the predicted impacts with the emission limits.

Benin

The emission limits applicable to engines on gas and on HFO are summarised in *Table 2.3*.

Table 2.3 ***Benin Emission Limits for Engines***

Pollutant	Emission Limit	Units	Notes
NO_x (Note 1)	325 611	ppm mg/Nm^3 (at 3%O_2 dry, 273K)	
PM_{10}	85	mg/Mj	Operation on liquid fuels

Source: Air quality standards Decree No. 2001-110 of 04 April 2001
Note 1: Emission limits relate to total NO_x emissions, whereas air quality standards refer only to the NO_2 fraction of NO_x. The conversion from NO_x to NO_2 is discussed in this report.
Note 2: Benin introduced a 50ppm fuel sulphur limit in 2016 for diesel fuels.

World Bank Group EHS Guidelines

The power plant has a sum total power greater than $50MW_{thermal}$, and is therefore subject to the emission limits set out in the EHS Guidelines for Thermal Powers. As the Project is less than $300MW_{thermal}$ in isolation, and HFO use will be temporary, the emissions limits applicable to the Project are the higher threshold emission limits. The emission guidelines applicable to dual fuel reciprocating engines operating on gas and HFO are summarised in *Table* 2.4.

Table 2.4 ***World Bank Group Emissions Guidelines for Engines***

Pollutant	**Emission Limit**	**Units**
Gas		
NO_x	400 (Dual Fuel engine, undegraded airshed)	mg/Nm^3 (at 15%O_2 dry, 273K)
HFO		
NO_x	2000 (Dual fuel engine, undegraded airshed)	mg/Nm^3 (at 15%O_2 dry, 273K)
PM	30	mg/Nm^3 (at 15%O_2 dry, 273K)
SO_2	2% Sulphur, 1170	% Sulphur mg/Nm^3 (at 15%O_2 dry, 273K)

Note 1: Emission limits relate to total NO_x emissions, whereas air quality standards refer only to the NO_2 fraction of NO_x. The conversion from NO_x to NO_2 is discussed in this report.

These emission limits are not legally binding *per se*, as they are provided by lenders as guidelines rather than set out in law. However, it is anticipated that, as a minimum, lenders will expect these to be achieved.

2.1.4 *Good International Industry Practice*

The IFC General EHS Guidelines for Air Emissions and Ambient Air Quality state:

> *The stack height for all point sources of emissions, whether 'significant' or not, should be designed according to GIIP to avoid excessive ground level concentrations due to downwash, wakes, and eddy effects, and to ensure reasonable diffusion to minimize impacts. For projects where there are multiple sources of emissions, stack heights should be established with due consideration to emissions from all other project sources, both point and fugitive.*

This approach is used to ensure that building downwash effects are not excessive. *Figure 2.1* is extracted from the IFC Guidelines, and illustrates the method by which the minimum stack height should be determined for a project.

Figure 2.1 GIIP Method

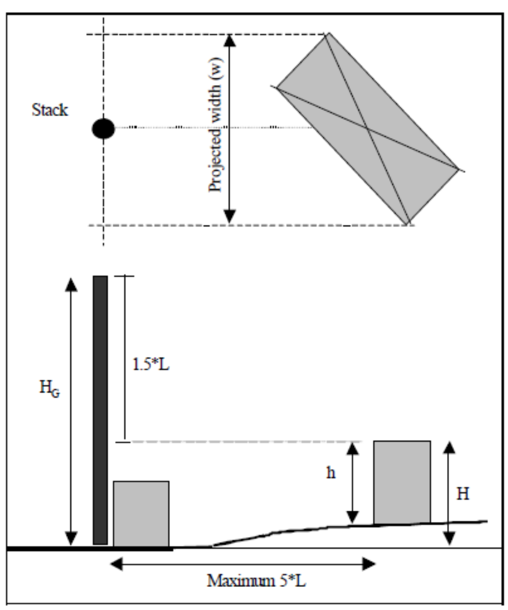
$H_G = H + 1.5L$; where

H_G = GEP stack height measured from the ground level elevation at the base of the stack

H = Height of nearby structure(s) above the base of the stack.

L = Lesser dimension, height (h) or width (w), of nearby structures

"Nearby structures" = Structures within/touching a radius of 5L but less than 800 m.



The stack height for the Project is designed to comply with GIIP. In this case the building envelope is not known; however the maximum allowable building height has been calculated as follows:

[Eq1] $H_G = H + 1.5L$

In this case L is the height of the building envelope (ie H), as this is assumed to be less than the width of the building, if all the engines are assumed to be within the same building envelope.

Therefore:

[Eq2] $H_G = H + 1.5H = 2.5H$

The design stack height is 40m. On this basis [Eq2] can be rearranged as follows:

[Eq3] $H = H_G/2.5 = 40/2.5 = 16m$

Therefore, the building envelope would need to be 16m in height or less in order to be compliant with GIIP. Whilst the exact height of the building is not known exactly, it will be less than 16m.

2.2 *OVERVIEW OF ASSESSMENT METHODOLOGY*

2.2.1 *Introduction*

The assessment uses computer-based dispersion modelling to identify the increase in air pollutants at ground-level attributable to the emissions from the power plant. With due consideration of the baseline, the potential for significant impacts to occur is ascertained.

2.2.2 *Identifying Impact Magnitude*

The predicted change in ground level concentrations of pollutants from the Project is referred to as the Process Contribution (PC). In order to consider the significance of potential impacts, the existing baseline also needs to be taken into consideration. The sum of the PC and the existing baseline is described as the Predicted Environmental Concentration (PEC). The significance of potential impacts, using both the PC and PEC, is determined following World Bank Group guidance as described below.

The General EHS Guidelines state:

'Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that:

- *Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources.'*

- *Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed [ie, in an undegraded airshed].'*

In practice, it is ERM's experience that lenders currently are applying the '25% rule' is more stringently than in the past.

The General EHS Guidelines also state:

'*An airshed should be considered as having poor air quality [degraded] if nationally legislated air quality standards or WHO Air Quality Guidelines are exceeded significantly.'*

'*Facilities or projects located within poor quality airsheds, and within or next to areas established as ecologically sensitive (e.g. national parks), should ensure that any increase in pollution levels is as small as feasible, and amounts to a fraction of the applicable short-term and annual average air quality guidelines or standards as established in the project-specific environmental assessment.'*

Using this approach, the PC and PEC are established, and with consideration of the airshed, the overall impacts are determined.

2.2.3 Receptor Sensitivity

In creating a scale for sensitivity, human health within the general population would be generally considered 'Medium'. In an assessment, this applies at all sensitive human receptors. As air quality standards are set to protect the most vulnerable individuals in society, there is inherently a margin of safety within air quality standards. 'High' sensitivity would only be applied in a small number of specific cases, such as hospitals with intensive care wards where health conditions or receptors may be poor and vulnerable. A 'Low' sensitivity is typically only applied to locations where people are transient and exposures limited, for example agricultural areas or fishing areas.

2.3 DISPERSION MODELLING

2.3.1 Overview

The dispersion model used for the AQIA was USEPA's AERMOD. AERMOD is considered to be appropriate for this type of assessment and is recommended by the IFC as an organisation and is widely recognised by

national regulators. The model incorporates a number of parameters to simulate the dispersion of emissions from source, and predict the subsequent pollution concentration at receptors. The key inputs to the model are emissions data and source characteristics, terrain data and meteorological data. Within the dispersion model, specific receptor locations are defined. For this study, a grid of receptors has been defined to identify impacts across the Project area.

2.3.2 *Emissions Data*

Emissions data is provided for the three scenarios discussed in *Section 5.1*. The dispersion model requires the following data for the sources:

- Emission point height (m);
- Emission point diameter (m);
- Exit velocity (m/s) or Actual volume flow rate (Am^3/s);
- Emission temperature (degrees Celsius);
- Pollutant mass emissions (g/s); and
- Emission point location (m).

Information for the Phase 1 plant and the Project is derived from information provided by the Project Proponent, obtained from the technology supplier. All relevant parameters for the stack and emissions have been provided.

With regards to the emissions, the following are noted:

- The emissions and exhaust gas profile will differ when Phase 1 and the Project operate on gas, compared to HFO;

- The exhaust flues from the engines are clustered together around a single spine. This means that the plumes combine which leads to improved dispersion;

- A steam turbine is utilised to recover waste heat; and

- The exhaust temperature, volume flow rate and exit velocity are lower when the steam turbine is in use as the exhaust gases contract as waste heat is removed.

The parameters used in the modelling are set out in *Table 2.5*.

Table 2.5 Emissions Parameters

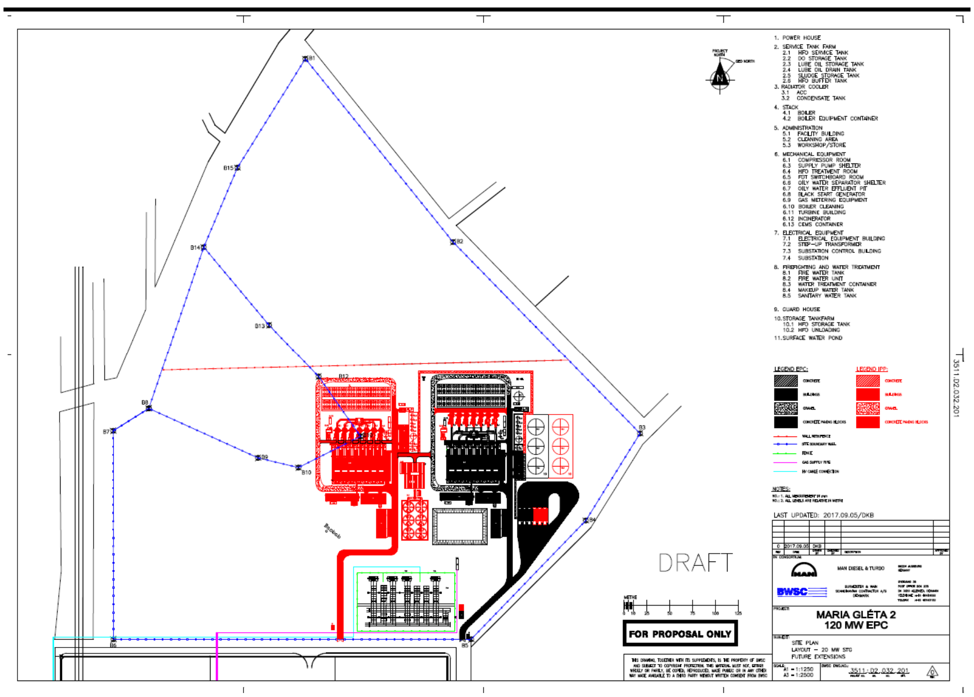
Parameter	Units	Project and Phase 1 Plant					
Number of engines in use		7	7	6	6	5	5
Fuel		Gas	HFO	Gas	HFO	Gas	HFO
Stack height	m	40	40	40	40	40	40
Individual flue diameter	M	1.61	1.61	1.61	1.61	1.61	1.61
Effective flue diameter (1) (2)	m	4.25	4.25	3.94	3.94	3.60	3.60

Parameter	Units	Project and Phase 1 Plant					
Emission velocity (2)	m/s	18.9	23.4	18.9	23.4	18.9	23.4
Volume flow rate Actual (2)	Am³/s	269	333	230	285	192	238
Emission temperature (with WHR)	Celsius	170	170	170	170	170	170
Emission temperature (without WHR)	Celsius	N/A	300				
Emissions							
SO_2	mg/Nm³	N/A	1130	N/A	1130	N/A	1130
NO_x	mg/Nm³	400	2000	400	2000	400	2000
PM	mg/Nm³	N/A	30	N/A	30	N/A	30
SO_2	g/s	N/A	297	N/A	127	N/A	106
NO_x	g/s	102	525	75	383	62	319
PM	g/s	N/A	13.1	N/A	11.2	N/A	9.36

Note 1: The effective diameter is calculated from the combination of individual flue diameters.

The plant layout and immediate surroundings are illustrated in *Figure 2.2*. The Project is shown in red, with the adjacent Phase 1 shown in black.

Figure 2.2 *Plant Layout*



2.3.3 *Meteorological Data*

The meteorological data used in the model must be reflective of the local conditions. Two options were considered:

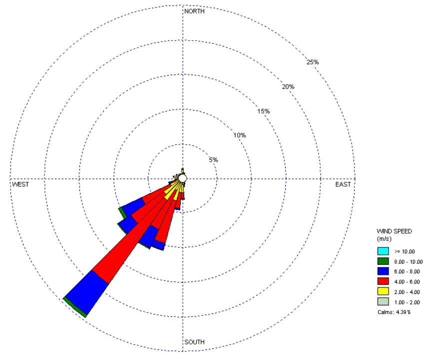
- Meteorological data is available from Contonou Airport, located approximately 11km southeast of the plant.

- Prognostic meteorological data derived from the MM5 meteorological model is an option. This data is derived from global weather modelling refined to localised level and verified against available local data. This takes into account local topography and features to produce site specific meteorological data.

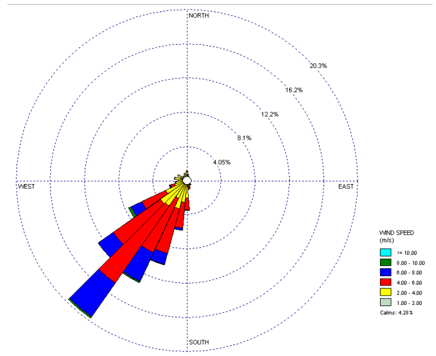
A review of Contonou Airport identified that the meteorological data available is of adequate quality and covers a sufficient period to be reliably used in the dispersion modelling. This data was therefore used in the assessment in preference to the MM5 data as it is considered on balance to be more reflective of the local conditions.

Five years of meteorological data (2013 to 2017, inclusive) were used for this assessment. The wind rose for 2013 to 2017 is presented in *Figure 2.3* and show that the prevailing wind direction is from the southwest, and in common with this region of West Africa, is strongly mono-directional from the southwest.

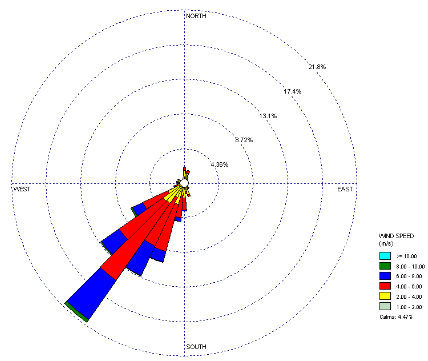
Figure 2.3 Wind Roses



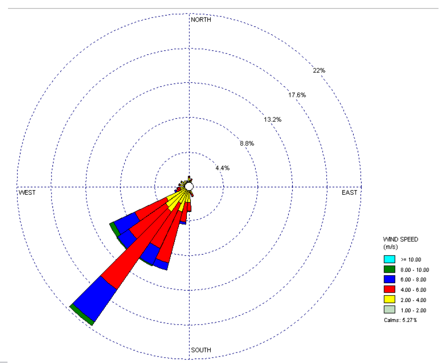
2013



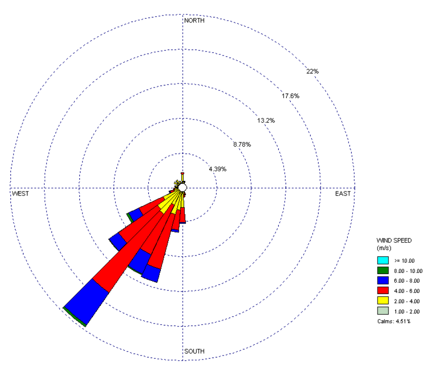
2014



2015



2016



2017

2.3.4 *Terrain Effects*

Changes in terrain elevations (ie, hills or mountains) can have a significant impact on dispersion of emissions, in terms of funnelling of plumes and changing local wind flows. Terrain effects are typically considered important where there are sustained gradients of 1:10 or greater.

Terrain has not been included in this case as there is no significant variation in terrain in the area of the Project.

2.3.5 *Land Use*

The surrounding land will have an effect on the airflow, atmospheric turbulence and dispersion of emissions. The land use in the area surrounding the power plant is characterised as being primarily residential suburban in all directions.

2.3.6 *Building Downwash*

When air flow passes over buildings, a phenomenon known as building downwash occurs where the air is entrained in the lee of the building and drawn down to ground level. This phenomenon can bring the plume from the stack down to ground level more quickly than would otherwise be the case, and therefore increase the ground level concentration relative to a case where there are no buildings. This effect is relevant where buildings are greater than one-third stack height. In this case the only buildings are the engines themselves and the steam turbine. The height of these will be less than one third of the stack height. In addition the stack height meets GIIP (Section 2.1.4), ensuring that downwash effects will be negligible. Therefore, building effects have not been included in the dispersion model.

2.3.7 *Conversion of NO_x to NO_2*

Emissions from the power plant will contain oxides of nitrogen (NO_x). These occur as both nitric oxide (or nitrogen oxide) (NO) and nitrogen dioxide (NO_2). The ratio of these two gases in the exhaust gases from combustion processes varies, but is typically in the ratio of 95% NO to 5% NO_2, and this ratio has been used in this assessment.

With regard to the assessment of impact on human health, NO_2 is the pollutant of interest as NO has little effect on human health at concentrations typically encountered in ambient air. Within the atmosphere, various processes oxidise (convert) NO to create NO_2 but this process will not occur quickly or completely before the plume reaches ground level. Therefore it is overly pessimistic to assume 100% conversion from NO_x to NO_2, and it is necessary to convert NO_x to NO_2 to estimate ground level concentrations of NO_2 based upon total NO_x emitted.

The USEPA [1] provide a tiered methodology for making the NO_x to NO_2 conversion, using increasingly detailed methods. Where impacts remain significant after Tier 1, Tier 2 is then used, and where impacts remain significant, Tier 3 is then used. The assumptions are as follows:

- Tier 1: Assumes that 100% conversion of NO to NO_2 occurs.
- Tier 2: Ambient Ratio Method (ARM) utilising a conversion ratio of 80% for the short term and 75% for the long term.
- Tier 3: Plume Volume Molar Ratio Method (PVMRM) utilises ground level ozone concentrations.

Initial modelling demonstrated that NO_2 impacts could not be screened out using Tier 1 or Tier 2 methodology. Therefore, the impact assessment undertaken and the results presented in this report utilise the PVMRM Method.

For Tier 3 the rate of NO_x to NO_2 conversion is driven by environmental factors including the availability of ozone, volatile organic compounds, and sunlight. The PVMRM approach utilises the dependence on ozone availability to calculate the conversion rate. This method requires data on ambient ozone and allows conversion of NO_x to NO_2 on an hour-by-hour basis. Ozone concentrations of 25ppb were identified for Cotonou from published measurements by Thouret, Saunois *et al* (2009) [2]. This was used as the annual mean in the PVMRM calculation.

(1) USEPA, 2011. Memorandum - Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard. United States Environmental Protection Agency, March 01 2011.
(2) Thouret V., Saunois M. et al (2009) An overview of two years of ozone radio soundings over Cotonou as part of AMMA *Atmospheric Physics and Chemistry 9 pp6157-6174*

3 TECHNICAL LIMITATIONS AND ASSUMPTIONS

The assessment of potential impacts of the operation of the power plant has some technical limitations, and requires some assumptions to be made. The key limitations and assumptions are set out below:

- The power plant will not operate at full load continuously, as there will be some periods of downtime for maintenance. The impact assessment is based upon continual operation of the engines.

- The emissions from the Project and Phase 1 are assumed to arise at the World Bank Group NO_x emission limits. In practice, the engines emissions will be 10-15% lower than the limit. Scenario 1 and 2 are undertaken at emission limit. Scenario 3 includes these lower emissions.

- The HFO fuel is assumed to have a sulphur content of 2%, in line with the EHS Guidelines maximum permissible fuel sulphur limit. However, in practice, Benin, along with other West African countries have been improving fuel quality by reducing sulphur content. HFO fuel may be available with a sulphur content of 0.5% or lower. This reduction in fuel sulphur is directly reflected in lower SO_2 emissions.

- The dispersion modelling uses five years of sequential hourly meteorological data. This approach is taken to capture year-on-year variation in meteorology and therefore dispersion. The results of the assessment are based upon the highest results from any of the five years. This worst-case approach follows international best practice, and is adopted to ensure that the worst likely impacts on human health are identified.

- The baseline has not been quantified using primary data measured for the study. Rather, professional judgement has been used to assess the likelihood of the airshed being degraded or undegraded based upon the surrounding land use and understanding of the local environment.

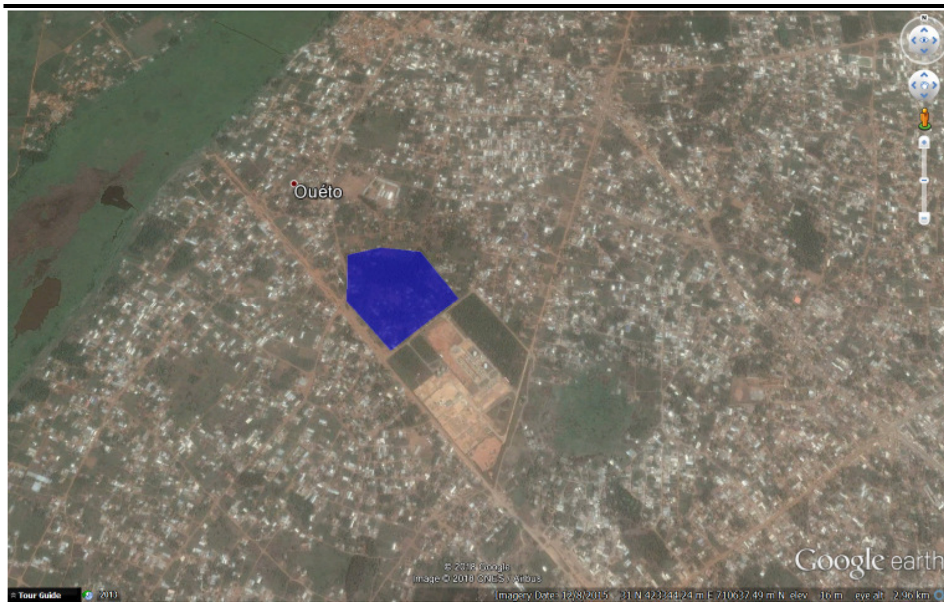
4 BASELINE CONDITIONS

4.1 INTRODUCTION

The power plant is situated in a suburban area to the northwest of Cotonou. The surrounding area is suburban, with low density housing and light industry surrounding the site. The power plant location and surroundings are illustrated in *Figure 4.1.*

Ambient air quality in the vicinity of the power plant and at nearby receptors is influenced by many factors. In the case of NO_2 and SO_2, the baseline is dominated by anthropogenic (man-made) sources, principally combustion sources and these will tend to be the same sources for both NO_2 and SO_2. Sources include road vehicle emissions, heating and cooking fires, industrial processes, and small scale waste burning.

Figure 4.1 Power Plant and Surrounding Area



In the case of PM_{10} and $PM_{2.5}$ the baseline is influenced by both natural sources and man-made sources. In addition to combustion sources, emissions of PM_{10} and $PM_{2.5}$ also arise from diffuse sources such as open ground, vehicles using unpaved roads, industrial activity, waste burning, agriculture, natural dust and regional natural dust transportation.

For the purposes of this assessment the baseline is taken to be that some level of air pollution that would exist without the presence of the power plants. There is no current baseline data available and instead professional judgement has been used to consider the sources in the local area and identify the

likelihood of the airshed being degraded or undegraded for the pollutants of interest.

4.2 *NO_2*

There are a small number of sources of emissions (ie, local road traffic, unregulated waste burning, residential cooking fires) in the vicinity of receptors which may also be impacted by emissions from the power plant. There are no major industrial or road sources, and the nearby residential areas are low density.

On this basis, the baseline NO_2 at receptors is expected to be well below the air quality standards and the airshed for NO_2 is undegraded. The operation of the existing 20MW_e will increase the baseline. However, as this plant will not be operated when the Project and Phase 1 come online, this is not considered in the future baseline.

4.3 *SO_2*

As with NO_2, there are a small number of sources of emissions (again, local road traffic, unregulated waste burning, residential cooking fires) in the vicinity of receptors which may also be impacted by emissions from the power plant. There are no major industrial or road sources, and the nearby residential areas are low density.

On this basis, the baseline SO_2 at receptors is also expected to be well below the air quality standards and the airshed for SO_2 is also undegraded.

4.4 *PM_{10} AND $PM_{2.5}$*

There are several man-made sources of emissions (eg, local road traffic, unregulated waste burning, residential cooking fires, domestic activity, dust emissions from unpaved roads and open areas) in the vicinity of receptors which may also be impacted by emissions from the power plant. In addition, there are emissions from diffuse and natural sources, including dust and particulates from open ground, unpaved roads and small-scale localised sources in the residential areas. The baseline is expected to be substantially variable with season, and be elevated in the dry season when the ground is dry and dusty.

On this basis, the baseline PM_{10} and $PM_{2.5}$ at receptors is anticipated to be close to or above the air quality standards and the airshed for PM_{10} and $PM_{2.5}$ is degraded. No baseline monitoring of PM_{10}/$PM_{2.5}$ will be required, as PM emissions are only a concern during the initial temporary operations on HFO

and the Project is designed to be compliant with the requirements of operating in a degraded airshed.

5 RESULTS

5.1 SCENARIOS

The operational scenarios considered in the study are set out in *Table 5.1*.

Table 5.1 Scenarios

Scenario	Plants assessed	Fuel	Number of Engines	Sulphur content	Waste Heat Recovery	NO_x as % of Emission Limit	Notes
1a	Project only	HFO	7	2%	WHR used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
1b	Project only	NG	7	n/a	WHR used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
2a	Project + Phase 1	HFO	14	2%	WHR used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
2b	Project + Phase 1	NG	14	n/a	WHR used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
2c	Project + Phase 1	HFO	14	2%	WHR not used	100% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack
3a	Project + Phase 1	HFO	11	1%	WHR used	85% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack, 6 engines Project, 5 engines Phase 1
3b	Project + Phase 1	NG	11	n/a	WHR used	85% of Limit	PVMRM used, 25ppb ozone, 5% NO_2 in stack, 6 engines Project, 5 engines Phase 1

5.2 *ASSESSMENT RESULTS*

The results of the impact assessment for the scenarios described are set out in *Table 5.1* to *Table 5.8*.

Results for $PM_{10}/PM_{2.5}$ have not been presented for Scenarios 2c and 3a, as the impacts in 1a and 2a are insignificant so no further consideration of PM is required.

Table 5.2 *Scenario 1a*

Basis of AQS	Pollutant	Averaging period	AQS (µg/m³)	Baseline (µg/m³)	PC (µg/m³)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	6.01	6.0%
	NO_2	24 Hour Mean	150	Undegraded	24.5	16%
IFC	NO_2	Annual Mean	40	Undegraded	6.0	15%
	NO_2	1 Hour Mean	200	Undegraded	69.2	35%
Benin	SO_2	Annual Mean	80	Undegraded	57.1	71%
	SO_2	24 Hour Mean	200	Undegraded	**225 (Note 1)**	**113%**
	SO_2	1 Hour Mean	1300	Undegraded	662	51%
IFC	SO_2	24 Hour Mean	125	Undegraded	**225 (Note 1)**	**180%**
	SO_2	10 Minute Mean	500	Undegraded	**947 (Note 1)**	**189%**
Benin	PM_{10}	Annual mean	50	Degraded	0.6	1%
	PM_{10}	24 hour mean	230	Degraded	3	1%
IFC	PM_{10}	Annual mean	70	Degraded	0.6	1%
	PM_{10}	24 hour mean	150	Degraded	2.4	2%
	$PM_{2.5}$	Annual mean	35	Degraded	0.6	2%
	$PM_{2.5}$	24 hour mean	75	Degraded	3	4%

Note 1: IFC and Benin SO_2 air quality standards are exceeded due to Project emissions alone. This is based upon the use of HFO fuel with sulphur content of 2%

Table 5.3 *Scenario 1b*

Basis of AQS	Pollutant	Averaging period	AQS (µg/m³)	Baseline (µg/m³)	PC (µg/m³)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	4.29	4.3%
	NO_2	24 Hour Mean	150	Undegraded	13.5	9.0%
IFC	NO_2	Annual Mean	40	Undegraded	4.29	11%
	NO_2	1 Hour Mean	200	Undegraded	28.8	14%

Table 5.4 Scenario 2a

Basis of AQS	Pollutant	Averaging period	AQS (µg/m³)	Baseline (µg/m³)	PC (µg/m³)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	11.2	11%
	NO_2	24 Hour Mean	150	Undegraded	45.3	30%
IFC	NO_2	Annual Mean	40	Undegraded	11.2	28%
	NO_2	1 Hour Mean	200	Undegraded	115	57%
Benin	SO_2	Annual Mean	80	Undegraded	**113 (Note 1)**	**141%**
	SO_2	24 Hour Mean	200	Undegraded	**443 (Note 1)**	**221%**
	SO_2	1 Hour Mean	1300	Undegraded	**1214 (Note 1)**	**93%**
IFC	SO_2	24 Hour Mean	125	Undegraded	**443 (Note 1)**	**354%**
	SO_2	10 Minute Mean	500	Undegraded	**1736 (Note 1)**	**347%**
Benin	PM_{10}	Annual mean	50	Degraded	3	6%
	PM_{10}	24 hour mean	230	Degraded	12	5%
IFC	PM_{10}	Annual mean	70	Degraded	3	4%
	PM_{10}	24 hour mean	150	Degraded	9.6	6%
	$PM_{2.5}$	Annual mean	35	Degraded	3	9%
	$PM_{2.5}$	24 hour mean	75	Degraded	12	16%

Note 1: IFC and Benin SO_2 air quality standards are approached or exceeded due to Project and Phase 1 emissions. This is based upon the use of HFO fuel with sulphur content of 2%.

Table 5.5 Scenario 2b

Basis of AQS	Pollutant	Averaging period	AQS (µg/m³)	Baseline (µg/m³)	PC (µg/m³)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	5.39	5.4%
	NO_2	24 Hour Mean	150	Undegraded	17.1	11%
IFC	NO_2	Annual Mean	40	Undegraded	5.39	13%
	NO_2	1 Hour Mean	200	Undegraded	45.1	23%

Table 5.6 Scenario 2c

Basis of AQS	Pollutant	Averaging period	AQS (µg/m^3)	Baseline (µg/m^3)	PC (µg/m^3)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	6.48	6.5%
	NO_2	24 Hour Mean	150	Undegraded	25.6	17%
IFC	NO_2	Annual Mean	40	Undegraded	6.48	16%
	NO_2	1 Hour Mean	200	Undegraded	99.5	50%
Benin	SO_2	Annual Mean	80	Undegraded	62.6	78%
	SO_2	24 Hour Mean	200	Undegraded	**242 (Note 1)**	**121%**
	SO_2	1 Hour Mean	1300	Undegraded	1040	80%
IFC	SO_2	24 Hour Mean	125	Undegraded	**242 (Note 1)**	**194%**
	SO_2	10 Minute Mean	500	Undegraded	**1487 (Note 1)**	**297%**

Note 1: IFC and Benin SO_2 air quality standards are approached or exceeded due to Project and Phase 1 emissions. This is based upon the use of HFO fuel with sulphur content of 2%. In this scenario the waste heat recovery system is not in use. This increases emission temperature and improves dispersion of emissions reducing impacts compared to Scenario 2a

Table 5.7 *Scenario 3a*

Basis of AQS	Pollutant	Averaging period	AQS (µg/m³)	Baseline (µg/m³)	PC (µg/m³)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	9.87	10%
	NO_2	24 Hour Mean	150	Undegraded	39.6	26%
IFC	NO_2	Annual Mean	40	Undegraded	9.87	25%
	NO_2	1 Hour Mean	200	Undegraded	90.5	45%
Benin	SO_2	Annual Mean	80	Undegraded	55.7	70%
	SO_2	24 Hour Mean	200	Undegraded	**215 (Note 1)**	**108%**
	SO_2	1 Hour Mean	1300	Undegraded	496	38%
IFC	SO_2	24 Hour Mean	125	Undegraded	**215 (Note 1)**	**172%**
	SO_2	10 Minute Mean	500	Undegraded	**709 (Note 1)**	**142%**

Note 1: IFC and Benin SO_2 air quality standards are approached or exceeded due to Project and Phase 1 emissions. In this scenario the fuel sulphur content is 1%, and 11 engines are operational (6 Project, 5 Phase 1). This reduces the overall emissions of SO_2, however, impacts remain above the air quality standards. In addition, the smaller plume arising from 11 engines compared to 14 engines results in a lower initial lift due to lower initial momentum and thermal buoyancy. The dispersion before reaching ground level is somewhat less than when operating 14 engines, meaning that the reduction in impacts due to running less engines is not linear with reducing numbers of engines. This scenario demonstrates that fuel with sulphur content of 0.5% is required to achieve SO_2 air quality standards.

Table 5.8 *Scenario 3b*

Basis of AQS	Pollutant	Averaging period	AQS (µg/m³)	Baseline (µg/m³)	PC (µg/m³)	PC/AQS (%)
Benin	NO_2	Annual Mean	100	Undegraded	5.60	6%
	NO_2	24 Hour Mean	150	Undegraded	17.3	12%
IFC	NO_2	Annual Mean	40	Undegraded	5.60	14%
	NO_2	1 Hour Mean	200	Undegraded	41.5	21%

5.3 *DISCUSSION*

5.3.1 *Scenario 1 and 2*

NO_2

The results show the point of maximum impact arising around the Project and Phase 1.

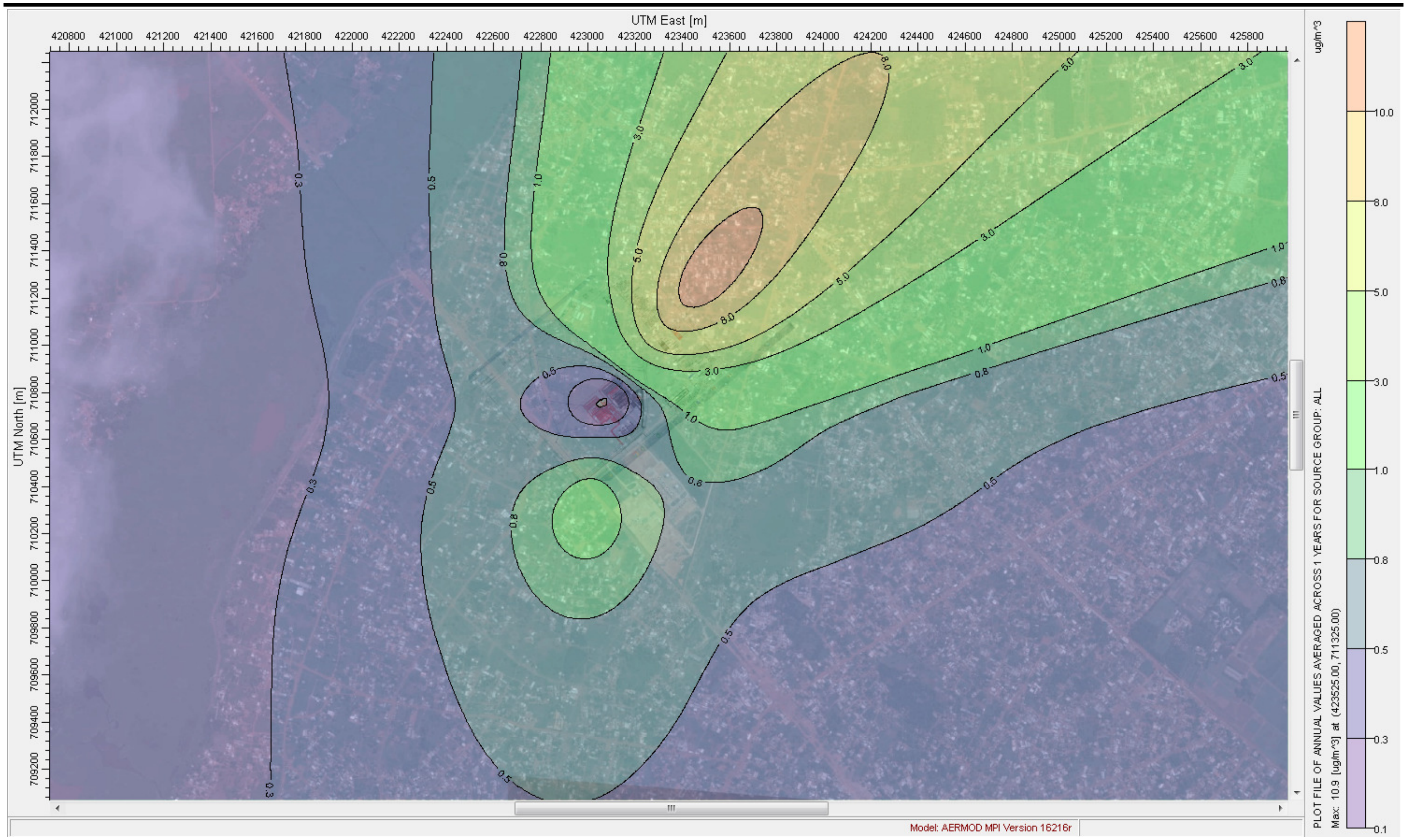
The long-term operation of the Project running on both gas and HFO results in impacts that are within the air quality standards. When the Project and Phase 1 are considered together when using both gas and HFO, impacts are also within the NO_2 air quality standards. However, of note is that this does not consider the existing baseline, which if elevated already may mean that these in-combination impacts exceed the air quality standards at some locations.

The operations of the Project plant alone is not predicted to result in air quality standards being exceeded. In addition, as illustrated in *Table 5.2*, the highest impacts are 35% of the IFC NO_2 air quality guidelines. In terms of the '25% rule' this is close to the 25% threshold. When considering that emissions of NO_2 are overstated in this scenario by 10% to 15%, the 25% threshold will only be marginally exceeded.

The NO_2 annual mean and 1 hour mean are illustrated in *Figure 5.3* and *Figure 5.4.*

The contour plots show the maximum impacts arising at locations around the plant. In the case of the 1 hour mean, the plot shows the highest 1 hour concentration at each receptor point modelled. Of note is that these impacts will arise at different times, as the wind direction and dispersion conditions vary throughout the year. The wind direction is dominated by wind from the southwest. Therefore, receptors to the northeast of the plant will be impacted for more hours in the year compared to other locations. For the annual mean, this is the cumulative average impact of emissions throughout the year. From this, the direction of the winds from the southwest is clear, with receptors to the northeast having the highest impacts.

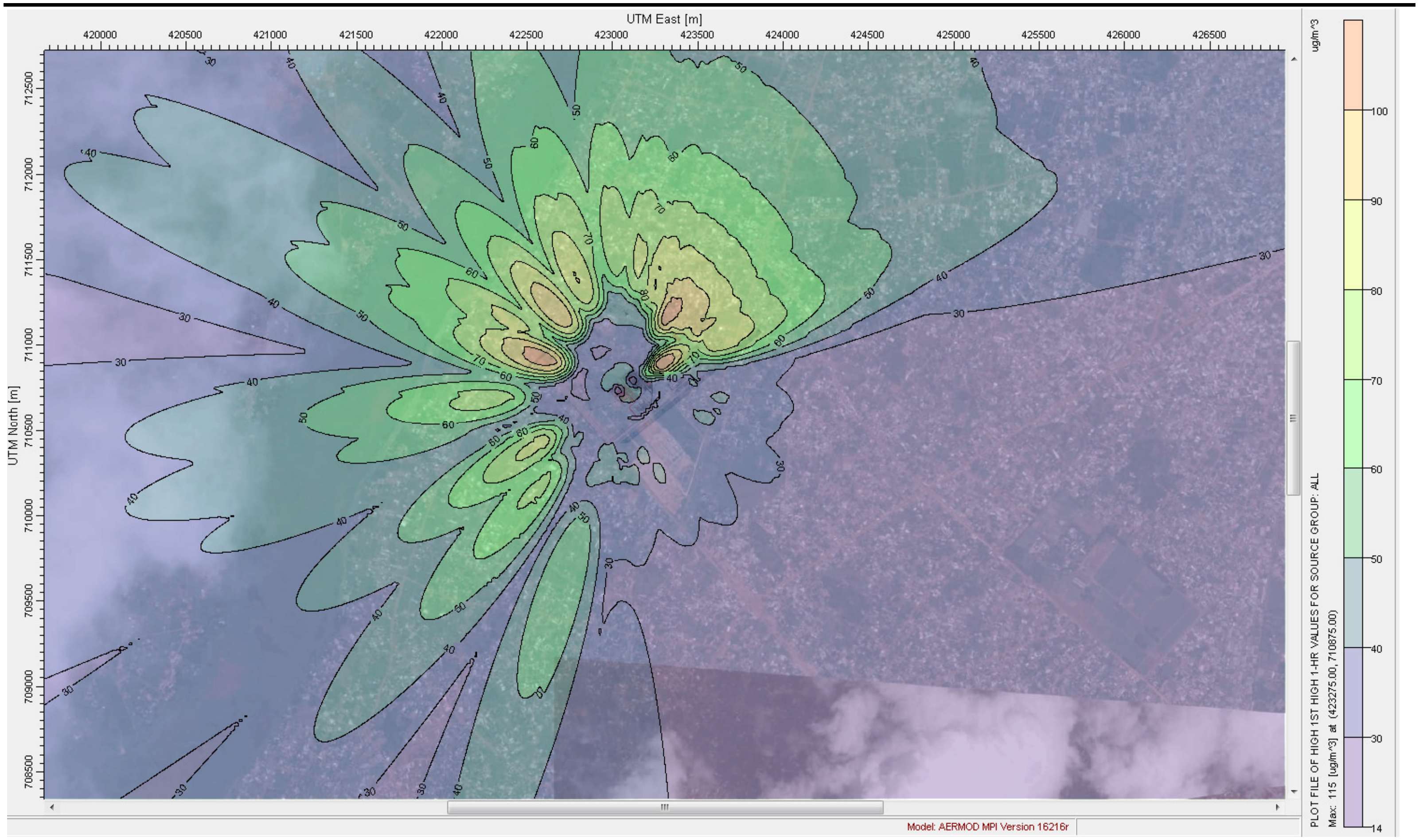
Figure 5.1 *Scenario 2a NO_2 Annual Mean*



AQS: Benin – 100µg/m³, IFC 40µg/m³

The contour plot illustrates that neither the Benin or IFC AQSs are exceeded due to plant emissions. When considering the likely baseline, it is unlikely that the AQSs will be exceeded.

Figure 5.2 *Scenario 2a NO_2 1 Hour Mean*



AQS: IFC 200µg/m³

The contour plot illustrates that neither the IFC AQS is exceeded due to plant emissions. When considering the likely baseline, it is unlikely that the AQSs will be exceeded. However, there will be occasions when the ambient ozone is higher than the 25ppb used in the assessment, which may lead to somewhat higher NO_x to NO_2 conversion, and higher NO_2. However, this does not necessarily coincide with the worst case dispersion conditions, and therefore the predicted impacts are reasonable.

SO_2

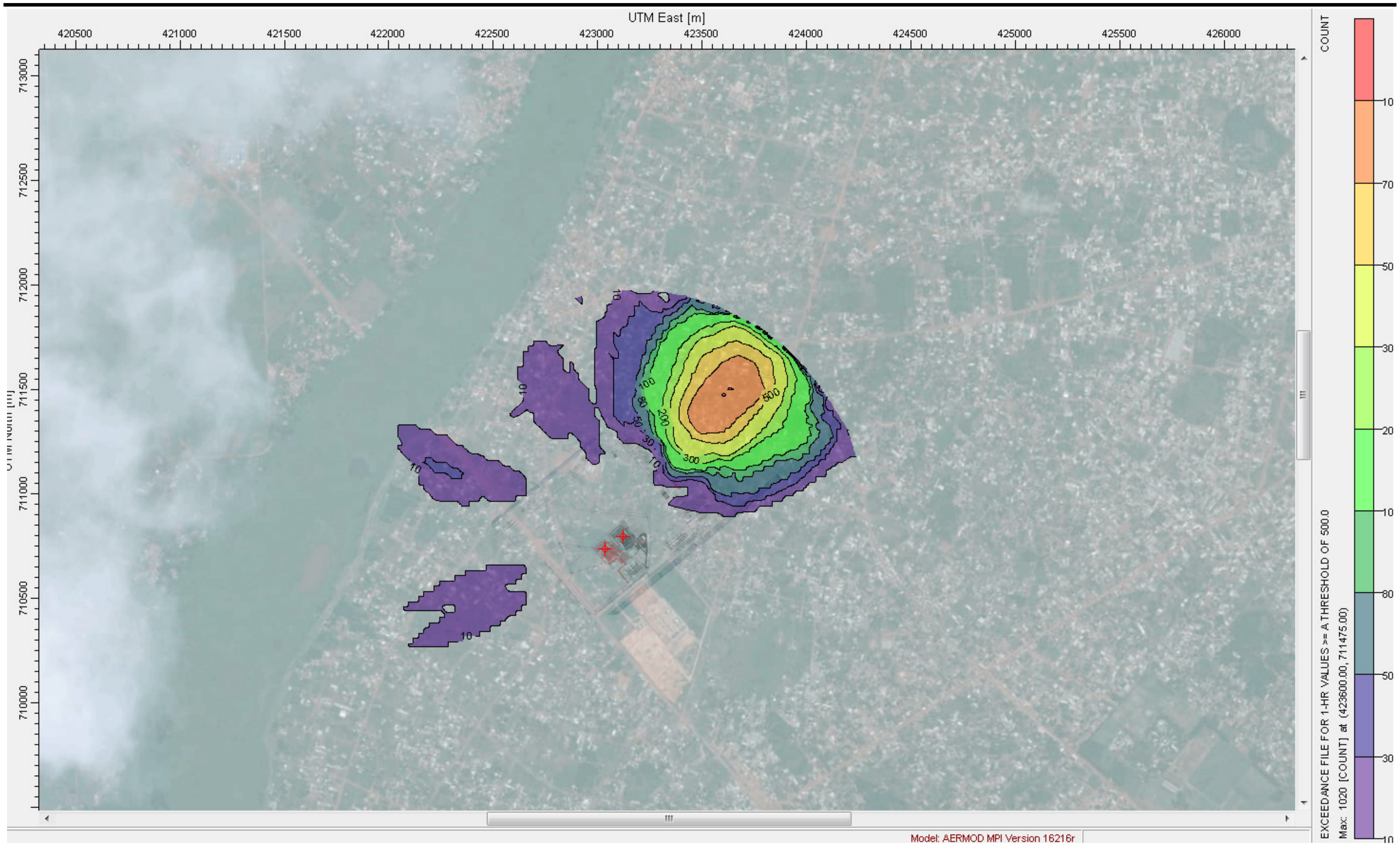
When operating on HFO, the SO_2 air quality standards are exceeded. This is the case with the Project operating alone as well as when the Project and Phase 1 are operating. The number of exceedances of the IFC SO_2 air quality standards are set out in *Table 5.9*. These are based upon the emissions in Scenario 2a.

Table 5.9 Exceedances with Various Fuel Sulphur Contents

Percent Sulphur	Number of Occasions That SO_2 Air Quality Standards Are Exceeded			
	10 Minute		24 Hour	
	Number of occasions per year	Number of hours per year	Number of occasions per year	Number of hours per year
2.0%	1020	170	164	3936
1.5%	288	48	82	1968
1.0%	12	2	25	600
0.5%	0	0	0	0

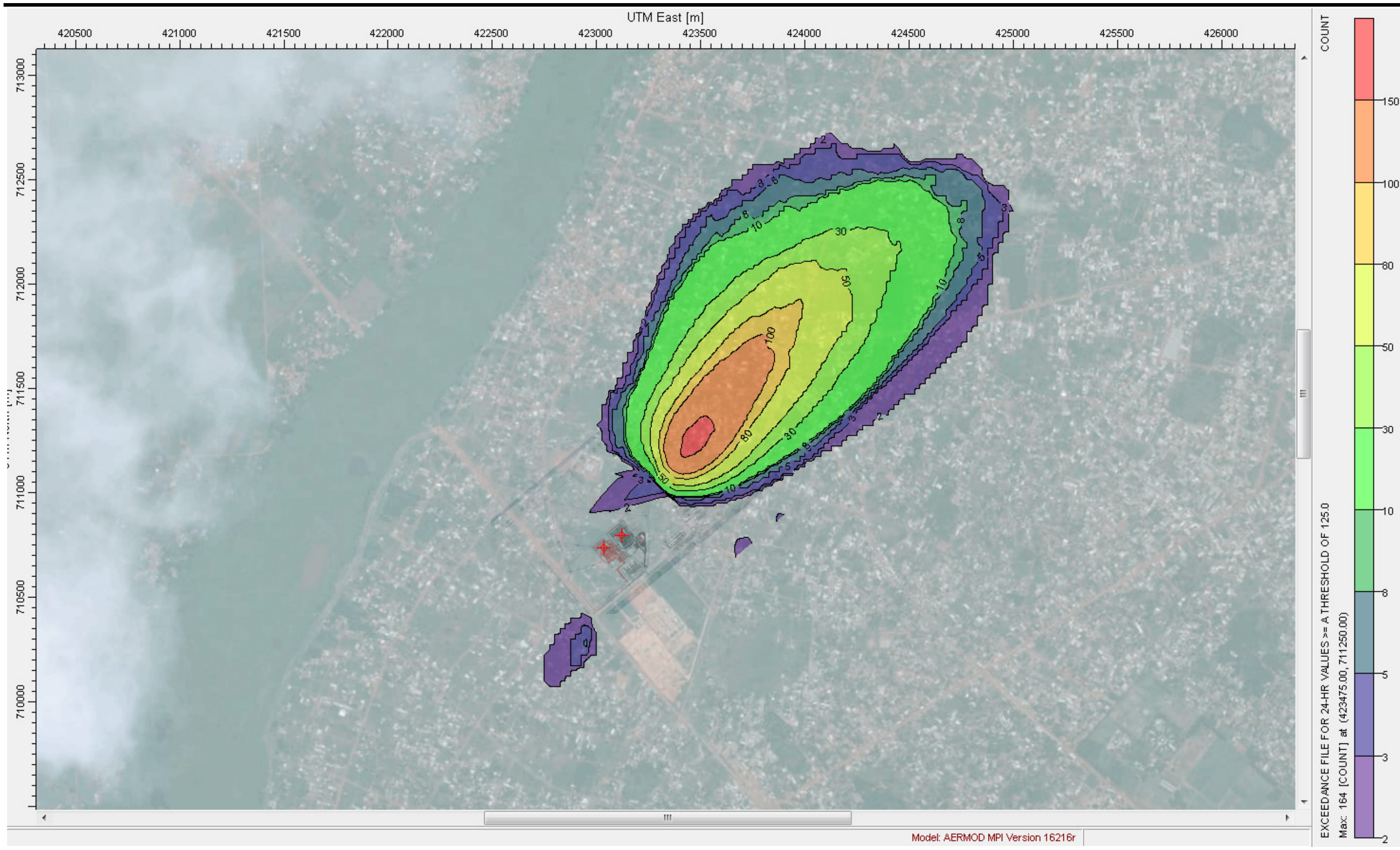
The extent and number of SO_2 exceedances using 2% Sulphur fuel are illustrated in *Figure 5.3* and *Figure 5.4*.

Figure 5.3 Scenario 2a Number of Exceedances of SO_2 10 Minute AQS with 2% Sulphur Fuel



The contour plot illustrates that the IFC SO_2 10 minute AQS is predicted to be exceeded on more than 500 occasions at some locations to the north east of the plant, when using HFO with 2% sulphur content.

Figure 5.4 Scenario 2a Number of Exceedances of SO_2 24 Hour AQS with 2% Sulphur Fuel



The contour plot illustrates that the IFC SO_2 24 hour AQS is predicted to be exceeded on more than 150 occasions at some locations to the north east of the plant, when using HFO with 2% sulphur content.

5.3.2 *Scenario 3*

Scenario 3a presents the impacts of the Project plant and the Phase 1 plant based upon a refined assessment case. This includes modelling 11 engines rather that 14, representing the initial expected power demand, and the use of HFO with 1% sulphur. When using both gas and HFO, the NO_2 air quality standards are achieved, as would be expected given the fewer engines being used. When using HFO with 1% sulphur, the IFC SO_2 air quality standards are still exceeded. This indicates that mitigation is appropriate in some circumstances.

5.4 *MITIGATION*

The air quality impact assessment has identified that under some circumstances there is a risk of air quality standards being approached or exceeded, in particular for SO_2. In this respect it is appropriate to consider options for mitigating these impacts. These mitigation measures can be used in isolation or in combination to reduce impacts:

- Using fuel with a sulphur content below 2% will directly reduce SO_2 emissions;
- The engines can be run on a mixture of HFO and gas. This option is feasible as there will be some gas available from the WAGP, even if there is not enough available to run the plant entirely on gas. This would again reduce the overall sulphur content of the fuel;
- Turning off the Waste Heat Recovery improves dispersion (due to higher emission temperature and higher exit velocity) to reduce impacts;
- Reducing the number of engines running will reduce emissions and impacts.

These measures will need to be implemented only during those circumstances when there is a risk of air quality standards being exceeded, due to poor dispersion conditions. Real-time monitoring will also be implemented in order to alert the operators to occasions when these circumstances arise and impacts are at risk of exceeding air quality standards.

6 REAL-TIME MONITORING

Dispersion modelling indicates that operation of the Project and Phase 1 on HFO has the potential to result in the SO_2 air quality standards being exceeded when using HFO of sulphur content greater than 0.5%. In addition, whilst NO_2 air quality standards are not predicted to be exceeded, the baseline has not been monitored, and the modelling is based upon assumptions which in some cases may be worse than used in the assessment. An example of this may be periods of higher ozone than the 25ppb used in the modelling.

On this basis, real-time monitoring of NO_2 is therefore proposed to verify the modelling and ensure that air quality exceedances do not arise during the period when HFO is used. Monitors would be set up downwind of the power plants close to sensitive receptors. In the event that SO_2 or NO_2 concentrations are elevated and the wind direction is blowing from the direction of the power plants, engine turn down could be initiated in order to reduce emission levels and short-term impacts. The engines could then be re-instated when the meteorological conditions change, and are more favourable for dispersion. An upwind monitoring site would also be utilised to ensure that variation in baseline is considered.

The procedure for using the monitoring to control plant operations and impacts is set out in Annex A.

The monitoring would need to be undertaken with real-time devices, and therefore a suitable system, such as the AQMesh would need to be used. This device is a standalone NO_2 monitor, with an integral power supply, and mobile phone connectivity capable of reporting real time NO_2 data via a website. Whilst this is not a 'reference' monitoring method, the data is real time, and would be suitable for verifying that exceedances of air quality standards are not arising. This monitoring is only anticipated to be required during the initial phase of operations using HFO.

7 *CONCLUSION*

The long-term operations of the Project and Phase 1 will use gas as the fuel, and will utilise a waste heat recovery system to generate steam for a turbine. In this configuration, the plant is unlikely to result in air quality standards being exceeded.

When operating on HFO the assessment identified that it is unlikely that the NO_2 air quality standards will be exceeded, noting that the baseline has not been monitored. When using HFO with a sulphur content of greater than 0.5% the SO_2 air quality standards are likely to be exceeded. Mitigation measures are therefore recommended, as discussed in *Section 5.4*.

The baseline has not been monitored and some of the assumptions used in the model may under some circumstances be worse than those used in the model, such as occasional ozone concentrations of greater than 25ppb. On this basis, it is recommended that during HFO operations, real-time monitoring is undertaken. The function of this is to allow the Project to take measures to curtail emissions through engine turn down or turning off the WHR where feasible to reduce the impact of emissions on receptors.

8 ANNEX A: PROCEDURE FOR MANAGING PLANT IMPACTS USING REAL-TIME MONITORING

8.1 OVERVIEW

Ambient monitoring is proposed to allow active management of the plant, if air quality is noted to be at risk of breaching air quality standards due to plant emissions. The pollutants of interest are NO_2 due to oxides of nitrogen emissions and SO_2. When concentrations approach air quality standards, a procedure will be triggered to investigate the origins of this, and if needed, mitigation will be implemented until concentrations reduce.

8.2 INVESTIGATION PROTOCOL

The monitoring will utilise four monitoring sites. The wind direction in Cotonou is very mono-directional, with winds almost exclusively from the southwest. Given the mono-directional wind direction, there will be one site to the southwest (upwind) and three to the northeast (downwind). Three downwind sites are proposed as there is some variation in the wind direction, and this approach will maximise the likelihood of capturing high concentrations. A meteorological station will also be required, to ensure that when a high concentration is recorded this is definitely from the power plant. The monitoring data and meteorological is interpreted as set out in *Box 1* to actively manage impacts from the power plant.

Box 8.1 Procedure for Actively Managing Emissions

Monitor concentrations at all monitoring stations and report every 15 minutes

If concentration of NO_2 or SO_2 >75% of the 1 hour standards at any monitoring site, check wind direction

If monitoring site showing the high concentration is downwind of the Project and Phase 1, check the upwind concentration

If downwind minus upwind concentration >75% of the 1 hour standard the implement mitigation until downwind <75% of the 1 hour standards

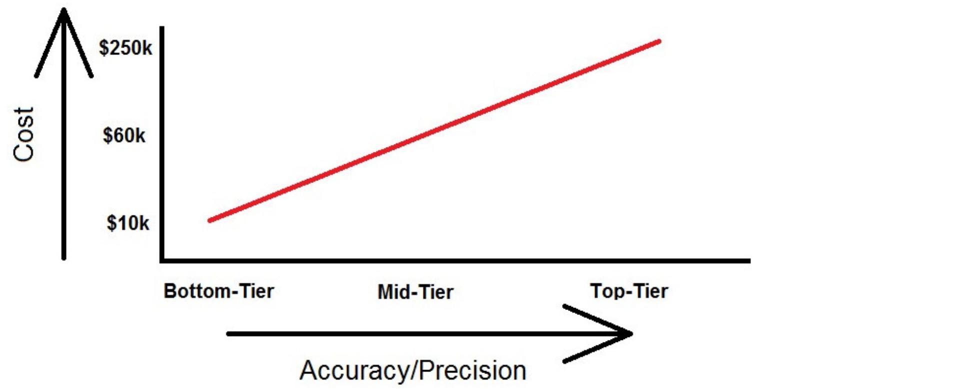
Review downwind concentration and withdraw mitigation when concentrations of NO_2 and SO_2 <75% of 1 hour standards

Monitoring Equipment

The air quality monitors used need to be able to report NO_2 and SO_2 concentrations in -real time. There are a range of monitoring equipment

available that would be suitable. However, the cost of these varies drastically, depending on the degree of accuracy and precision required.

Figure 8.1 *Cost Range per Monitoring Unit*



- Top-Tier is monitoring required to meet international regulatory standards, for example USEPA and EU monitoring regulations;

- Mid-Tier is monitoring required to meet 'indicative' standards, for example the second tier EU monitoring standards;

- Bottom-Tier is where no regulatory compliance is necessary, however noting that some degree of proven reliability is required.

In this case, the monitoring is designed to be used primarily for allowing active control of the impacts, rather than demonstrating regulatory compliance. In addition, a degree of uncertainty is incorporated into the monitoring with the use of the threshold at 75% of the AQS, rather than 100%. On this basis, Bottom-Tier monitoring equipment is considered to be adequate.

The AQMesh has been identified to be suitable for the monitoring:
- Capable of monitoring NO_2 and SO_2
- Real time reporting via mobile phone network to web-based viewer
- No external power required, internal batteries and sensors will last 2 years
- No routine calibration and servicing required

The AQMesh requires mobile phone signal to report to the cloud. In addition, it will be necessary to install a meteorological station at the site. A meteorological site will also be required to report wind direction in real-time. Again, as the meteorological data is not used for regulatory compliance, the station can be Bottom-Tier as an indication of wind direction and wind speed

is all that is required. The AQMesh can be fitted with a small meteorological station.

The AQMesh has been tested in the field in various locations including equatorial and humid climates. Whilst the method is not Indicative or Reference, the AQMesh has shown to provide reasonable results when co-locate against Reference stations. *Figure 8.2* shows the AQMesh *in situ*.

Figure 8.2 AQMesh

The AQMesh reports air quality directly into the web, from where data is retrieved. Alerts can be set to flag high concentrations, meaning that concentrations do not need to be manually monitored all the time.

8.3 INSTALLATION

It is anticipated that the monitoring sites can be located within the site boundary. This will avoid the need to install the monitors in areas outside the direct control of the project. The monitoring sites need to be some distance from the power plant to avoid the plume going over the top of the monitors, noting that the maximum impacts will occur when the plume is grounding quickly.

The installation of the four monitoring stations needs to be undertaken with considerable care. A thorough understanding of the micro-environment around each monitoring location is required to avoid localised sources interfering with the monitoring. Intermittent small scale sources, can unduly influence the monitoring and need to be avoided. This would include residential locations where there are cooking fires, garages and vehicle maintenance, bus stops, small generators, occasionally busy junctions and queuing traffic etc.

ANNEX B. NOISE EMISSIONS STUDY

CONTENTS

FIGURES

TABLES

ACRONYMS

ACC	Air-Cooled Condensers
AIMM	Africa Infrastructure Investment Managers
BWSC	Burmeister & Wain Scandinavian Contractors
C	Degree Celsius
dB	Decibel
dB(A)	A-Weighted Decibel
EHS	Environmental, Health, and Safety
EPC	Engineering, Procurement, and Construction
IFC	International Finance Corporation
IPP	Independent Power Producer
ISO	International Organization for Standardization
Km	Kilometer
L_{Aeq} or L_{eq}	A-Weighted Equivalent Sound Levels
M	Meter
MW	Megawatt
NSRs	Noise Sensitive Receptors

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Project

The Project involves the installation and operation of a new thermal power generation plant in Maria Gleta, near Cotonou, Benin. The Project proponent is a joint venture comprising:

- Burmeister Wain Scandinavian Contractors (BWSC);
- African Infrastructure Investment Managers (AIIM);
- Enterprise Power (En/Power); and
- Investment Fund for Developing Countries (of Denmark) (IFU).

The power plant will comprise a new natural gas-fired 144 MW_e combined-cycle, thermal power generation plant made up of the following:

- Seven (7) dual-fuel reciprocating engines each producing 18.2 MW_e for a total of 127 MW (MAN Group 18V51/60 DF units are specified); and
- Steam turbine system producing 18 MW_e.

A similarly designed 127 MW_e plant is being constructed adjacent to the plant and waste heat from that plant will also be used to power the steam turbine system.

For the purposes of this report, the following references are used:

- The Project plant is referred to as the 'Project'.
- The similarly designed plant currently under construction is referred to as the 'Phase 1.'

1.2 STUDY OBJECTIVES AND SCENARIOS

The purpose of the study is to:

- Predict noise levels from the proposed Project operations to assess impacts and risks on the surrounding community and to insure applicable noise assessment criteria are not exceeded after installation and full load operation of the power plant(s); and

- Verify BWSC design and noise specification and confirm their conclusion regarding noise level contribution from the plant(s) at the site boundary (rather than developing an entirely new model from scratch).

Scenarios to be modelled for this noise emissions study are as follows:

- Scenario 1: Phase 1 power plant operating at rated power output;
- Scenario 2: Project power plant operating at rated power output (assumes structures for the Phase 1 power plant are in-place but not operating); and
- Scenario 3: Project power plant and Phase 1 power plant both operating at the same time at rated power output.

The noise emissions data from this study will be used for noise-related engineering design of the proposed power plant and associated facilities.

Previous Technical Studies

BWSC prepared a noise study for this Project in February 2018 (BWSC 2018a) and provided additional backup data via email in April 2018 (BWSC 2018b). BWSC used Excel spreadsheets and followed the Nordic calculation methods, which is one of the calculation methods for industrial facilities used in some commercial noise software packages. The BWSC noise study accounted for propagation parameters including source directivity, geometrical attenuation, air absorption, ground absorption, and screening. However, one of the drawbacks of the BWSC spreadsheet model (forward model) was the treatment of screening effects, which was somewhat simplified, representing buildings as barriers only without depth and does not account for reflections from buildings. In addition, the BWSC forward model did not account for screening effects and reflections from other structures such as the large heavy fuel oil storage tanks located east of the facility. The results from the BWSC forward model show that based on their equipment design and noise specifications, the noise level contribution (contour format) from the operation of the Project power plant only is lower or equal to the noise assessment criteria at receptors close to the site boundary. However, the noise level contribution (contour format) from the operation of the Project and Phase 1 power plants together show that receptors near the northern and southeastern boundaries could exceed the assessment criteria by a few decibels (<3 decibels). It should be noted that results from the BWSC forward model did not include a 2.8 perimeter wall that would be installed around the Project site.

It should be noted that the Phase 1 power plant has been designed, permitted, and contracted based on a Benin noise assessment criteria of 50 dB(A), which is slightly higher than the World Bank criteria of 45 dB(A).

Although this 50 dB(A) criteria is not utilized after the site is extended (i.e. after purchase of the west-northwest intrusion area) to accommodate both plants, it is contributing to the fact that strict compliance with the World Bank 45 dB(A) criteria may be difficult to achieve.

1.3 *PROJECT LOCATION*

The proposed Project plant is located in Maria Gléta in the municipality of Calavi, about 20 kilometers (km) to the west of the city of Cotonou, Republic of Benin. The Project site is located in an urbanized area with surrounding, relatively dense residential, business, and industrial development.

There are two existing power plants (both dual-fired reciprocating engines) located south of the proposed Project. The first is an 80 MW power plant owned by SBEE and located approximately 200 meters (m) south of the proposed Project boundary. The second is a 25 MW power plant owned by CEB and located approximately 280 m south of the proposed IPP Project boundary. The SBEE power plant is currently not operating and slated for decommissioning while the CEB plant is currently operating. Note however that both existing power plants are <u>not</u> part of this noise emissions study.

A map of the Project site, nearby power plants, and noise sensitive receptors (residential areas and educational institutions) is provided in later sections.

1.4 *REPORT STRUCTURE*

The report comprises the following elements:

- noise terminology and definitions;
- assessment criteria;
- modelling methodology;
- model results;
- conclusions; and
- references.

2 METHODOLOGY

2.1 NOISE TERMINOLOGY AND DEFINITIONS

The terms 'sound' and 'noise' tend to be used interchangeably, but noise can be defined as unwanted sound, whereas sound is a normal and desirable part of life. However, when noise is imposed on people it can lead to disturbance, annoyance and other undesirable effects. Noise is measured and quantified using decibels (dB). The decibel scale is logarithmic, which means that sound levels do not add up or change according to simple linear arithmetic. For example, adding two equal sound sources results in a doubling of sound energy, which gives a combined sound level that is 3 dB higher than the individual levels.

Because the human ear is less sensitive to low and high frequencies than mid-frequencies, decibels on the A-weighted frequency scale (dB(A)) were devised to correspond to the sensitivity of the human ear. The letter 'A' denotes that 'A'-weighting has been used and the 'eq' indicates that an equivalent level has been calculated. The human ear's threshold of perception for sound change is considered to be about 3 dB. A 5 dB difference is generally noticeable to the human ear, and a 10-dB increase is perceived as a doubling of sound. Noise levels and subjective loudness of common noise sources are presented for reference in *Table 2.1.*

Table 2.1 Noise Levels and Subjective Loudness of Common Noise Sources

Common Noise Source	**Noise Levels, dB(A)**	**Typical Subjective Loudness**
Moon launch at 100 meters; artillery fire, gunner's position	140	Intolerable
Ship's engine room; rock concert, in front and close to speakers	120	Intolerable
Textile mill; press room with presses running; punch press and wood planers, at operator's position	100	Very noisy
Next to busy highway, shouting	80	Noisy
Department store, restaurant, speech levels	60	Noisy
Quiet residential neighborhood, ambient level	40	Quiet
Recording studio, ambient level	20	Very quiet
Threshold of hearing for normal young people	0	Very quiet

Source: Bies et al 2018. Engineering Noise Control, Fifth Edition, CRC Press.

2.2 NOISE ASSESSMENT CRITERIA

Below, *Table 2.2* presents noise guidelines from potential lenders (International Finance Corporation (IFC) is the main lender)1 that should not be exceeded at the nearest receptor locations offsite. The World Bank Group Guidelines state that noise impacts should not exceed the levels listed or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. For this assessment, noise contribution from the Phase 1 plant is assumed part of the existing background levels.

Decree No. 2001-294 of August 8, 2001 governs the regulation of noise in the Republic of Benin. Below *Table 2.3* presents ambient noise level standards for general environment in Benin. It should be noted that the daytime period starts at 07:00 hours for IFC and 06:00 hours for Benin.

Considering the fact that the nearest receptors affected by noise are residential and educational institutions (See *Section 2.3, Receptors Affected by Noise*), and because plant operation (load) during the day and at night are expected to be the same, the Project (Scenario 1, 2, and 3) will be designed to target an overall Phase 1 and Project plant contribution of 45 dB(A) at the nearest receptors, noting that at worst only a marginal addition to pre-project noise level would occur (<3 dB(A)) as provided in the World Bank noise guidelines.

The night time criterion of 45 dB(A) was selected as a design target because it is the most stringent limit in both noise criteria tables above.

Description of the nearest noise sensitive receptors to the Project boundary is provided in *Section 4.2, Receptors Affected by Noise*.

1 Aside from the IFC being the main lender, a few other financial institutions have expressed interest (eg, African Development Bank).

Table 2.2 World Bank Group Noise Level Guidelines

	One Hour LAeq (dB(A))	
Receptor	**Daytime (07:00-22:00)**	**Nighttime (22:00-07:00)**
Residential, institutional, educational	55	45
Industrial, commercial	70	70

L_{Aeq} (or L_{eq}) = A-weighted equivalent sound levels over a measurement period, dB(A) = A-weighted decibel.
Source: General Environmental, Health, and Safety (EHS) Guidelines, April 2007 (IFC/World Bank Group 2007)

Table 2.3 Permissible Noise Limits for General Environment in Republic of Benin

	Noise Limit in LAeq (dB(A))		
Period	**Residential Zone**	**Commercial Zone**	**Industrial Zone**
06:00 - 13:00 hour (day)	50	50	70
13:00 – 13:00 hour (day)	45	55	70
15:00 – 22:00 hour (day)	50	50	70
22:00 – 06:00 hour (night)	45	55	70

L_{Aeq} (or L_{eq}) = A-weighted equivalent sound levels over a measurement period, dB(A) = A-weighted decibel.
Source: Decree No. 2001-294 of August 8, 2001. Noise regulations in the Republic of Benin (Republic of Benin 2001)

2.3 *NOISE SOURCES AND ASSOCIATED SOUND POWER LEVELS*

Noise emissions from the Project will potentially contribute to increases in ambient noise levels in the surrounding environment. The major noise sources for the Project and Phase 1 power plants include the engine powerhouse, steam turbine building, ventilation intake and outlets, radiator coolers, generator outlets, air-cooled condensers, steam turbine combustion intakes, exhaust stacks, loading bay gate, and step-up transformers. A 2.8-meter high perimeter wall would be constructed around the Project site (encompassing both plants). The sound wall is expected to be constructed of dense material such as concrete blocks (concrete masonry unit) and have no gaps.

Below *Table 2.4* and *Table 2.5* provide noise emission profiles for major sources during normal operation at full load for the Project and Phase 1 power plants, respectively. The noise emission profiles for the plants were based on noise design specifications provided by BWSC and include engineering noise controls such as acoustic buildings for the reciprocating engines and steam turbines; air filters for combustion air intakes and ventilation inlets; and silencers for exhaust stacks, combustion air intakes, and ventilation inlets/outlets.

A 3-D representation of the major noise sources, buildings, storage tanks, and the 2.8-meter perimeter wall for Scenario 1, 2, and 3 are shown *on Figure 2.1 Figure 2.2,* and *Figure 2.3* respectively. The emission sources are represented as either emitting façades (group of point sources on building walls), emitting roofs (group of point sources on building roof), or individual point sources and depicted as **red dots** on the 3-D figures. The **grey structures** represent the buildings, storage tanks, and other structures (e.g., exhaust stacks and structures for the ACC and radiator coolers). The **grey lin**e surrounding the Project site is the 2.8-meter perimeter wall. The **black dots** on the figures represent nearby receptors.

Table 2.4 Noise Source Description and Sound Power Levels for the Project Power Plant Only

Designation	Source no.	Directivity	Height Above Grade (m)	Overall A-weighted Sound Power Level, dB(A)
IPP engine house, façade N	S1	Build. Elem.	8.4	91.0
IPP engine house, façade S	S2	Build. Elem.	8.4	91.0
IPP engine house, façade E	S3	Build. Elem.	9.0	87.7
IPP engine house, façade W	S4	Build. Elem.	9.0	87.7
IPP engine house roof, N section	S5	Build. Elem.	14.7	93.3
IPP engine house roof, S section	S6	Build. Elem.	14.7	90.3
IPP steam turbine building, façade N	S7	Build. Elem.	6.7	80.9
IPP steam turbine building, façade S	S8	Build. Elem.	6.7	80.9
IPP steam turbine building, façade W	S9	Build. Elem.	6.7	81.7
IPP steam turbine building, façade E	S10	Build. Elem.	6.7	81.7
IPP ventilation intake NW	S11	Opening	2.5	81.0
IPP ventilation intake NE	S12	Opening	2.5	81.0
IPP ventilation intake SW	S13	Opening	2.5	78.6
IPP ventilation intake SE	S14	Opening	2.5	78.6
IPP top ventilation outlet, W	S15	Opening	16.6	92.5
IPP top ventilation outlet, W	S16	Opening	16.6	92.5
IPP radiator group NW	S17	Uniform	7.0	85.6
IPP radiator group NE	S18	Uniform	7.0	85.6
IPP radiator group SW	S19	Uniform	7.0	85.6
IPP radiator group SE	S20	Uniform	7.0	85.6
IPP generator outlet (W)	S21	Opening	7.5	84.0
IPP generator outlet (E)	S22	Opening	7.5	84.0
Air cooled condenser N	S23	Uniform	20	89.0
Air cooled condenser S	S24	Uniform	20	89.0
Steam turbine building roof	S25	Build. Elem.	14.7	83.6
IPP engine turbo charger combustion-intake group 1 (W)	S26	Opening	5.4	84.9
IPP engine turbo charger combustion-intake group 1 (E)	S27	Opening	5.4	84.9
IPP exhaust stack	S28	Stack	40	94.3
IPP loading bay gate	S29	Build. Elem.	3.3	87.0
IPP step-up transformer	S30	Uniform	3.0	81.1

Source: BWSC

Table 2.5 Major Noise Source Description and Sound Power Levels for the Phase 1 Power Plant Only

Designation	Source no.	Directivity	Height Above Grade (m)	Overall A-weighted Sound Power Level, dB(A)
IDB engine house, façade N	S31	Build. Elem.	8.4	91.0
IDB engine house, façade S	S32	Build. Elem.	8.4	91.0
IDB engine house, façade E	S33	Build. Elem.	9.0	87.7
IDB engine house, façade W	S34	Build. Elem.	9.0	87.7
IDB engine house roof, N section	S35	Build. Elem.	14.7	93.3
IDB engine house roof, S section	S36	Build. Elem.	14.7	90.3
IDB ventilation intake NW	S37	Opening	2.5	81.0
IDB ventilation intake NE	S38	Opening	2.5	81.0
IDB ventilation intake SW	S39	Opening	2.5	78.6
IDB ventilation intake SE	S40	Opening	2.5	78.6
IDB top ventilation outlet, W	S41	Opening	16.6	92.5
IDB top ventilation outlet, W	S42	Opening	16.6	92.5
IDB radiator group NW	S43	Uniform	7.0	85.6
IDB radiator group NE	S44	Uniform	7.0	85.6
IDB radiator group SW	S45	Uniform	7.0	85.6
IDB radiator group SE	S46	Uniform	7.0	85.6
IDB generator outlet (W)	S47	Opening	7.5	84.0
IDB generator outlet (E)	S48	Opening	7.5	84.0
IDB engine turbo charger combustion-intake group 1 (W)	S49	Opening	5.4	84.9
IDB engine turbo charger combustion-intake group 1 (E)	S50	Opening	5.4	84.9
IDB exhaust stack	S51	Stack	40	94.3
IDB loading bay gate	S52	Build. Elem.	3.3	87.0
IDB step-up transformer	S53	Uniform	3.0	81.1

Source: BWSC

Figure 2.1 Major Noise Sources and Facilities - Scenario 1

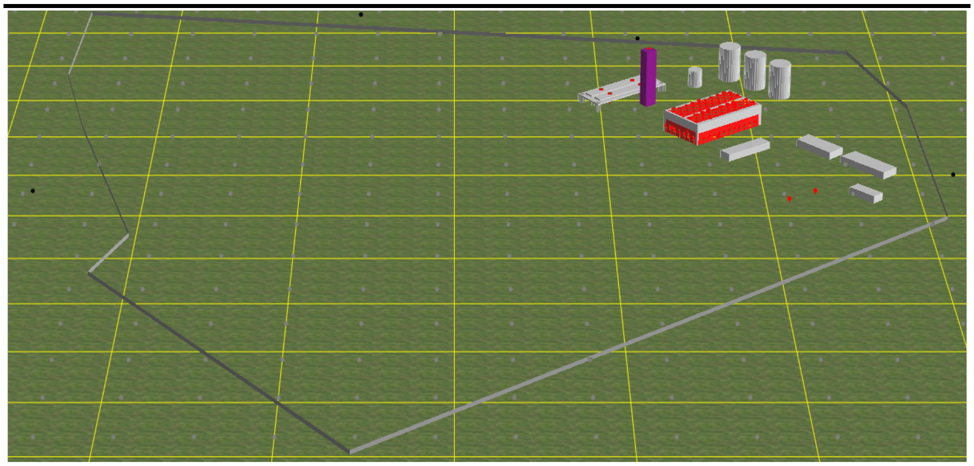


Figure 2.2 Major Noise Sources and Facilities - Scenario 2

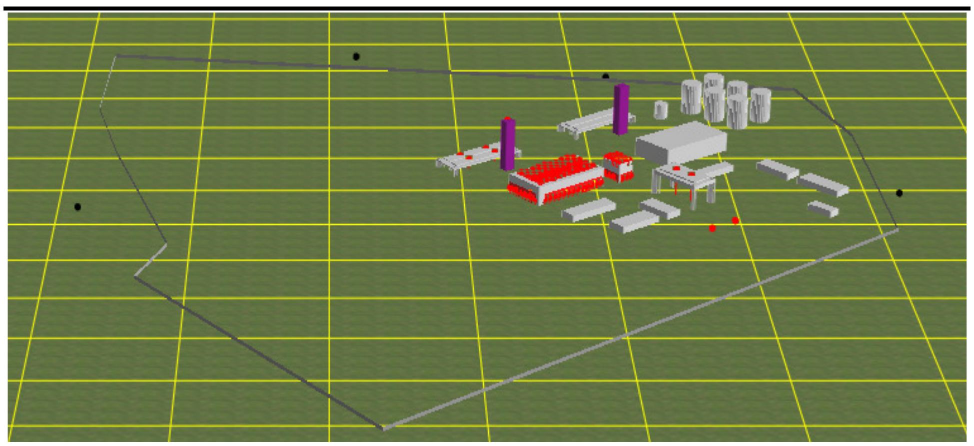
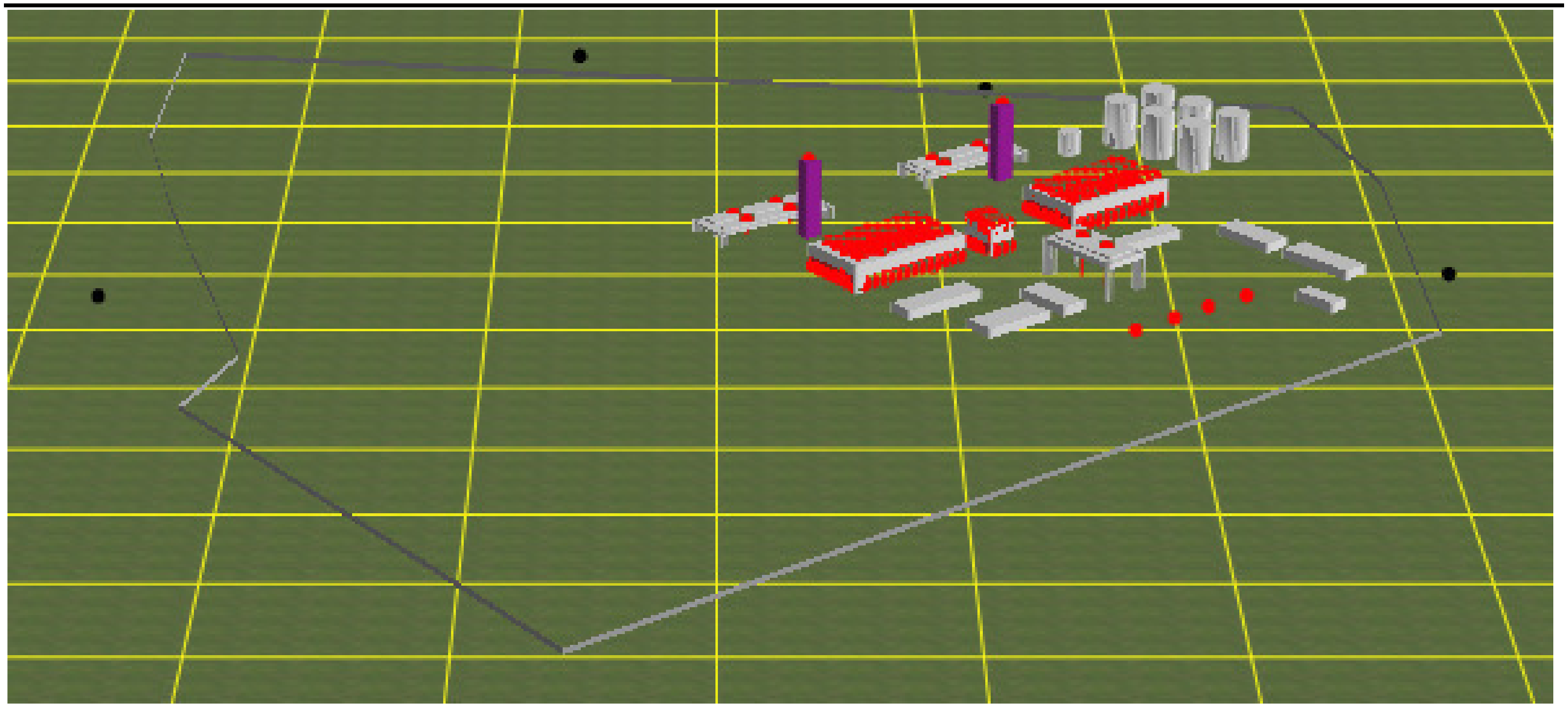


Figure 2.3 Major Noise Sources and Facilities - Scenario 3



2.4 RECEPTORS AFFECTED BY NOISE

As indicated the Project will be located at Maria Gléta in the municipality of Calavi, about 20 km to the north-west of the city center of Cotonou. The site is surrounded by an industrial zone in the southeast, an educational institution in the north-northwest, and residential area (with some businesses) everywhere else.

Below *Table 2.6* shows four nearby noise sensitive receptors (NSRs) to the Project boundary, including three residential areas (multiple residences to the west, east, and north) and Houeto College to the north-northwest. The blue line on the figure represents the Project boundary where the 2.8-meter perimeter wall would be constructed. A brief description of the four NSRs and approximate distance and direction from the closest Project boundary are provided in *Table 2.6.*

Table 2.6 Distance and Direction of Receptor Locations from Closest Project Boundary

Receptor ID	Description	Approximate Distance and Direction from Closest Project Boundary (meters)
NSR 1	Residences	45 m south of Project boundary
NSR 2	Residences	15 m east of Project boundary
NSR 3	Residences	10 m north of Project boundary
NSR 4	Educational Institution	40 m north-northwest of Project boundary

Figure 2.4 Proposed Project Site and Nearest Noise Sensitive Receptors

2.5 MODELLING METHODOLOGY AND ASSUMPTIONS

Bruel & Kjaer's Predictor Type 7810 noise modelling software (Version 12.0) was used to calculate noise emissions from the Project during normal operations. The Predictor noise model uses the ISO 9613-2 industrial standards for sound propagation (Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation) (ISO 1996). The computer model allows for octave band calculation of noise from multiple noise sources, as well as computation of distance losses, source directivity (e.g., directivity for exhaust stacks and air intakes), atmospheric absorption (assumed a temperature of 27 degree Celsius (˚C) and relative humidity of 90%), reflection from surfaces, screening by obstacles (buildings and storage tanks), and ground attenuation. A ground absorption coefficient of zero (i.e., 0% soft ground and 100% hard ground) was conservatively assumed for the modelled areas. The model assumed meteorological conditions favourable to sound propagation per ISO 9613 Part 2 (ISO 1996) ie, downwind propagation in all directions. The model assumes a flat terrain because the topography of the area is mostly flat or with a constant (non-undulating) slope. The calculation height for receptors was executed at 1.5 m above ground level (approximate height of the human ear).

The engine powerhouse and steam turbine building are modelled as area sources or emitting façades (ie, walls and roof). Additionally, the entire buildings are modelled as structures so that they acts as a barrier to noise propagating in certain directions from outdoor equipment located close to it. The remaining sources are modelled as individual point sources or a combination of point sources grouped together as a single source. The model is then used to generate contour lines on a base map showing how noise radiates from the sources and how it is affected by intervening obstacles/structures and ground surface.

The Predictor model was first configured by importing a Google Earth® base map of the area. By doing this, the positions of various structures (buildings and storage tanks), receptor locations, and distances can be assured to a high degree of accuracy. The specified noise levels provided by BWSC were then entered into the model. Finally, NSR locations were selected to allow the model to evaluate the resulting noise levels for compliance with applicable noise assessment criteria.

2.6 ACCURACY AND LIMITATIONS OF NOISE PREDICTION METHOD

For sound calculated using the ISO 9613-2 method, the indicated accuracy ranges from ±1 to ±3 dB(A) at source to receiver distances between 0 and 100 m (depends on source height), ± 3 dB(A) at source to receiver distances between 100 and 1000 m (independent of source height), and unknown at distances above 1000 m (ISO 1996). The meteorological conditions as defined in ISO 9613-

2 is limited to (a) moderate downwind conditions of propagation, or their equivalent; and (b) a variety of meteorological conditions as they exist over months or years (ISO 1996).

There may also be some shielding uncertainty with regard to receptors located further away from a sound wall/barrier. As indicated in Section 2.5 above, a flat terrain was assumed for the modelling because the topography of the project area (as a whole) is considered relatively. However, there may be small differences in elevation (+/-1 m) at offsite receptor locations that could affect the effectiveness of sound wall modelled.

3 *RESULTS*

The predicted noise contribution at the nearest NSRs due to continuous operation of the Project is summarised in Table 3.1 (Scenario 1), Table 3.2 (Scenario 2), and Table 3.3 (Scenario 3). The tables include a comparison of the predicted noise levels to the noise assessment criteria for this Project.

As discussed in *Section 3*, the predicted noise levels from the power plant(s) (Scenarios 1, 2, and 3) are targeted to be below 45 dB(A) at the nearest NSRs. The predicted noise results as contours for Scenario 1, 2, and 3 are provided in *Figure 3.1, Figure 3.2, Figure 3.3,* respectively. The result tables and noise contour figures show that operation of all three scenarios would be below the 45 dB(A) noise limit at all NSR locations.

Table 3.1 Predicted Noise Levels for Scenario 1 and Comparison to the Noise Assessment Criterion for this Project

NSR Identifier	Receptor Type	Approximate Distance from Project Boundary (meter)	Predicted Noise Levels, dB(A)	Comply with 45 dB(A) Noise Limit? (Yes/No)[1]
NSR 1	Residential	45	32.7	Yes
NSR 2	Residential	15	41.9	Yes
NSR 3	Residential	10	39.4	Yes
NSR 4	Educational Institution	40	36.7	Yes

[1] The 45 dB(A) criterion was selected as a design basis because it is the most stringent limit of the applicable noise guidelines or standards for this Project.

Table 3.2 Predicted Noise Levels for Scenario 2 and Comparison to the Noise Assessment Criterion for this Project

NSR Identifier	Receptor Type	Approximate Distance from Project Boundary (meter)	Predicted Noise Levels, dB(A)	Comply with 45 dB(A) Noise Limit? (Yes/No)[1]
NSR 1	Residential	45	35.5	Yes
NSR 2	Residential	15	36.8	Yes
NSR 3	Residential	10	37.9	Yes
NSR 4	Educational Institution	40	36.9	Yes

[1] The 45 dB(A) criterion was selected as a design basis because it is the most stringent limit of the applicable noise guidelines or standards for this Project.

Table 3.3 Predicted Noise Levels for Scenario 3 and Comparison to the Noise Assessment Criterion for this Project

NSR Identifier	Receptor Type	Approximate Distance from Project Boundary (meter)	Predicted Noise Levels, dB(A)	Comply with 45 dB(A) Noise Limit? (Yes/No)[1]
NSR 1	Residential	45	37.2	Yes
NSR 2	Residential	15	43.1	Yes
NSR 3	Residential	10	41.7	Yes
NSR 4	Educational Institution	40	39.8	Yes

[1] The 45 dB(A) criterion was selected as a design basis because it is the most stringent limit of the applicable noise guidelines or standards for this Project.

Figure 3.1 Predicted Noise Contours - Scenario 1 – Phase 1 Plant Only

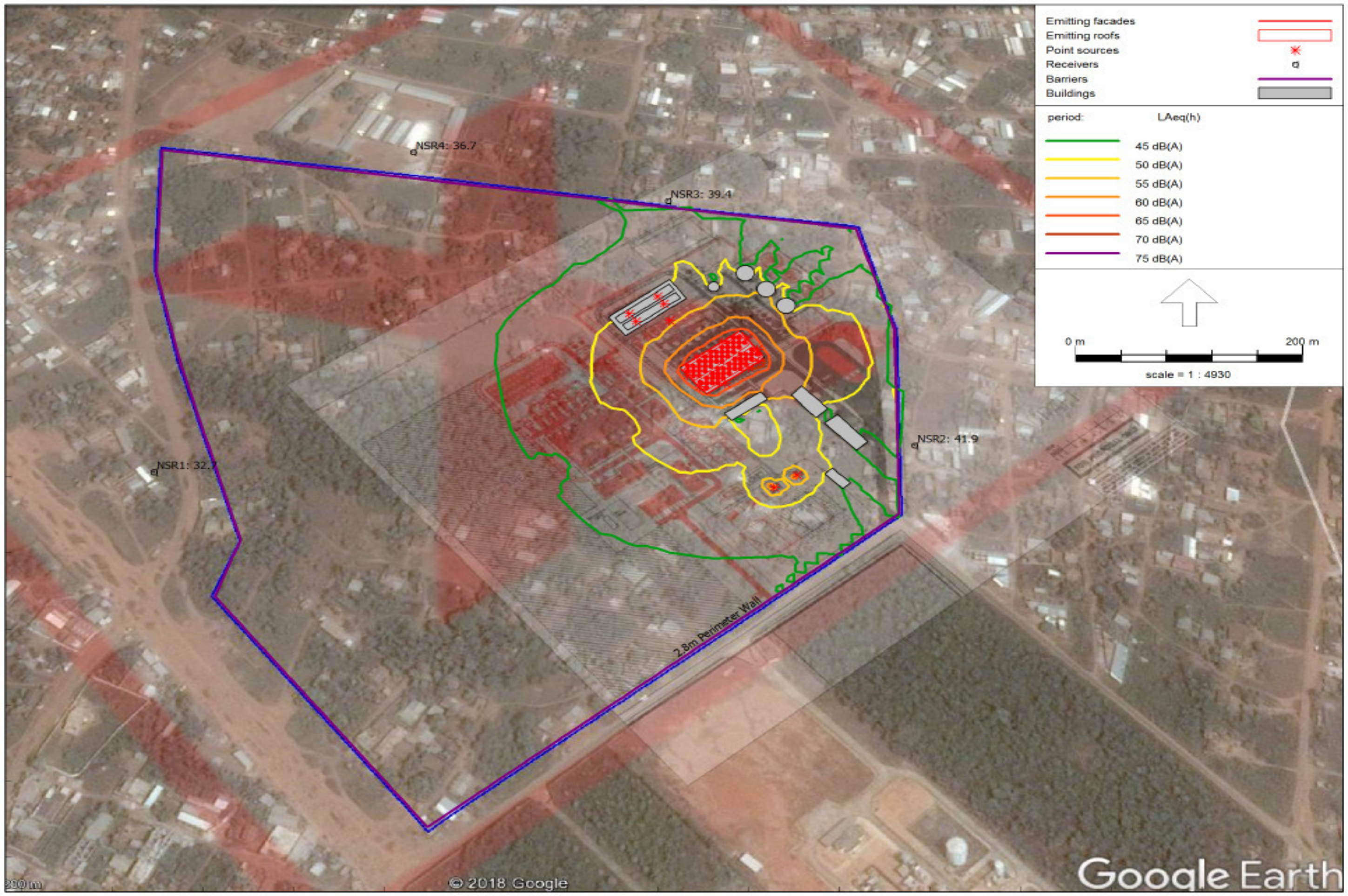


Figure 3.2 Predicted Noise Contours – Scenario 2 - Project Power Plant Only

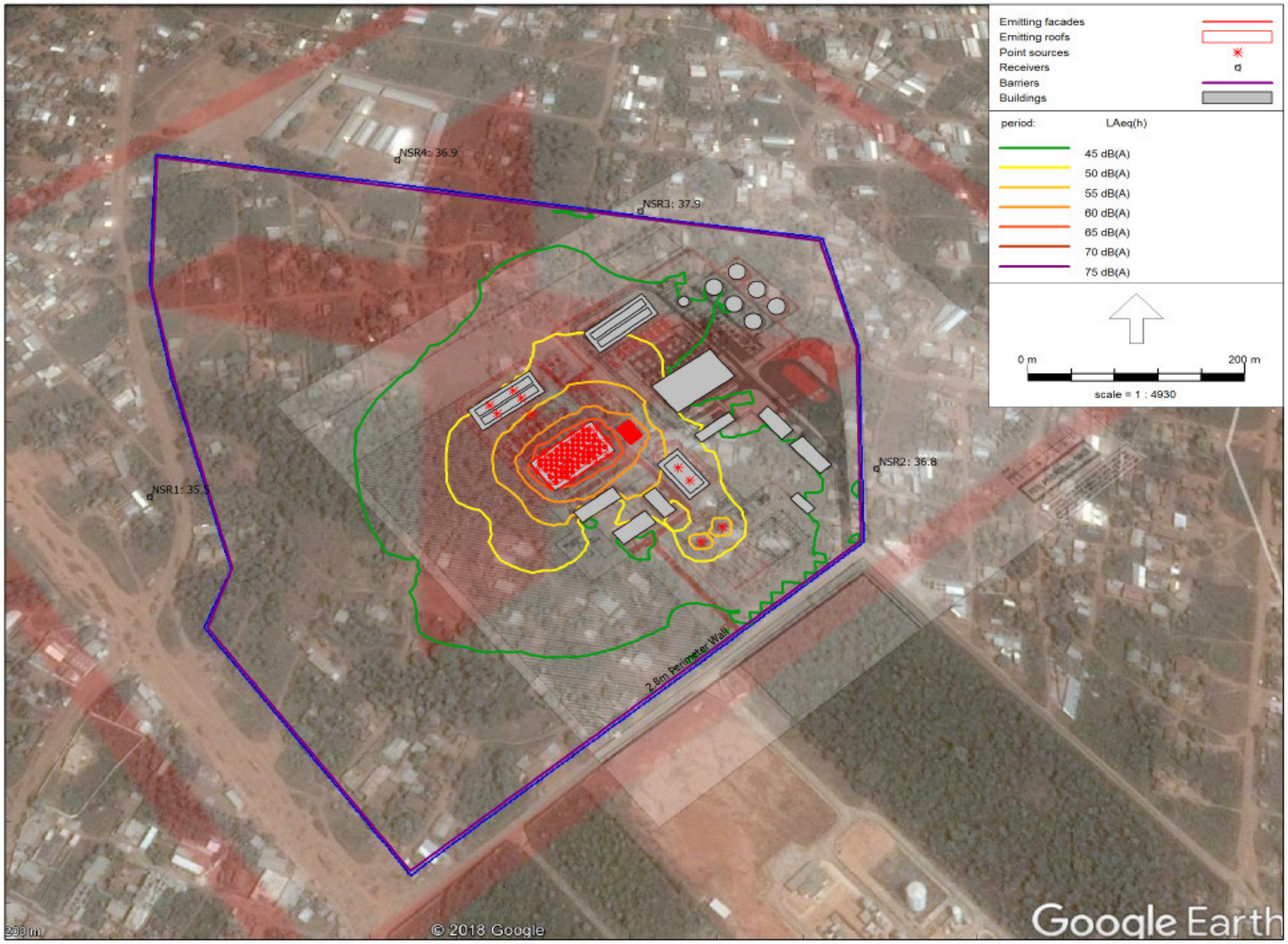
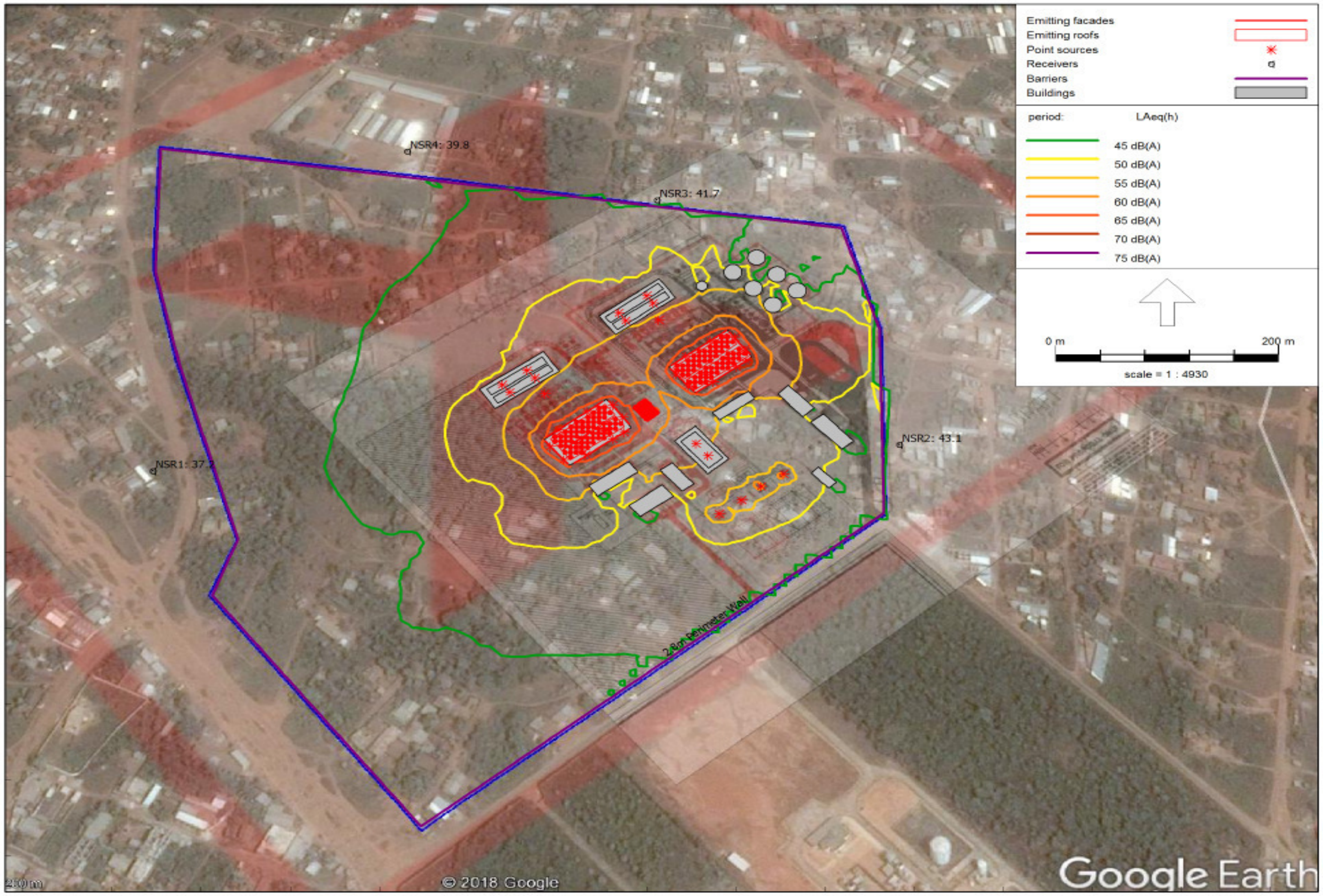


Figure 3.3 Predicted Noise Contours – Scenario 3 - Simultaneous Operation of the Project and Phase 1 Plants



4 CONCLUSIONS AND RECOMMENDATIONS

With the inclusion of standard engineering noise controls in BWSC's noise design specifications, predicted noise levels at nearest NSRs during operation of the proposed Project (Scenario 1, 2, and 3) are below the noise assessment criterion for this Project. As expected, with the inclusion of the 2.8-meter perimeter wall, the results from this study are lower than the BWSC noise study, which did not include the perimeter wall. Without the 2.8-meter perimeter wall, our modelled results (not shown here) and the recent noise study developed by BWSC are similar.

The conclusion of this study is that noise emissions from operation of the Phase 1 power plant alone (Scenario 1) and Project power plant alone (Scenario 2) would each have an acceptable noise impact in the neighbourhood of the site. Similarly, the simultaneous operation of both power plants (Scenario 3) would also have an acceptable noise impact in the neighbourhood of the site.

It should be noted that the model results described above includes no room for uncertainty or tolerance (see Section 2.6), so the actual noise contribution from all scenarios could slightly exceed the World Bank 45 dB(A) criteria at nearest receptors, particularly at NSR 2 and 3. In addition, noise contribution from the Phase 1 plant is considered to be part of the existing background level since it would be in operation before the proposed Project plant (at least a year or more prior). Considering the fact that 'actual' noise contribution from Scenario 1 (i.e., Phase 1 plant only) could exceed 45 dB(A) at nearest receptors (i.e. if a few decibels are added to account for uncertainty), the World Bank 3 dB increase above background criteria may be more appropriate for evaluating impacts. In such situations (i.e., if background levels exceed 45 dB(A)), noise contribution from the Project power plant is expected to comply with the World Bank + 3dB limit at nearest receptors.

Although the Project is not expected to cause adverse noise impacts on nearby sensitive receptors, the following general measures are recommended during plant operations to minimize the risks of noise as part of a good industry practice.

- Conduct two separate noise monitoring surveys at the four NSRs. The first survey should be conducted just after commissioning of the Phase 1 power plant and the second after commissioning of the Project power plant (i.e. both plants operating together).

- If noise complaints occur from nearby communities during plant operations, consider further mitigation measures increasing the height of the 2.8-meter perimeter wall at certain locations, particularly at the northern, eastern, and southern project boundary. Other mitigation

measures that can be considered include upgrading silencers for exhaust stacks and top ventilation outlets (i.e. silencers with higher dynamic insertion losses)

- To maintain positive community relations, keep the public informed about the construction and operation plans and efforts to minimize noise, and establish procedures for prompt response and corrective action with regard to noise complaints.

- Conduct periodic perimeter noise surveys (e.g., every 2 to 3 years) to be compared with commissioning results to ensure proper noise abatement maintenance standard throughout plant life cycle.

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ANNEX C. ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM FRAMEWORK

1 *FRAMEWORK CONSTRUCTION ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM (ESMS)*

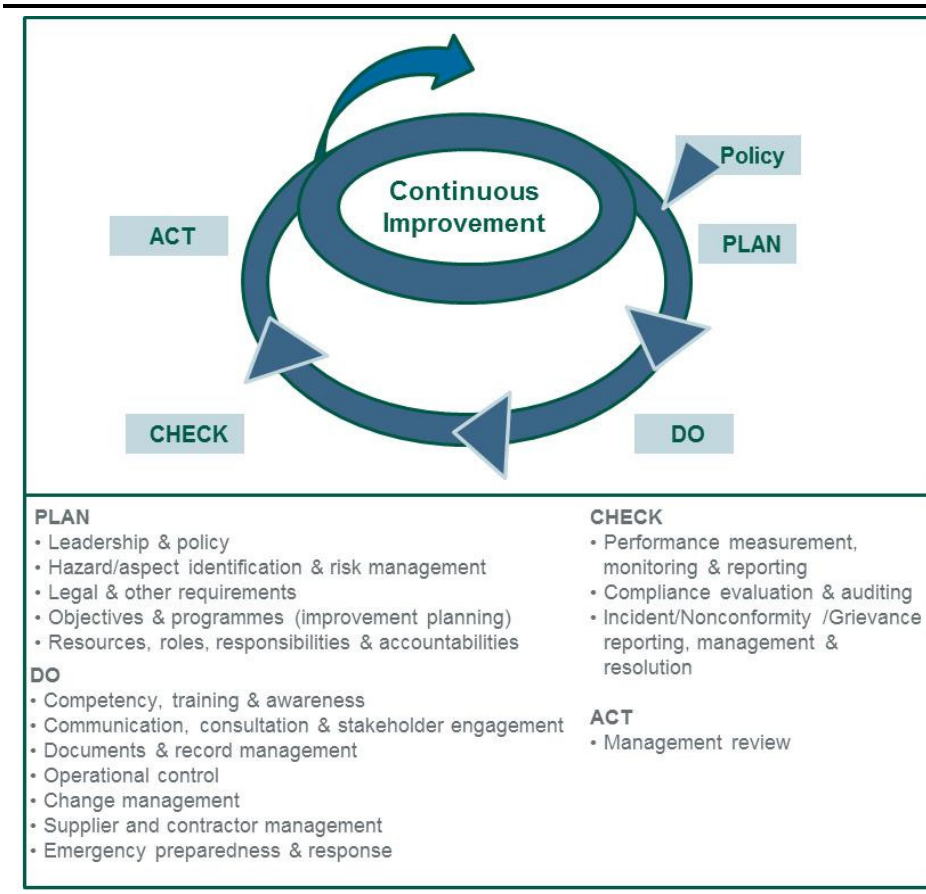
1.1 *INTRODUCTION*

This section sets out the key components of the planned Project E&S Management System (ESMS) which is still to be developed.

International Standards Organisation (ISO) 14001[3] and OHSAS 18001[4] are international management system specifications for environmental management systems and occupational health and safety management systems respectively, developed by leading national standards bodies, certification bodies, and specialist consultancies.

The planned ESMS must align with ISO 14001 and OHSAS 18001, and reflect the associated international good practice Plan-Do-Check-Act model of systematic management. This section describes the procedures, processes and approach that must be adopted for each element of the Plan-Do-Check- Act cycle shown in *Figure 1.1.*

Figure 1.1 ISO Plan-Do-Check-Act Model of Management



1.2 *POLICY*

The following environmental and social policies must be established for the Project:

- Environmental and Social Policy;
- Human Resources (HR) Policy;
- Drug and Alcohol Policy;
- HIV/ AIDS Policy, and
- Community Grievance Policy.

These policies must be developed to align with all regulatory requirements, international standards and good practices, including IFC standards, and to communicate the Developer's (in this case the Consortium) expectations with respect to environment, social and HR management. The policies will be adopted by the Contractor (comprising the EPC Contractor and its sub-contractors), and therefore communicated to sub-contractors, to enable them to align their policies/systems. The policies will be communicated to all workers during site induction, made available in visible areas onsite and made available to interested parties on request.

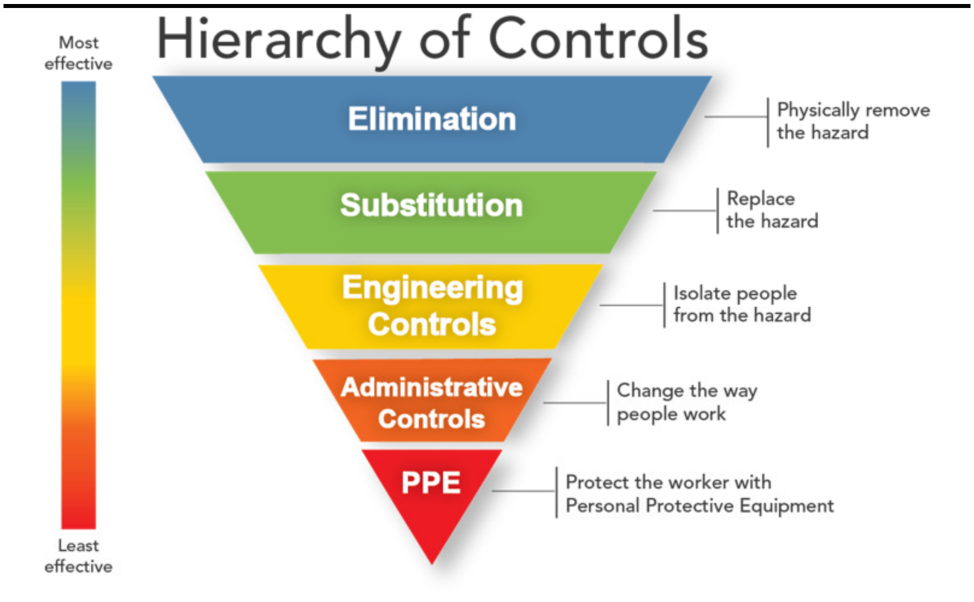
The policies will be reviewed a minimum of once annually, as part of management review processes and as the need arises - to ensure they are maintained appropriate to the nature and scale of the Project and business objectives.

1.3 *HAZARD/ASPECT IDENTIFICATION AND RISK MANAGEMENT*

An ESIA and various other E&S studies have been completed for the Project to identify key E&S aspects, risks and potential impacts requiring mitigation and control. Identification and assessment of impacts has been undertaken through a process comprising consultation, emission modelling, on-site observations, literature review and expert opinion based on experience of other similar projects. These modelling and assessment results have been reviewed and verified as part of finalizing the Original ESIA report (as well as updated versions for the ESIA: Supplementary Information Package (SIP)), and various other E&S reports.

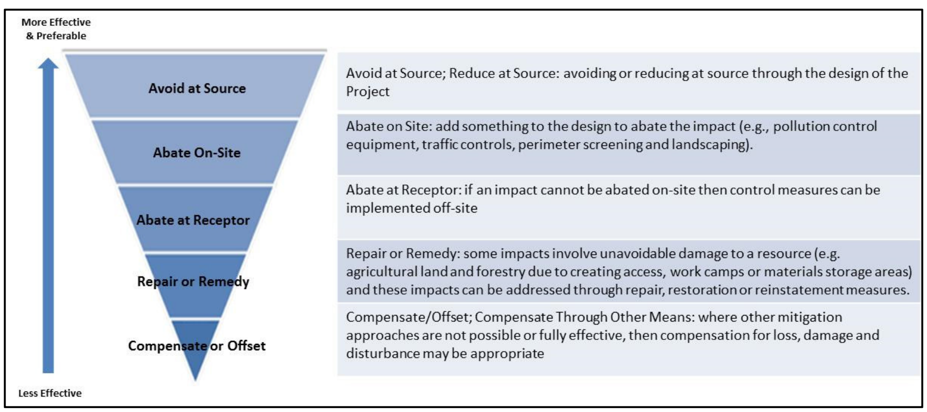
The Developer is committed to the Mitigation Hierarchy, as set out in *Figure 1.2* (for Health and Safety) and *Figure 1.3* (for Environmental and Social Risks) and this hierarchy was followed during the course of the various E&S studies, when devising appropriate mitigation and management strategies and measures.

Figure 1.2 Mitigation Hierarchy of Control for Occupational Health and Safety Risks



Source: https://www.cdc.gov/niosh/topics/hierarchy/

Figure 1.3 Mitigation Hierarchy of Control for Environmental and Social Risks



To ensure ongoing risk management during the construction phase of the Project, the Developer requires the Contractor to maintain a Risk Register, with oversight and input as necessary from the Developer.

1.4 LEGAL AND OTHER REQUIREMENTS

The compliance framework for the Project (i.e. the Project Standards) is provided in the Original ESIA, which included an in-depth analysis of relevant legislation, national policy and development plans; and lender requirements and related guidance.

Compliance with all relevant legislation is a core commitment of the planned Developer ESMS and must be communicated externally as part of the Project Policies. The Developer will stay abreast of relevant legal developments. Regular communication with relevant government departments will take place in order to keep updated with new legislation or amendments to existing legislation. The Contractor will be required to:

- identify the environmental laws, regulations and standards applicable to their scope work;
- obtain and review those laws, regulations and standards;
- ensure project personnel are aware of those laws and regulations that impact on their work; and
- ensure that project activities are in compliance with the laws and regulations.

Any environmental approvals (permits/ licenses) required in the name of Contractor will be the responsibility of the Contractor. Compliance with such documents, need to be undertaken by the Contractor on a regular basis, and will form part of the Developer's performance assessment of the Contractor.

1.5 ROLES AND RESPONSIBILITIES

The Developer will be the custodian of the Developer ESMS, and will ensure that it is actively communicated to the Contractor. The Developer ESMS will form part of the contractual agreements with the Contractor, and parties undertaking work for the Developer are required to align their systems with the Developer ESMS.

The Developer holds ultimate responsibility for the environmental and social performance of the overall Project, including the E&S performance of the Contractor. The Contractor is responsible to undertake the construction of the Project in accordance with the Developer's E&S requirements as part of its planned ESMS.

All staff have a responsibility to consider environmental and social impacts when they manage and undertake work. The Developer is committed to continuous improvement of environmental and social management and expects the same from the Contractor.

Further detail on the Developer roles for E&S management will be provided in the planned Developer ESMS. The Contractor is required to outline the roles and responsibilities for its E&S management in the Contractor CIPs.

The Developer requires the Contractor to be responsible for ensuring adherence to environmental and social commitments, including mitigation and control throughout the construction phase. The Contractor HSE Manager will be responsible for training all relevant sub-contractors and employees. The structure of the Contractor's E&S management must be further detailed in the Contractor CIPs.

The Developer recognises that the delivery of all relevant E&S management and monitoring controls requires effective and established mechanisms of communication, collaboration and coordination with the Contractor. To facilitate cross-project collaboration the Developer and the Contractor will meet weekly to facilitate the progress reviews of the Project.

The Developer requires all contractors to identify and define E&S roles, responsibility and authorities in the Contractor CIPs, and to ensure that human, technical and financial resources are provided where essential to the implementation and control of the E&S management.

During the Project ESIA process, formal stakeholder engagement was undertaken, in which several organisations and individuals had the opportunity to engage and raise comments regarding the Project. A Stakeholder Engagement Plan has been developed (see *Annex G*), which is a live document, and will be a key ESMS component that will be amended on a regular basis.

The key engagements expected during the construction phase are as follows:

- Engagement with external stakeholders will be led and managed by the Developer Community Liaison Officer (with support as necessary from the Contractor HSE Manager) including stakeholder engagement with communities, the government and other external parties, including the media; and

- Engagement with Project Personnel (workers) will be led and managed by the Contractor with more details provided within the relevant Contractor CIP.

1.6 TRAINING, COMPETENCY AND AWARENESS

The Developer ESMS will require the Contractor to ensure the competency of the construction Project team through:

- Clear definition of critical E&S roles and responsibilities;
- Robust interview processes and consultancy selection processes;
- Ongoing training and development activities; and
- Use of external specialist support, where appropriate.

The Developer will evaluate the performance of the Contractor's training activities during audits. Initially, based on the ESMP and then on an annual basis, the Developer requires the Contractor to carry out a training needs analysis and report any competency gaps or training needs. The analysis will identify options for internal capacity building and training of existing staff, and/or recruitment of additional personnel with relevant skills. The Contractor will allocate resources or training courses as necessary.

As part of establishing the construction contract, the Developer must communicate its competency expectations and training requirements to the Contractor. A detailed description of Contractor competency and training procedures must be provided in the Contractor's CIPs. In general, the Contractor's approach should comprise analysis of competency needs (for the specific project), effective recruitment to ensure alignment with those needs, and ongoing training to maintain and enhance the competency of hired staff.

All necessary training will be provided as part of the Contractor's induction training (to provide general awareness) and job-specific training as necessary.

The site induction will ensure that all personnel acknowledge the Project policies, organisational structure, job description requirements, regulations, site specific induction and health, safety and environmental awareness training.

All Project personnel involved in construction activities will be provided with toolbox training that outlines the specific management and monitoring controls included in the Developer ESMP and the Contractor CIPs. Attendance records for all training will be kept for evaluation during the Developer's and third party audits.

1.7 DOCUMENTATION AND RECORD KEEPING

The Developer requires the Contractor to manage E&S documentation in line with the requirements of the planned Developer ESMS Documents, Data, and Correspondence Management Procedure. The Developer and Contractor will maintain appropriate levels of documentation to demonstrate compliance with Project Standards and the Developer's requirements, as set out in this document. The Contractor documentation shall be available for review at all reasonable times.

The Contractor is required to operate an Open File Policy for all E&S documentation in order that Developer HSE management and Lender representatives can review any aspect of the E&S documentation at all reasonable times. The Contractor is also required to establish procedures governing review, approval, updates, version control, confidentiality, distribution, storage, retention and disposal of E&S information. Documents will be shared between the Contractor and the Developer electronically and in

hard copy. Over the course of the construction period, specific project documentation may also be publicly disclosed as necessary, via appropriate methods.

1.8 *OPERATIONAL CONTROL*

The Developer requires the Contractor to identify activities with the potential to cause E&S impacts and implement appropriate operational controls. These controls shall include effective supplier and contractor management procedures controlling the purchase of goods, equipment and services, control of any workplace visitors and stipulated operating criteria. As part of the ESIA process, the Developer identified Project Standards, including GIIP and specific management and mitigation measures, to be implemented by the Contractor as part of day-to-day management of operations (e.g. management and monitoring controls, and procedures).

1.9 *EMERGENCY PREPAREDNESS AND RESPONSE*

The Developer requires all Project personnel, including the Contractor, to identify potential and actual emergencies, and respond to these situations in an appropriate manner, in order to prevent or mitigate potentially adverse E&S impacts. The Developer requires the needs of relevant interested parties to be taken into account (e.g. emergency services, communities, neighbours) as part of this process, and procedures shall be reviewed, tested and revised periodically, and where required.

The Developer requires the Contractor to update/develop a Project-specific Emergency Preparedness and Response Plan and associated procedures in accordance with the requirements of the Developer's plan. An Emergency Preparedness and Response Plan has been created for the construction phase (see Appendix 2 of the C-ESMP in *Annex F*).

The Developer will review and monitor the performance of the Contractor's plan and related procedures as part of the monthly reviews, weekly meetings, and through performance reporting, as necessary. As the Project transitions to the operational phase, Emergency Preparedness and Response will become the responsibility of the Developer and/or the power plant operator, for the operational part of the site.

1.10 *MANAGEMENT OF CHANGE*

A Management of Change Procedure will be developed which addresses both physical changes and changes in policies, standards and work instructions. It will be a procedure, which allows for the development and amendment of policies and standards and determines their impact on their specific operation.

This is a key aspect in the implementation of a Safety, Health, Environment and Quality (SHEQ) Management System that provides the bridge between the global policies and standards and the specific instructions that provide guidance to workers at lower levels.

The Management of Change Procedure ensures that when a change is made to an organisation's activities, operations or services, the associated changes to SHEQ aspects and impacts are identified at, or preferably before, the time at which changes are made. All these factors are considered within the context of determining whether the changes require a change in SHEQ objectives and targets and an overall change in the SHEQ Management Programme.

1.11 ESMS REVIEW AND CONTINUAL IMPROVEMENT

As the planned Developer ESMS continues to develop and evolve, the Developer will periodically review the overall effectiveness of the system, and decide if any changes are necessary or desired. The review will consider the results of internal and external audits, incidents, regulatory developments, communications with external parties, etc.

This review process will take place with necessary input from the Contractor. The Developer's HSE management will agree actions, if any, to ensure the Project policies, ESIA commitments, ESMP and associated procedures and practices remain fit for purpose, and are implemented and effective.

ANNEX D1. STAKEHOLDERS ENGAGEMENT PLAN

Maria Gléta Power Plant Project
Stakeholder Engagement Plan

07 December 2018

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Client: Burmeister Wain Scandinavian Contractors (BWSC); African Infrastructure Investment Managers (AIIM); Enterprise Power (En/Power); and Investment Fund for Developing Countries	Project No: 0445162
Summary and version history: V2 Second draft of the proposed stakeholder engagement plan for Maria Gléta Power Plant Project	Date: 18 December 2018 Approved by: ---

2	Stakeholder Engagement Plan	Robert Wade Joseph Mbua	Marina Johnson	Henry Camp	07/12/18
		By	Checked	Approved	Date

This report has been prepared for *The Consortium* in accordance with the terms and conditions of our appointment for submission to the Client.	Distribution: The Consortium

CONTENTS

ACRONYMS

ABE	Benin Environmental Agency
APE	Association des parents et des élèves
ANDF	Agence Nationale Domaine Foncier
BWSC	Burmeister & Wain Scandinavian Contractor A / S
CA	Chef d'Arrondissement
CLO	Community Liaison Officer
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
INSAE	National Institute of Statistics and Economic Analysis
IPP	Independent Power Producer
GOB	Government of Benin
IFC	International Finance Corporation
IGN	National Geographic Institute
MEEM	Department of Energy, Water and Mines
NGO	Non-Governmental Organisation
PAC	Project Affected Communities
PAP	Project Affected People
RAP	Resettlement Action Plan
SBEE	Société Béninoise d'Energie Electrique
SEP	Stakeholder Engagement Plan

1 INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF THIS DOCUMENT

Stakeholder engagement is essential for building trusting relationships and opening lines of communication between the project and stakeholders. The main purpose of the Stakeholder Engagement Plan (SEP) is to ensure that all stakeholders that are directly or indirectly affected by Project activities or those that may have an interest in or influence in the Project are fully engaged and are provided with an opportunity to participate in related decisions.

The key objectives of the SEP are to:

- Understand the stakeholder engagement requirements of Benin legislation;
- Provide guidance for stakeholder engagement such that it meets the standards of International Best Practice;
- Identify key stakeholders that are affected, and/or able to influence the Project and its activities;
- Identify the most effective methods and structures through which to disseminate project information, and to ensure regular, accessible, transparent and appropriate consultation;
- Guide the Maria Gléta Project to build mutually respectful, beneficial and lasting relationships with stakeholders;
- Outline a grievance procedure allowing stakeholders to log their concerns, and a procedure to address these concerns; and
- Suggest mechanisms that enable stakeholders to influence project planning and design.

The SEP has been designed in accordance with national legislation and requirements and international best practice including the requirements of International Finance Corporation (IFC) as described in *Section 3.3* below. It is a living document, which means it should be updated and adjusted by the Project, as the supplementary ESIA progresses and Project planning evolves. It thus provides – and will continue to provide – a framework to manage effective and meaningful engagement with stakeholders.

1.2 STRUCTURE

This SEP is organised as follows:

- ***Section 2***: Project overview, including brief description of the Project.
- ***Section 3***: National and international regulation requirements for stakeholder engagement.
- ***Section 4***: Stakeholder identification and mapping
- ***Section 5***: Stakeholder engagement process, including the ongoing consultation strategy
- ***Section 6***: Grievance mechanism
- ***Section 7***: Monitoring and reporting
- ***Annex 1***: Grievance register template

2 PROJECT DESCRIPTION

At the beginning of 2015, the Government of the Republic of Benin issued a call to participate in a closed tender for the development of a new independent power producer (IPP) power plant in the town of Maria Gléta near Cotonou (the Project). The Project comprises construction and operation of a new 144 MW combined-cycle, thermal power generation plant made up of the following:

- Seven (7) dual-fuel reciprocating engines each producing 18.2 MW for a total of 127 MW (MAN Group 18V51/60 DF units are specified);

- Steam turbine system producing 18 MW; and

- Plant support infrastructure including:
    - Liquid fuel storage tanks (3 x 3,500 m^3) and truck offloading station;
    - Connection to natural gas supply manifold;
    - Connection to power grid sub-station; and
    - Plant support facilities.

The reconfiguration of the power evacuation lines to tie in an existing power line to the existing substation may be regarded as an associated facility. The reconfiguration of the power evacuation lines to tie in an existing power line to the existing substation may be regarded as an associated facility. The need for reconfiguration is dependent on the technical studies of the grid capacity which are ongoing. The reconfiguration is expected to involved only limited activities and would be restricted to within existing industrial areas. If more extensive work is required this would involve consultation with environmental authorities and possible further approvals.

The power plant will be built on a portion of a 23.5ha parcel of land (of this 20ha has been acquired and a further 3.5ha is in the process of being acquired by the Government of Benin) located in the town of Maria Gleta about 20 km to the west of the city of Cotonou. Of the 23.5ha parcel of land 3ha has been leased by the Project for the construction of the IPP power plant and a similar portion has been leased for the IDB power plant, the remainder of the land is set aside for future use by the Government of Benin. The parcel of land is located in an urbanised area with surrounding, relatively dense residential, business, and industrial development.

A Consortium, comprising the following organisations, was selected by the government to build, own, operate and transfer the plant:

- Burmeister Wain Scandinavian Contractors (BWSC);
- African Infrastructure Investment Managers (AIIM);
- Enterprise Power (En/Power); and

- Investment Fund for Developing Countries (of Denmark) (IFU).

The Consortium appointed the International Finance Corporation (IFC) and the African Development Bank (AfDB) as joint Mandated Lead Arranger (MLA) for financing of the Project.

The Consortium engaged Environmental Resources Management (ERM) to provide technical and advisory support for the planning and implementation of the Project. As part of this, ERM has identified the need for a Stakeholder Engagement Plan (SEP) to document engagement undertaken to date, and plan an outline for engagement going forward for the Project. This Stakeholder Engagement Plan draws on information in the pre-existing Environmental and Social Impact Assessment (ESIA) as well as a Gap Assessment undertaken by ERM with regard to that ESIA.

3 LEGAL REQUIREMENTS

3.1 INTRODUCTION

This section provides an overview of relevant national and international standards and guidelines and seeks to identify key references to consultation and engagement in national policy and legislation. These legal and policy standards are applicable to Stakeholder Engagement in the context of this Project. The national and international guidelines and standards discussed below are considered legal requirements and good practice will be adhered to by the Project.

3.2 NATIONAL REQUIREMENTS

In June 1993, Benin adopted an Environment Action Plan (*Plan d'Action Environnemental* (PAE)), which constitutes a part of the overall policy of development of the country. The first application of this plan is the promulgation of the law framework for the environment and the creation of the Benin Environmental Agency (ABE), responsible to apply an effective environmental policy. The framework law on the environment of 12 February 1999 (Law n°98-030) defines the bases of the Policy on environment and organises its implementation. It defines the general principles of the management of the environment in the Republic of Benin.

The reference texts governing the stakeholder consultation procedure in Benin are as follows:

- Constitution of Benin (13 August 1990);
- Act No. 98-030 of 12 February 1999 laying the framework law on the Environment in the Republic of Benin;
- Decree No 2001-235 (12 July 2001) and Decree No 2015-382 (9 July 2015) define the ESIA procedures;
- Law No. 2013 – 01 of 14 August 2013 establishing the Private and State-owned Land;
- Law No. 2013 – 01 of 14 August 2013 establishing the Private and State-owned Land Code of the Republic of Benin and its implementing decrees;
- Decree No 2001–190 (19 June 2001) on the organization of the ESIA public hearing procedure; and

- the Framework Law on the Environment (Act 98-030 of 12 February 1999) and its implementing decrees.

Article 96 of the Framework Law on the Environment stipulates 'the public hearing on the environment is a consultation of the population on environment-related issues. It ensures that citizens have access to information and allows them to ask the necessary questions on the subject of projects, or to express their opinions.' These two procedures show that: (i) the Republic of Benin is eager to prevent damage caused to people (ii) alleviate or compensate such damage and (iii) have the population participate in decision-making relating to the environment.

3.3 INTERNATIONAL REQUIREMENTS

This section provides a summary of international standards that will be followed in undertaking the stakeholder engagement process for the Maria Gléta Project.

3.3.1 IFC Performance Standards

The *IFC Performance Standards on Environmental and Social Sustainability* (the *IFC Performance Standards*) are considered a benchmark for good practice for environmental and social risk management in private sector developments. The IFC Performance Standards require that clients engage affected communities through disclosure of information, consultation, and informed participation, in a manner commensurate with the risks to and impacts of the Project on the affected communities.

The IFC Performance Standards include specific guidance on conducting stakeholder engagement both during the planning phase as well as throughout the Project lifecycle. Relative to the EIA process, stakeholder engagement requirements are contained in *Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.* The key requirements for consultation and disclosure applicable to the EIA process are summarised in *Box 3.1.*

Box 3.1 IFC Performance Standards for Stakeholder Engagement

IFC PS1: Assessment and Management of Environmental and Social Risks and Impacts
Stakeholder engagement is an on-going process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and on-going reporting to Affected Stakeholders.

Disclosure of relevant project information
Provide affected stakeholders with access to relevant information on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such stakeholders and relevant mitigation measures;(iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.

Informed Consultation and Participation
For projects with potentially significant adverse impacts on affected stakeholders, conduct an informed consultation and participation process. It should involve deep exchange of views and information, and an organized and iterative consultation, leading to the project incorporating into their decision-making process the views of the affected stakeholders on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues.
The process should be documented, in particular the measures taken to avoid or minimize risks to and adverse impacts on the affected stakeholders. The stakeholders should be informed about how their concerns have been considered.

External Communications
Implement and maintain a procedure for external communications that includes methods to (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track, and document responses, if any; and (iv) adjust the management program, as appropriate. In addition, clients are encouraged to make publicly available periodic reports on their environmental and social sustainability.

Grievance Mechanism for Affected Stakeholders
Establish a grievance mechanism to receive and facilitate resolution of affected stakeholders' concerns and grievances about the client's environmental and social performance.

On-going Reporting to Affected Stakeholders
Provide periodic reports to the affected stakeholders that describe progress with implementation of the project Action Plans on issues that involve on-going risk to or impacts on affected stakeholders and on issues that the consultation process or grievance mechanism have identified as a concern to those stakeholders. IFC standards requires that after completion of an environmental assessment the consultation and disclosure must continue throughout the life cycle (construction and operation phase) of the project.

Source: IFC Performance Standard 1, January 2012

3.3.2 Good Practice

The IFC has published the following reference for stakeholder engagement: *Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets (2007)*

The handbook provides recommendations on use of written and oral communication in local languages, accessibility to information, the use of oral and visual methods, respect of local traditions, care that vulnerable groups are included in the process, and mechanisms to respond to peoples' needs, fears and expectations. This handbook was used to guide the development of this SEP in terms of format and content.

4 STAKEHOLDER IDENTIFICATION AND MAPPING

Stakeholder identification and analysis is the critical first step in stakeholder consultation and engagement. This section outlines the process of identifying stakeholders by:

- Defining stakeholder groups;
- Reviewing appropriate engagement approaches and tools; and
- Determining the extent to which these groups could potentially be impacted by a project, and/or could exert influence over a project.

4.1 DEFINING STAKEHOLDERS

The IFC's Handbook on Stakeholder Engagement (2007) defines stakeholders as "persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively."

The following non-exhaustive list of stakeholder groups has been provisionally identified for Maria Gléta:

- Government officials such as those from the Department of Energy, Water and Mines (MEEM) and the Benin Environmental Agency (ABE);

- Officials from national institutions such as the National Institute of Statistics and Economic Analysis (INSAE), the National Geographical Institute (IGN) and the Departmental of Health for the region of Atlantique-Littoral;

- Traditional Authorities, where applicable. Although, since the area is urbanised, traditional village level structures such as local associations are not common for the immediate PACs, rather existing at the higher commune level;

- Committees representing Project Affected Communities (PACs) including those from Ouéga, Tokpa, Somé, Houeto, Maria Gléta, Tagbé and Fifoncé;

- Associations within the PAC such as *Association de Developpement de l'Arrondissement* (Local Development Association); *Association des parents et des élèves* (APE) (Parent Teachers Association) of CEG Hueto School; and heads of Women's Associations;

- Representatives of motorcycle taxi drivers;

- Local land-owner committees, individual land-owners, land-users;

- Vulnerable people in the wider affected area who may not be represented;
- Project personnel;
- Civic and conservation organisations;
- Community based organisation (CBO);
- Health workers; and
- Religious authorities.

This list of stakeholders is likely to expand/change in composition as the Project moves to feasibility, construction, operations and closure, and additional stakeholder groups might include:

- Suppliers and businesses;
- Shareholders;
- Trade unions;
- Customers;
- Academic community; and
- Interest groups.

4.2 *DEFINING ENGAGEMENT*

A number of terms related to stakeholder engagement are defined below to ensure a common understanding of terms.

Consultation: consultation involves two-way communication between the company and the affected stakeholders. The consultation process is undertaken in a manner that is inclusive and culturally appropriate. It provides the affected stakeholders with opportunities to express their views on project risks, impacts and mitigations measures, and in turn allows the client to consider and respond to them.

Stakeholders: persons or groups of people who are directly or indirectly affected by a project, as well as those who may have interests in or the ability to influence the Project's outcome, positively or negatively. Stakeholders may include locally affected stakeholders and their formal and informal representatives, national, provincial or local government authorities, religious leaders, civil society organizations and special interest groups such as the academic community, amongst others.

Stakeholder engagement: stakeholder engagement is a process whereby efforts are made by one party to understand and involve the other parties' (the

stakeholders') concerns in the first party's activities and decision-making processes. There are various levels of engagement, and engagement will often involve a combination of approaches. ***Error! Reference source not found.****1* shows the various levels of stakeholder engagement. As part of stakeholder identification and analysis, the degree of engagement per stakeholder needs to be determined, as appropriate to the phase of the Project and the issues pertinent to the specific stakeholder.

Table 4.1 Levels and Objectives of Stakeholder Engagement

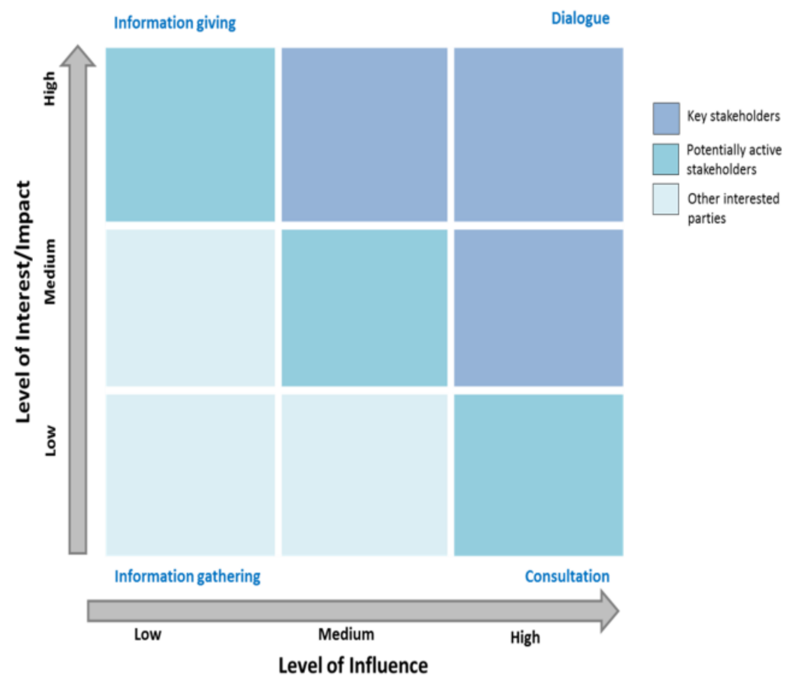
Level of Stakeholder Engagement	Objective	Direction of Information Exchange
Inform	To provide balanced and objective information to improve understanding of the issues, alternatives and/or solutions.	One way
Consult	To obtain feedback from stakeholder on issues, alternatives and/or decisions.	Two way
Collaborate	To partner with stakeholder in each aspect of a decision-making process.	Two way
Empower	To place final decision-making in the hands of the stakeholders.	Two way

Source: International Association for Public Participation (IAPP), 2004

4.3 STAKEHOLDER MAPPING

Prioritization of stakeholders determining the level and frequency of consultation with each group is based on the level of impact experienced and/or their interest in the Project. As such, stakeholders should be mapped and categorised according to their influence, impact and interest in the project, using *Figure 4.1* below.

Figure 4.1 Stakeholder Mapping



Stakeholder categories include:

- **Category 1 - Key stakeholders:** Stakeholders who have a high level of interest in the Project, including those who have provided regulatory approvals and will undertake monitoring (e.g. MEEM, ABE), and those who are likely to experience direct impacts e.g. Project affected communities, including vulnerable groups. These groups require a participatory role in project decision making and regular engagement.

- **Category 2 - Potentially active stakeholders:** Stakeholders who are likely to voice their opinions and/or concerns about the project and who may experience indirect impacts. These groups require engagement at key project milestones (e.g. project planning) and regular updates during the life of the project.

- **Category 3 - Other interested parties:** Stakeholders who are likely to voice their opinions and/or concerns but unlikely to experience any impacts from the project. These groups require project updates to keep them informed on project developments.

5 STAKEHOLDER ENGAGMENT PLANNING OVERVIEW

Despite some consultation and stakeholder engagement having taken place so far in the Project, there is the lack of a formalised Stakeholder Engagement Plan in place. The Project should use this SEP in line with IFC requirements to:

- Document an overview of stakeholder engagement activities undertaken since 2014;
- Define the principles that will guide the Project in managing coherent engagement with Project stakeholders; and
- Structure ongoing and future stakeholder engagement activities.

These stakeholder engagement activities include:

- Key stakeholders identified and key local administrative structures and institutional bodies such as associations;
- Stakeholder mapping based on interest, impact and influence;
- Tools that will be used to engage stakeholders during ongoing construction activities and operation;
- Approach to stakeholder engagement that will be taken with various stakeholder groups including the nature of the engagement and frequency of the engagement; and
- Outcomes of engagement and resolution of issues.

Further versions should include:

- A map of local administrative boundaries (as shown in *Figure 5.1*) provided to indicate commune, arrondissement, village and quartier level breakdown of PACs;
- Key materials to be disclosed;
- Updates on any further outcomes of engagement and resolution of issues.

Figure 5.1 Map of local administrative boundaries

This Section outlines the logic and purposes of a Stakeholder Engagement Plan. It also provides guidelines that were used for establishing this SEP in line with IFC standards.

Stakeholder engagement is an on-going process, which aims to improve the project decision-making processes and build understanding by actively involving individuals, groups and organisations with a stake in the Project. It involves interaction between identified groups of peoples and provide stakeholders with an opportunity to raise concerns and opinions e.g. by way

of meetings, surveys, interviews and/or focus groups) and ensure that this information is taken into consideration when making Project decisions.

Effective stakeholder engagement develops a social licence to operate and depends on mutual trust, respect and transparent communication between the project and its stakeholders, and enables the company to improve their decision-making and performance by:

- **Cutting costs:** Effective engagement can help project proponents avoid costs, while its absence can be costly both in terms of money and reputation;
- **Managing risk:** Engagement helps proponents and communities to identify, prevent, and mitigate environmental and social impacts that can threaten project viability;
- **Enhancing reputation:** By publically recognising human rights and committing to environmental protection, project proponents and financial institutions can boost their credibility and minimise risks;
- **Avoiding conflict:** Understanding current and emerging issues such as tension around influx and employment opportunities;
- **Improving corporate policy:** Soliciting perceptions about a project, which can act as a catalyst for changes and improvements in corporate practices and policies;
- **Identifying, monitoring and reporting impacts:** Understanding a project's impact on stakeholders, evaluating and reporting back on these impacts; and
- **Managing stakeholder expectations:** Consultation also provides the opportunity for exploration and mining licence holders to be aware of and manage stakeholder attitudes and expectations.

5.1 PRINCIPLES OF EFFECTIVE STAKEHOLDER ENGAGEMENT

Stakeholder engagement is usually informed by a set of principles defining core values underpinning interactions with stakeholders. Common principles based on International Best Practice include the following:

- **Commitment** is demonstrated when the need to understand, engage and identify the community is recognised and acted upon early in the process;
- **Integrity** occurs when engagement is conducted in a manner that fosters mutual respect and trust;

- **Respect** is created when the rights, cultural beliefs, values and interests of neighbouring communities are recognised;

- **Transparency** is demonstrated when community concerns are responded to in a timely, open and effective manner;

- **Inclusiveness** is achieved when broad participation is encouraged and supported by appropriate participation opportunities; and

- **Trust** is achieved through open and meaningful dialogue that respects and upholds a community values.

5.2 *LIMITATIONS OF STAKEHOLDER ENGAGEMENT*

Some common limitations of stakeholder engagement include:

Time and resources

It takes time to develop and build trust based relationships with stakeholders. The consensus from practitioners is that from the outset, relationships with stakeholders grow, not fade. Additional stakeholders will also want to engage. Some stakeholders will need to be educated about the concept of engagement itself, as well as on the complex issues requiring specialised and technical knowledge. These demands can result in an increasing drain on project resources to meet external expectations, often at a time when a project often lacks the internal capacity to engage with stakeholders and training in engagement is required.

Raised expectations

Stakeholders can have unrealistically high expectations of benefits that may accrue to them from a project. As such project proponents must be clear on what they can and cannot do, establishing a clear understanding of their roles and responsibilities. In developing countries, project proponents are often expected to take on responsibilities that are the usual responsibility of government (e.g. infrastructure development, and the provision of healthcare and education facilities). This behaviour should be avoided, as by doing so, governments may be relieved of delivering on their responsibilities to their people.

Securing stakeholder participation

Cultural norms and values can prevent stakeholders from freely participating in meetings. Often there are conflicting demands within a community, and it can be challenging for a project to identify stakeholders who are representative of common interests. This might be avoided by employing local community liaison officers who are empathetic to local power dynamics,

which means that project proponents need to develop the capabilities as well as the culture and mind set for effective stakeholder engagement.

Consultation fatigue

Moreover, there is evidence to suggest that stakeholders can easily tire of consultation processes especially when promises are unfulfilled, opinions and concerns are not taken into consideration, and/or stakeholders feel their lives are not improving and they are not benefiting from a project. This might be avoided by coordinating stakeholder engagement during an ESIA process, and by ensuring practitioners do not make promises to stakeholders, but rather use the public consultation process as an opportunity to manage expectations, challenge misconceptions, disseminate accurate project information, and solicit stakeholder opinions and feedback.

The engagement for Maria Gleta has additional complications as consultations took place for both resettlement components of the Project and the ESIA concurrently. The resettlement process lasted 6 years, and issues were regularly raised during engagement in relation to wider environmental and social concerns than just for resettlement. In addition, there is scope for confusion and overlap with the IDB project being built (as of end of 2017) on the same 20ha parcel, adjacent to the IPP.

5.3 STAKEHOLDER ENGAGEMENT TOOLS AND COMMUNICATION METHODS

A number of methods will be used to engage with specific groups based on their level of authority, language, cultural and intellectual factors such as education and literacy levels.

Methods include:
- Community meetings;
- Focus Groups Discussions;
- Key informant interviews;
- Public consultation;
- Specific PAC committee meetings (see *Section 6.2* for PAC Committee).

Meetings have contributed to stakeholder engagement, risk management and have increased community support for the Project.

Figure 5.2 outlines an overview of the meeting formats and communication tools that have and will be used to disseminate information according to the group and situation, regarding Project related issues and the Project.

Figure 5.2 Stakeholder Engagement Channels and Materials

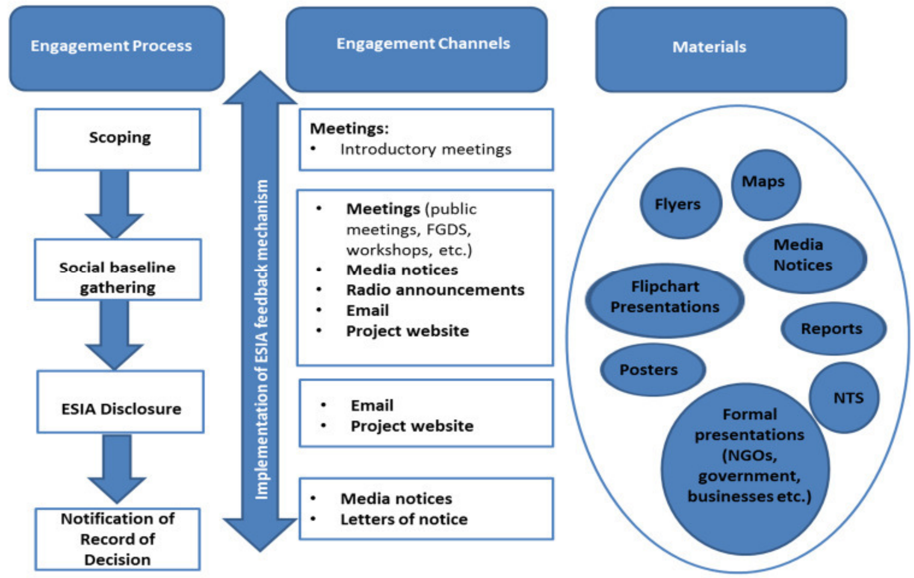


Table 5.1 Engagement Techniques

Engagement Technique	Most appropriate application of technique
Correspondence by phone/fax/email	• Distribute project information to government officials, organisations, agencies and companies; and • Invite stakeholders to meetings.
Print media and radio announcements	• Disseminate project information to large audiences, and illiterate stakeholders; and • Inform stakeholders about consultation meetings
One-on-one interviews	• Solicit views and opinions; • Enable stakeholders to speak freely and confidentially about controversial and sensitive issues; • Build personal relations with stakeholders; and • Recording of interviews
Formal meetings	• Present project information to a group of stakeholders; • Allow the group of stakeholders to provide their views and opinions; • Build impersonal relations with high level stakeholders; • Distribute technical documents; • Facilitate meeting using PowerPoint presentations; and • Recording of discussion, comments/questions raised and responses

Engagement Technique	Most appropriate application of technique
Public meetings	• Present project information to a large audience of stakeholders, and in particular communities; • Allow the group of stakeholders to provide their views and opinions; • Build relationships with neighbouring communities; • Distribute non-technical project information; • Facilitate meetings using a PowerPoint presentation, posters, models, and pamphlets or project information documents; and • Recording of discussions, comments/questions raised and responses
Workshops	• Present project information to a group of stakeholders; • Allow the group of stakeholders to provide their views and opinions; • Use participatory exercises to facilitate group discussions, brainstorm issues, analyse information, and develop recommendations and strategies; and • Recording of responses
Focus group meetings	• Allow a smaller group of between 8 and 15 people to provide their views and opinions of targeted baseline information; • Build relationships with neighbouring communities; • Use a focus group interview guideline to facilitate discussions; and • Recording of responses
Surveys	• Gather opinions and views from individual stakeholders; • Gather baseline data; • Recording of data; and • Development of a monitoring baseline database

5.4 *ENGAGEMENT WITH MAPPED STAKEHOLDERS*

As described in *Section 4.3*, stakeholder mapping determines the likely relationship between stakeholders and the Project, which helps to identify the appropriate engagement methods for each specific stakeholder group during the life of the project.

Stakeholder analysis determines the likely relationship between stakeholders and the Project, and helps to identify the appropriate engagement methods for each stakeholder group during the life of the project. Some of the most common methods used to consult stakeholders include:

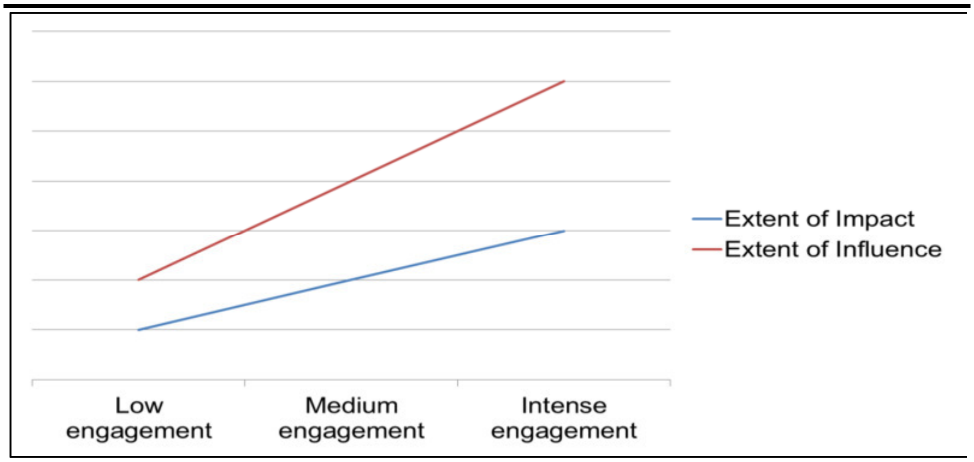
- Phone / fax / email;
- One-on-one interviews;
- Workshop / focus group discussions;
- Distribution of pamphlets and newsletters;
- Public meetings; and
- Newspaper / magazines / radio.

When deciding the frequency and the appropriate engagement technique used to consult a particular stakeholder group, three criteria must be considered:

- The extent of impact of the project on the stakeholder group;
- The extent of influence of the stakeholder group on the project; and
- The culturally acceptable engagement and information dissemination methods.

In general, engagement is directly proportional to impact and influence, as per stakeholder mapping categories in *Section 4.3*. As the extent of impact of a project on a stakeholder group increases, or the extent of influence of a particular stakeholder on a project increases, engagement with that particular stakeholder group should intensify and deepen in terms of the frequency and the intensity of engagement, as shown in *Figure 5.3*.

Figure 5.3 ***Directly proportional relationship between extent of impact, influence and engagement***



All engagement should proceed based on culturally acceptable and appropriate methods for each of the stakeholder groups. For example, when consulting government officials formal presentations are the preferred consultation method, while communities prefer public meetings, and informal focus group discussions facilitated by posters, non-technical pamphlets and other visual presentation aids. *Table 5.2* matches generic stakeholder groups to a list of different engagement techniques.

Table 5.2 Stakeholder Groups and Engagement Methods

Stakeholder Group	Engagement Methods
Government officials	• Phone / fax / email; • One-on-one interviews; and • Formal meetings
Traditional Authorities	• Phone; • Print media and radio announcements; • One-on-one interviews; and • Focus group meetings
Neighbouring communities	• Print media and radio announcements; • Public meetings; • Focus group meetings; and • Surveys
Employees and managers	• Phone / fax / email; • Print media and radio announcements; • Workshops; • Focus group meetings; and • Surveys
Civic and conservation organizations	• Phone / fax / email; • One-on-one interviews; and • Focus group meetings

5.5 PHASES OF STAKEHOLDER ENGAGEMENT

The ESIA stakeholder engagement and disclosure process was completed in April 2017. During the data collection four (4) sessions of focus group discussions and eight (8) Key informant interviews KIIs. The stakeholder meetings and was undertaken by the following Persons Affected by Project (PAPs), Grassroots Community Development Associations (ADB), resettlement committee members in charge of PAPs, local and administrative authorities, the President Schools Associations (APE) and teachers of CEG Houèto, health workers, Heads of various Women's Associations (GF), the Coordinator of Maria-Gleta II Project, both Hygiene, Health and Environment Manager (HSE) of Maria-Gleta II project and GMT (subcontractor). Although the resettlement was a Government led exercise, on behalf of the project, the government engage the affected communities for compensation disclosures and set of grievance committee to manage grievance resulting from the land acquisition.

During the 2018 data update, primary data collection was obtained from four (4) Focus Group Discussions (FGDs) and eight (8) separate Key Informant Interviews (KIIs). See meeting summary notes SEP. The four focus in included:

- On Thursday, March 29, 2018, a focal group discussions were conducted in the Somè Village Chief with the participation of local stakeholders in the context of Maria-Gleta II project.

- On Thursday, March 29, 2018, another focal group discussion was conducted with the Chief of Maria-Gléta with the participation of local stakeholders in the context of Maria-Gleta II project.
- On Thursday, March 29, 2018, focus group discussion were held in Houèto Village Chief group in Togba district. This was conducted in the residence of with the participation of local stakeholders in the context of Maria-Gleta II project.
- On Saturday, March 31, 2018, focal group discussions were conducted with the Fifonsi Village Chief with the participation of local stakeholders in the context of Maria-Gleta II project

Table 5.3 Table of Stakeholder Engagement Activities

District	Participants	Venue	Date
Togba	Delegation of the MEEM, community members and consultants	CEG Hueto School	17/05/2018
Togba	local stakeholders	Somè Village Chief residence	29/03/2018
Togba	local stakeholders	CEG Houèto	29/03/2018
Togba	local stakeholders	Maria-Gléta Village Chief	29/03/2018
Togba	local stakeholders	Fifonsi Village Chief	31/03/2018

5.5.1 Phase 1: Engagement during ESIA

Data gathering activities provided stakeholders with more information about the Project, answer questions and receive further comments, as well as gather information. Baseline data gathering activities aimed to:

- Understand the existing environmental and socio-economic context of the Project area of influence. This served as a benchmark of pre-project livelihoods and conditions;
- Inform impact predictions (positive and negative) and assessments of the ability of receptors and stakeholders to benefit from, adapt to and accept change;
- Further identify stakeholders who are potentially sensitive/ vulnerable to the proposed Project or able to support in the implementation of information disclosure and mitigation measures; and
- Ground-truth stakeholder feedback in order to differentiate between perceived and actual impacts.

5.5.2 Phase 2: ESIA Consultation

The objectives of the Draft ESIA Phase consultation included the following:

- Disclose the findings of the specialists studies;
- Gather comments and concerns regarding the identified potential impacts; and
- Identify potential mitigation measures that may have been overlooked.

The ESIA was completed in April 2017. Supplementary ESIA studies are due for completion in May 2018. Consultation activities associated with this phase are described below.

The public consultations organized as part of the ESIA were undertaken as required by Beninese law, which details the requirements for environmental and social impact studies in Benin. According to law, the implementation of the ESIA must be carried out with the participation of the populations concerned through consultation and public hearings, in order to gather their opinions on the project.

Public consultation was held on 17 May 2014 at the local CEG Hueto School as part of the ESIA development and land acquisition asset survey. About 80 people attended including members from MEEM, local land owner committee members, and land owners onsite and in the general area, and the ESIA consultants. Minutes were taken and an attendance register completed, as included in the ESIA. The main queries and concerns reported by the stakeholders included in the ESIA are:

- Desire to sell land for those partially impacted by Project land take;
- Queries related to the valuation and compensation process; and
- Noise and vibrations associated with the start-up of the existing power plant.

Section 5 of the ESIA notes that during the socio-economic studies various engagement with stakeholders took place including with Beninese authorities such as the Ministry of Water and Energy and ABE; and national institutions such as the National Institute of Statistics and Economic Analysis (INSAE), the National Geographical Institute (IGN) and the departmental of health for the region of Atlantique-Littoral.

Based on the information reviewed it is unclear to what extent communities in the Project area were adequately identified and included in consultation activities (for example the fuel transport access road was excluded). Local level engagement was said to have been undertaken in key impacted villages surrounding the project site including Ouéga, Tokpa, Somé, Houéto, Maria Gléta, Tagbé and Fifoncé, although this is not documented in the ESIA.

The ESIA notes that individual level consultations were held such as with the Chief of the district of Houèto, members of the committee of land owners, chiefs of traditional worship institutions and members of the wider Project Affected area. Field surveys were conducted as part of the comprehensive

census of resident's onsite based on the list of structures and impacted parcels developed by the consultancy Wall Street Engineering Group. A number of individual interviews were undertaken with the local population during these surveys.

Adequate data is not provided for all the key interest groups. For example, identifying the poorest or more vulnerable; where people are likely to reside; which groups are more likely to be impacted by the Project; and which are more dependent on services in proximity to the Project site for their livelihoods. In addition to this, gender issues and roles within the local community are not described and do not seem to be clearly understood. The status of men and women are not articulated and would need to be better defined to allow for a clearer understanding of the vulnerabilities.

The Chef d'Arrondissement (CA), met with during the ESIA update site visit (February 2018), noted that PACs generally feel informed regarding the project development. The SBEE representatives manage the relationship with the local CA for dissemination of project updates to the PAPs and PACs. The Project has also identified a local NGO *Racine* to sensitise PACs in the area neighbouring the Project and to communicate project updates.

The head teacher of the adjacent college also noted that engagement was sufficient, and that on average, informal project progress updates were received on a monthly basis. During the site visit, which also included a representation of teachers, it was suggested that the level of formal engagement should be increased to every two or three months. The suggested forums for engagement included: social media and mobile phone alerts (e.g., WhatsApp) with the CA and Chef de Village from key impacted villages; radio and television announcements; face to face visits with key stakeholders; and a formal forum to register grievances as this does not currently exist. Given that the Project area is in an urbanised environment, traditional village level structures such as local associations are not common for the immediate PACs, rather existing at the higher commune level. However, during the supplementary ESIA site visit it was suggested that the Project could consult with associations within the PAC, such as *Association de developpement de l'arondissement* who could act as a useful focal point, and with A*ssociation des parents et des élèves* (APE) of CEG Hueto School.

As part of the EIA update studies, stakeholder consultation and other community meetings such as focus groups discussion and key informant interview were undertaken. Some of these meetings were undertaken to understand the socio-economic baseline conductions within the project footprint. Further consultation was undertaken with local institutions and community services like clinics, hospitals and schools.

Engagement during Resettlement Action Plan (RAP) Process

There is no formally documented resettlement engagement process for the Project. However, disclosure procedures were in place during key stages of

the resettlement process, which occurred between 2009 and 2016. The issuance of the Expropriation Decree was disclosed in the Project area, and public input, including grievances, was solicited. A poster board with a map of the impacted area was displayed onsite, and a town crier was used to disseminate information in 2009. The government body responsible for the expropriation process, Agence National Domain Foncier (ANDF), notified the Mayor and the Chef d'Arrondissement (CA) of the *declaration d'utilite publique* (DUP), who then disseminated the information to the Chefs de village and Chefs de quartier. When consulted onsite during the supplementary ESIA fieldwork, the CA noted that Project Affected People (PAPs) felt informed on project progress.

An information point was provided onsite for a month with Government of Benin GoB, ANDF and SEEB representatives during the inventory process (*Appendix 2, Figure 9*). For two weeks the list of impacted PAP owners with the total surface area of their impacted assets was also displayed publicly (*Appendix 2, Figure 7*) at the Abomey-Calavi Mayor's office and onsite (accessible to PAPs). Grievances were registered at this point. The ANDF holds these records but they were not available for review.

It is reported that a Grievance mechanism, or *Cahier de Doleance,* was in place during payment of compensation; this was not available for review. SBEE noted that all grievances they collected were sent to ANDF.

The Government-led resettlement process includes the establishment of a PAP Committee. For the Maria Gléta site this was referred to as the *Comité des 20ha* or *Comité des expropriés.* This association or committee engaged with an Inter-ministerial Commission which was formed to lead the expropriation process under ANDF. The committee reportedly consisted of 17 elected locals including community leaders, women's representation, local authorities such as the village chief, and was consulted on a monthly basis. Many meetings with the State were held, to the extent that PAPs reported business activities suffering as a result. PAPs interviewed noted that grievances were also sent to the ministerial committee but rarely responded to.

Negotiation sessions with the Project PAPs started on 24 November 2016 at the Abomey - Calavi Town Hall, and payments to PAPs were made on 1 December 2016. Details of community engagement undertaken by the Committee were provided for 12 and 19 October 2016 ahead of compensation payment. The minutes noted that due to delays in the operational schedule, meetings would be held every Wednesday with the PAP Committee, indicating a good level of communication between the Project and PAPs in the latter stages of the resettlement process. It was agreed that signing of approved minutes would take place, and attendees would sign attendance forms. It was noted that the establishment of a 'sensitisation mechanism' should be implemented to improve communication; it is not clear whether this was implemented.

Commencement of land clearance and construction was publicised on the radio and via the above-mentioned public meeting.

The ESIA notes that complaints were received during the ESIA consultation such us the PAP Committee not providing written records of engagement undertaken on behalf of the PAPs. There are no records of a standard complaint form used by SBEE or ANDF during the engagement process, however a complaint management mechanism was in place. For example, the valuation process was revised based on grievances raised by PAPs. This indicates that effective consultation was in place and that the inter-ministerial committee, which was project specific, addressed and managed key grievances.

5.6 *STAKEHOLDER ENGAGEMENT PLAN*

During each phase, a number of tools and communication methods have and will continue to be used to facilitate engagement and disclosure in line with the mapping of stakeholders. *Table 5.3* below thus provides a summarised version of the Stakeholder Engagement Plan. It provides a list of key stakeholders identified so far. These stakeholders have then been mapped using the method proposed in *Section 4.1.* Appropriate engagement methods and frequency of engagements are also included. It should be noted that this Plan provides a non-exhaustive, living list of the main stakeholder groups, which should be kept updated as the Project progresses.

Moving to mobilization and construction, the Project will take care to ensure it maintains a balanced and inclusive approach in engagement and consultation to close gaps and strengthens project disclosure to activities, timelines to the PAPs. This should be done by including a broad spectrum of stakeholder groups across the local social hierarchy. The consultation will be in two stages.

Stage 1: Strengthening ESIA Consultation and Engagement to Close Gaps

In the immediate future further stakeholder engagement and disclosure will be required to close out the gap of ESIA public consultation and engagement. Disclosure and consultation of ESIA is a key requirement of the IFC in order to ensure that all stakeholders are provided with an opportunity to provide feedback to be considered mitigation measures and implementation management plans. Disclosure in settlement at district level will include:

- sharing of the draft ESIA and entitlement matrix document with relevant stakeholders including the traditional authorities, local government agencies and all directly affected households, including vulnerable groups.
- meetings with representative of affected households and district and local authority and presenting the main components of the ESIA in an appropriate format tailored to the group/s.

Following any updates ESIA a final round of disclosure on ESIA will be undertaken. This disclosure will explain any the changes made since the draft initial ESIA. All project affected households will also be met to discuss impacts resulting mitigating measures.

Stage 2: Ongoing and Continues Stakeholder engagement

Communication and Engagement: Although French is the official language of Benin, the project should consider changing communication material to reflect the local dialect. Further, literacy levels are low, especially among females. In combination with poor access to education, use of written communication will not be understood by the majority. The majority of engagement in the Project AoI will therefore be verbal, with frequent use informal channels of communication, as this is seen as the most appropriate mode of disseminating messages in the local context. Verbal communications will be in the relevant language of the target group, with an interpreter used in situations where there are mixed language groups.

Pre-construction engagement: Stakeholder engagement leading up to construction will be of critical importance, as this is the phase when PAPs will vacate their land and need to re-establish their livelihoods elsewhere. Engagement activities will focus heavily on ensuring that PAPs are provided with timely information about the process and monitored to limit the number of grievances that arise, and if they do, that they are promptly addressed.

Construction Engagement: During construction, the Maria Gleta community relations team will monitor the works to ensure it does not pose a hazard to the health, safety or security of the community. Maria Gleta will continue to engage with stakeholders during construction to continually update them of disturbances that they may experience and associated timeframes. This will include ongoing relationship building and participation of affected communities regarding management of construction impacts and effectiveness of monitoring.

As construction comes to an end, Maria Gleta will engage stakeholders regarding the impacts associated with the end of the construction Phase, including the conclusion of temporary contracts with local employees supporting construction works, as well as the process of transitioning to operation. The grievance mechanism will continue to be discussed at meetings.

Operations Engagement: In order to manage environmental and social project risks, ongoing communication between Maria Gleta and stakeholders will be required throughout the operation phase of the Project.

During the transition between construction and operation, Maria Gleta will review its social AoI and stakeholders list and adapt it for the operation phase of the Project. As operational impacts are likely to be less significant than

construction and the bulk of permitting process will have been completed, this exercise will reduce the number of stakeholders and directly affected communities to be engaged. As a consequence, the number and frequency of meetings to be held will be reduced.

Meetings during operation will include an update on Project activities, community health and safety considerations, progress of CDP implementation and a feedback process regarding the project to date and how well the grievance mechanism is working. These operation-phase stakeholder engagement requirements are summarised in table 5.3.

Community Development Programs: Maria Gleta will need to implement a Community Development Programme (CDP) throughout the life of the Project. The objective of the Community Development Plan will be to implement programmes that enhance and support the livelihoods of communities in the AoI, including those of PAPs and their households. To ensure that the CDP is effective in meeting community needs and addressing challenges and that it is developed in a consultative manner, a series of engagement and consultation rounds will feed into its development; ensuring beneficiaries are involved from the beginning. As the development of a CDP is an iterative process, with input from various stakeholders, the following rounds of consultation will be carried out for its development:

- Validation of the main community needs and challenges;
- Consultation and agreement on objectives and content of CDP programmes;
- Consultation, mapping and identification of appropriate implementing partners; and

Table 5.3 Stakeholder Engagement Plan Summary

Stakeholder Group	Stakeholder Importance (Mapping Category)	Engagement Methods	Project Stage	Frequency of Engagement
Government officials and officials from national institutions	Category 1 - Key stakeholders	▪ Phone / fax / email ▪ One-on-one interviews ▪ Formal meetings	Pre-construction	Quarterly
			During construction	Monthly
			During operations	Quarterly
Traditional Authorities (where applicable)	Category 1 key stakeholder	▪ Phone ▪ Print media and radio announcements ▪ One-on-one interviews ▪ Focus group meetings ▪ Key informants Interviews ▪ Focus Groups Discussion	Pre-construction	Quarterly
			During construction	Weekly during first few weeks and monthly thereafter
			During operations	Weekly during first few months and quarterly thereafter
Project Affected People (PAPs)	Category 1 - Key stakeholders	▪ Face to face meetings ▪ Focus Groups Discussions (FGDs) ▪ Key Informants Interview (KIIs)	Pre-construction	Quarterly
			During construction	Weekly during first few weeks and monthly thereafter
			During operations	Weekly during first few months and quarterly thereafter
Associations within the PACs	Category 1 – Key stakeholder	▪ Face to face meetings ▪ Focus Groups Discussions (FGDs) ▪ Key Informants Interview (KIIs) ▪ Community meetings	Pre-construction	Quarterly
			During construction	Monthly
			During operations	Monthly initially and quarterly thereafter
	Category 2 - Potentially active stakeholders	▪ Print media and radio announcements	Pre-construction	Quarterly

Neighbouring Project Affected Communities (PACs)		▪ Public meetings ▪ Focus group meetings ▪ Surveys	During construction	Monthly initially and quarterly thereafter
			During operations	Monthly initially and quarterly thereafter
Land owner committees, land owners and land users	Category 1 key stakeholder	▪ Public meetings ▪ Focus group meetings ▪ Surveys	Pre-construction	Quarterly
			During construction	Quarterly as per livelihood monitoring
			During operations	Quarterly as per livelihood monitoring
Vulnerable/poor PAPs	Category 1 – Key stakeholder	▪ Public meetings ▪ Focus group meetings ▪ Surveys	Pre-construction	Quarterly
			During construction	Weekly during first few months and monthly thereafter
			During operations	Weekly during first few months and monthly thereafter
Employees and managers	Category 1 – Key stakeholder	▪ Phone / fax / email ▪ Print media and radio announcements ▪ Workshops ▪ Focus group meetings ▪ Surveys	Pre-construction	Ongoing
			During construction	Ongoing
			During operations	Ongoing
Civic and conservation organizations	Category 3 - Other interested parties	▪ Phone / fax / email ▪ One-on-one interviews ▪ Focus group meetings	Pre-construction	Quarterly
			During construction	Quarterly
			During operations	Quarterly

6 GRIEVANCE MECHANISM

During the socio-economic field studies, it was discovered there was no formal grievance procedures in place. In order to efficiently interact in the field, the Beninese society of Electrical Energy (SBEE) has initiated a strategy as part of the settlement of various disputes. Thus, in the context of the implementation of resettlement a local operations monitoring committee is set up comprising of 22 members is the intermediate between the PAPs and institutional stakeholders for resettlement actions. These two group of stakeholders meet periodically in order to prevent and handle issues resulting from resettlement operations.
Socio-economic surveys and documentary analysis show that SBEE has no records of a standard complaint form or a complaint management mechanism. However, the SBEE process was initiated to address anticipated issues relating to resettlement, which include the following:

- wrong identification of PAPs with poor evaluation of affected assets;
- conflict over ownership of a property (two or more PAPs claim to be the owner of a single property);
- inheritances, divorces, and other family related problems resulting in conflicts between heirs or members of the same family over the property, or shares of particular property;
- disagreement on resettlement measures, such as the compensative cost for land per m^2 and total estimation of land per square meter;
- delay in compensation payments.

Whilst an informal grievance mechanism was in place for the ESIA and Resettlement Process, for the construction and operation phase of the Project, the current grievance mechanism needs to be developed and formalised as per international best practices and standards, taking the local contact concerning grievance management into consideration.

The current grievance structures needs to define clear roles, responsibility, timelines, and third party involvement.

This section outlines the logic and purposes of a Grievance Mechanism. It also provides guidelines for establishing a Grievance Mechanism in line with IFC standards.

The management of grievances is a vital component of stakeholder management and an important aspect of risk management for a project. Grievances can be an indication of growing stakeholder concerns (real and perceived). The grievance mechanism actively keeps track and manage grievances and the feedback associated with it to ensure that appropriate actions are taken and resolutions achieved.

Feedback must be scheduled appropriately to ensure that issues are addressed timeously. Corrective actions must be implemented sensitively and the

complainant must be informed of outcome. As a general policy, the Project will work pro-actively towards the prevention of grievances through the implementation of impact mitigation measures defined in the ESIA and addressing any grievances in a timely and effective manner

6.1 *KEY PRINCIPLES*

The IFC Standards outline requirements for an effective grievance redress mechanism. The grievance mechanism allows stakeholders to submit complaints and comments at no cost, without retribution. Furthermore, concerns should be addressed promptly using an understandable and transparent process that is culturally appropriate and readily acceptable to affected stakeholders. The process of reporting a grievance should be easily accessible and un-intimidating to any stakeholder. The preferable channels for reporting grievances can be discussed with the community as part of community engagement. The key principles and overview of an effective grievance mechanism are outlined below.

Publicised and Accessible

To ensure accessibility of the complaints and grievance management process, Maria Gléta shall:

- Publicise the complaints and grievance management procedure widely to those who may wish to access it;
- Create awareness among stakeholders and members of host communities (especially in community meetings) to ensure that they understand and are able to follow the procedure;
- Receive complaints and grievances in the preferred language of the complainants. Where there is a language barrier Maria Gléta shall offer translation services for complainants;
- Ensure that where there is a literacy barrier, complainants shall be assisted and encouraged to report their complaints and grievances verbally in a manner convenient for the complainant;
- Ensure that where there are any (or other than above listed) barriers, adequate assistance is given (especially to project identified vulnerable groups);
- Use a wide range of means including telephones, regular physical presence of Maria Gléta officers in the communities; and
- At the outset, explain to the complainant that using the mechanism does not prevent or preclude the complainant from seeking legal recourse,

and the differences between legal recourse and the grievance management process of Maria Gléta.

Predictable Process

Maria Gléta shall provide a clear and known community complaints and grievances management procedure with a time frame specified for each stage and clarity on types of process and outcome it can and cannot offer, as well as means of monitoring the whole process and implementation of any outcome. The process shall include:

- Formal record keeping for every single complaint and its resolution; and
- An appeal process for the complainant.

Equitable Process

The procedure must ensure that aggrieved parties have reasonable access to sources of information, advice, and expertise necessary to engage in the complaints and grievance resolution process on fair, respectful and equitable terms.

Transparent Process

Maria Gléta shall ensure that the process of resolving a complaint and the outcome is transparent, ensuring that sufficient information about the process is available to complainants and to other interested parties to ensure public confidence in its effectiveness, while respecting requested or other appropriate confidentiality of the complainant. No complainant shall ever be placed at risk or be victimised for lodging a complaint.

Engagement and Dialogue

The procedure should focus on engagement and dialogue between Maria Gléta and the complainant / stakeholders with the aim of reaching agreeable solutions to the complaints that need to be resolved.

In line with human rights

The procedure should ensure that outcome and remedies are in accordance with internationally recognised human rights and applicable domestic and other human rights law and regulation.

Continuous Learning

The effectiveness of the procedure should be measured (monitor key performance indicators) and cumulative lessons from complaints and grievances should be reviewed to identify systemic changes required for either company practices or the workings of the complaints and grievance procedure, to prevent future adverse impacts, harm and grievances.

- Culturally appropriate: Tailored to the local language and French;
- Accessible: Accessible to all settlements and stakeholder groups within the project area;
- Inclusive of vulnerable groups: Available to those less likely to have the means to voice their concerns or opinions within the Beninese context (e.g., women, elderly, children, etc.);
- Reliable: The Company will respond to grievances within an agreed timeframe in order to manage expectations;
- Publicized: The Company will publicize the grievance mechanism through engagement activities and advertisements to ensure that stakeholders are aware and understand the process;
- Logged: Grievances will be logged and tracked; and
- Confidential: Grievances will remain confidential and anonymous.

6.2 ROLES AND RESPONSIBILITIES

The Project will ensure that there are sufficient funds available for on-going engagement activities, such as provision of necessary staff and associated training activities, distribution of documents and posters, translation of documentation where appropriate and provision for hosting of public meetings.

As described in *Section 5.5.2*, a PAP Committee was established during the resettlement process in order to represent those directly affected and displaced by the Project.

The Project should also establish a PAC Committee, whose scope will encompass communities living adjacent to the Project site and indirectly affected by Project operations (those who were directly impacted have largely moved away from the site). One person within the PAC Committee will be designated to be the primary contact for dealing with Grievances, as per Table 6.2.

A Community Liaison Officer (CLO) will be appointed by the PAC Committee. The CLO will be responsible for the implementation of this Grievance Mechanism. Clear lines of responsibility, accountability, information and consultation within the organisation will be established. The CLO will be responsible for:

- Continued community engagement, facilitation of meetings, distribution of information to stakeholders and eliciting comments, translation of material into the local languages and record keeping Interfacing with Provincial and District Authorities, Traditional Authorities and Project Affected Villages;

- Responding to low priority grievances and initiating and coordinating responses from the appropriate managers to mid and high priority grievances;

- Reporting to the Company's Project Manager on a weekly or monthly basis regarding engagement activities and community issues and concerns including the management of grievances;

- Being present in, and accessible to, the communities and overseeing the Grievance Mechanism function; and

- Directing communication with stakeholders around the resolution of grievances.

6.3 *TERMINOLOGY OF GRIEVANCE PROCEDURE*

Complaints - Refers to concerns, negative comments, expressions of displeasure or discontent, which are relatively minor and either brought to the attention of or raised (for example in the media) about the Company with regards to activities or impacts

Grievance - Refers to serious concerns, resentment and allegations which are made against the Company regarding its activities or impacts. These are complaints that are classified as high, major or extreme by the Company.

Mechanism - Refers to the interrelated elements that support the implementation of the Complaints and Grievance Management Procedure. It consists of activities, responsibilities, timelines, procedures and processes. The key processes within a mechanism are lodging and receipt of a grievance or complaint, acknowledgement, methods of investigation, findings, resolution, communication, sign-off and closure, escalation and grievance prevention.

Stakeholder - Refers to persons or groups that are directly or indirectly affected by the Company activities as well as those that may have interests in a complaint and/or the ability to influence its outcome either positively or negatively.

Third Party - Refers to a person or entity who is not directly involved in the transaction that is the subject of contention.

Resolved Complaint - Refers to a complaint or grievance that has been resolved by the Company and one which the complainant is satisfied with the outcome.

Close Complaint - Refers to the complaint or grievance which has been resolved by the Company and where no further action is required by the Company.

6.4 *GRIEVANCE PROCEDURE*

The requirement of this procedure applies to all manner of complaints and grievances that come to the fore as a result of the project impacts.

- This procedure applies to all instance of verbal and written complaint and grievances lodged by individuals or groups against the company i.e. its employees, contractors and other service providers;

- Onsite contractors such as BWSC are required to adhere to this procedure. It should be included in the terms and conditions of work to be undertaken on behalf of the company, and should form part of signed contract and induction;

- The procedure is not applicable to labour-related grievances;

- The procedures applies to complaints and grievances that have not escalated to judicial proceedings;

- It is based on dialogue of engagement focusing on processes of direct and/or mediated dialogue to seek agreed solutions, and leaving adjudication to independent third-party mechanisms; and

- The procedures should be applied to activities of the company that have environmental and social implications and impacts.

The method for addressing grievances should be systematic and divided into key steps. The suggested procedure to be used for Maria Gleta is shown in *Figure 6.1* below.

Figure 6.1 Grievance Procedure Outline

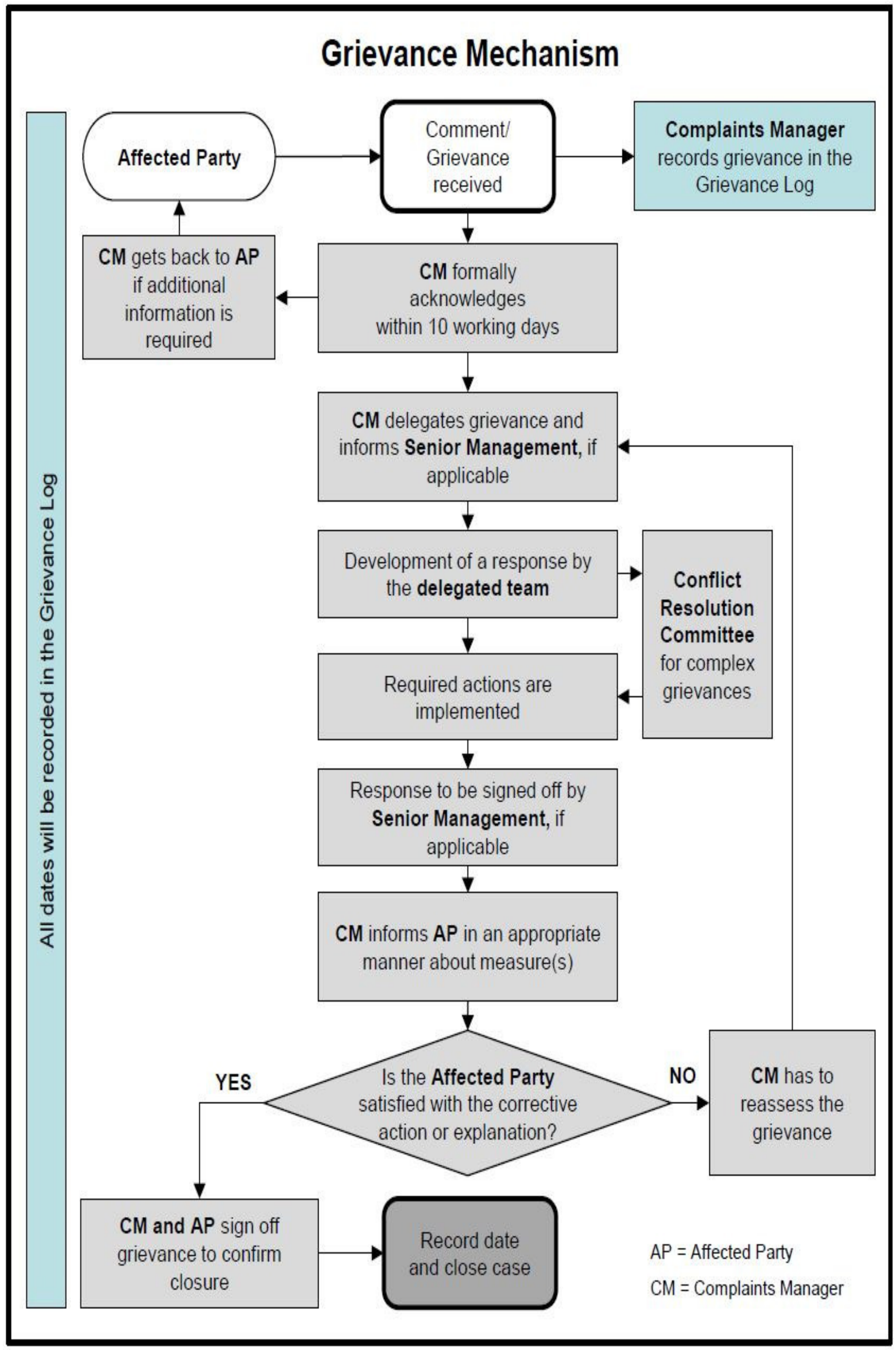


Table 6.1 provides a more detailed account of the steps comprising the Grievance Procedure for the Project. The steps in this Table should be followed by the Project in order to ensure an effective management of grievances is in place.

Table 6.1 Grievance Procedure Steps

Step	Steps No.	Activity/Task	Responsibility	Timeline
RECORD	1.1	Submit complaint or grievance (in person, telephone, letter, during meting etc.)	Complainant	
	1.2	Record the complaint on page 1 of the complaint form (example template is presented in Annex 1 to be adapted by the Project and relevant software utilised). During this process, the complaint is defined as a "concern" or a "grievance"	CLO Check on complaint manager	1 day
	1.3	Register the complaint in the register, mentioning if it is a concern, a grievance, and what subject does it refer to	CLO	1 day
	1.4	Formally communicate to the Complainant to acknowledge receipt of the complaint and give details of how the complaint will be processed. This should be done in writing and verbally. Note: • Explain to the complainant the process including timeframes for resolving the issue. • The process for a 'concern' or a 'grievance' is different.	CLO	0-7 days after receiving the complaint
INFORM	2.1	Assess if grievance is a complaint or concern	CLO	1 day
	2.2	***If the complaint is a 'Concern',*** provide the relevant information to the complainant (verbal and/or written information).	CLO	

Step	Steps No.	Activity/Task	Responsibility	Timeline
INVESTIGATE	3.1	***If the complaint is a 'Grievance',*** call relevant departments and expertise for investigation. Note: • The investigation should gather facts, look at root causes and potential management actions (both corrective actions related to the specific grievance and preventive actions to reduce the risk of the grievance occurring again). • Depending upon the nature of the grievance, the team could include Maria Gléta Senior Management, the heads of the relevant Departments, representative from each Maria Gléta contractor associated with the Grievance and community leadership. The CLO will follow-up the implementation of the investigation • The investigation team should have the authority to gather information and commit to the timeframe for the investigation. • The Complainant must be involved and include meetings with the investigation process. • Investigations should include site visits. • No recommendation or discussion of resolution should be made during the investigation, as commitments can only be made by the committee • The investigation team needs to nominate a head for this investigation.	CLO	Depends on the nature and complexity of the grievance.

Step	Steps No.	Activity/Task	Responsibility	Timeline
	3.2	Produce an investigation report on the outcome of the investigation including recommendations and an action plan for addressing the grievance. Note: • The report must clearly lay out the facts and conclusions. • The report should include a discussion / actions to avoid grievance recurrence i.e. preventative actions. • The action plan should include roles and responsibilities. • The action plan should include a budget and other resources needed (internal) where necessary.	CLO	2 days
COMMITTEE DECISION	4.1	Meeting of the PAC Committee for decision based on the investigation report presented by the social development manager. Decision is taken and details of the corrective action, compensation and preventive action are added to the file.	PAC committee	1 day
AGREEMENT	5.1	Explain the action plan (measures proposed) proposed to the complainant. If the complainant agrees, sign the agreement form.	CLO	Depends on how long the complainant needs to agree (if need for consultation with other family members)

Step	Steps No.	Activity/Task	Responsibility	Timeline
IMPLEMENTATION	6.1	Implement the action plan Note: • Agree on timelines for implementation. • Engage the complainant regularly • If other department is involved in the corrective action, monitor the implementation.	CLO	Depends on the nature and complexity of measures. But for compensation payment not more than 7 days
CLOSURE	7.1	Ensure that the whole action plan has been implemented. Close-out the complaint file with the complainant explaining that this ends the process and that no further compensation on the same claim can be done.	CLO	1 day
LESSONS LEARNED	8.1	Internal review of lessons regarding the grievance and its resolution Note: • Must include discussion of the process undertaken as well as preventative measures to prevent complaint reoccurrence.	CLO	5 days
APPEAL	9.1	If the complainant disagrees with the proposed action plan then call for a second meeting of the PAC committee after review from the social development manager.	CLO	1 day
	9.2	PAC committee reviews the complaint, assesses the outcomes/proposed action plan and decides whether existing options or other alternatives should be considered.	PAC committee	5 days

Step	Steps No.	Activity/Task	Responsibility	Timeline
	9.3	Communicate feedback and options to the complainant. If the complainant agrees, sign the agreement form.	CLO	1-3 days
	9.4	Implement the action plan Note: • Agree on timelines for implementation; • Engage the complainant regularly. If other department is involved in the corrective action, monitor the implementation.	CLO	Depends on the nature and complexity of measures. But for compensation payment not more than 7 days
	9.4	Ensure that the whole action plan has been implemented. Close-out the complaint file with the complainant explaining that this ends the process and that no further compensation on the same claim can be done.	CLO	1 day
	9.5	Internal review of lessons regarding the grievance and its resolution. Note: • Must include discussion of the process undertaken as well as preventive measures to prevent complaint reoccurrence.	CLO	5 days
THIRD PARTIE APPEAL	10.1	If complainant continues to disagree, inform the Country Manager and then involve a third party. Note: •Potential Third Party is the local Authority.	Project Manager	7 days
	10.2	Third party investigation of the complaint and proposes recommendations to Maria Gléta Management and the Complainant.	CLO	Depends on the complexity of the case
	10.3	Explain the action plan (measures proposed) proposed to the complainant. If the complainant agrees, sign the agreement form.	CLO	Get parties to sign off decision within 1 -3 days

Step	Steps No.	Activity/Task	Responsibility	Timeline
	10.4	Implement the action plan Note: • Agree on timelines for implementation. • Engage the complainant regularly If other department is involved in the corrective action, monitor the implementation.	CLO	Depends on the complexity of the case
	10.5	Close-out the complaint file with the complainant explaining that this ends the process and that no further compensation on the same claim can be done. Note • Get the complainant and Third Party to sign off or as appropriate affirm the completion.	CLO	1 day
	10.6	Internal review of lessons regarding the grievance and its resolution. Note: • Must include discussion of the process undertaken as well as preventative measures to prevent complaint reoccurrence.	Whole team	5 days

6.5 *GRIEVANCES SPECIFIC TO RESETTLEMENT ISSUES*

According to the requirements of IFC Performance Standard 5, a Land Acquisition and Resettlement specific grievance mechanism (or sub-section of the Project Grievance Mechanism) must be developed and managed as a stand-alone process (albeit one that is coordinated and aligned with the overall Project Grievance mechanism), and that sufficient and appropriate resources must be allocated to this function.

This requirement is intended to ensure any complaints raised specifically in association with the RAP are managed as quickly as possible and in a relevant and sensitive way to avoid disputes causing stakeholder challenge to land access, which can lead to very costly Project delays.

It is important to note that the complex technical nature of resettlement processes call for a specially trained resource (who is familiar with both the steps in the RAP process and the agreements in place within that process) to handle the investigation and formulation of responses to RAP related grievances, and where required the escalation of the those grievances to senior management.

If the Project requires any further land acquisition, or if physical or economic displacement is incurred, a Land Acquisition and Resettlement specific grievance mechanism should be developed.

7 MONITORING AND REPORTING

7.1 MONITORING

The SEP should be monitored and evaluated regularly using the indicators in the IFC Handbook. Suggested monitoring and evaluation activities are outlined below:

- Monitor the grievance register on a monthly basis in terms of response times to address complaints logged as well as the recurrence of complaints over time. This will inform the project risk assessment;
- Regularly update of the stakeholder register and stakeholder risk analysis;
- Keep records of all engagement activities;
- Keep a library (electronic or hard copy) of all communication material;
- Develop and assess performance in terms of Key Performance Indicators (KPIs) to be determined by the Project team and CLO. For example: number of engagements held per month; timeliness of disclosure of project information; incorporation of stakeholder views into Project design and ESMP; number of outstanding grievances / number resolved; number of grievances escalated for legal action; and
- Annually review grievance mechanism performance and revise policies, procedures and actions accordingly, with the aim of reducing the number of grievances, improving the process of resolution and improving overall performance.

Maria Gléta may choose to involve project stakeholders (including affected communities) or third-party monitors in the monitoring of project impacts and mitigation programmes as the project develops such as the ABE.

7.2 REPORTING

The monitoring results, both qualitative and quantitative, will be disclosed to stakeholders during quarterly or annual reporting cycles. The Project should ensure that a local NGO (such as *Racine* that is engaged for the IDB Power Plant) is appointed prior to construction to sensitise PAC and communicate project updates. Feedback should be shared with the EPC Contractor BWSC for addressing where appropriate.

The Project will report internally at least once a quarter on all grievances received (both open and closed), and how they were resolved. All grievances

received will be captured in the Grievance Register/log. A log of actions and progress toward implementing these commitments will be monitored regularly by the Project Manager.

The PAC Committee will nominate a CLO, who will act as the lead focal point between the PAC Committee and all other stakeholders, including staff and complainants. The CLO's key role will be to capture all grievances in a grievance log. The CLO will have specific responsibility for managing the implementation of the grievance process, including contact with the complainant, logging and tracking complaints, following up on investigations, solution identification and redress activities, and internal reporting.

Stakeholder engagement activities will be reported back to affected stakeholders and to broader stakeholder groups at least annually. In particular, Maria Gléta will provide affected communities and other stakeholders with regular reports (at least annually) on the progress and performance of its community relations activities, in line with this SEP. Significant changes to the plan will be communicated. Communication will be in a form which is timely, accessible and culturally appropriate, but may include leaflets, social and environmental assessment reports, company newsletter, annual report or corporate sustainability report.

ANNEX 1 GRIEVANCE REGISTER TEMPLATE

EXAMPLE GRIEVANCE REGISTER TEMPLATE FIELDS TO BE DIGITISED

Complaint Number	Date Received	Details of grievance	Proposed Corrective action	Date of Response to Complainant	Date Closed Out

Grievance Registration Form Example

Formulaire de rapport des griefs

Office Location **Emplacement du bureau** *	:	--- Select --- ▾
Date of grievance / Date de grief *	:	10/ 07/ 2016
Worker	:	◉ No / Non ○ Yes / Oui
Community Member **Membre de la Communauté**	:	◉ No / Non ○ Yes / Oui
Last Name / Nom	:	ivolou
First Name / Prenom	:	celestin
Gender / Genre	:	◉ Male ○ Female ○ N/A
Occupation	:	Other ▾

Phone No. / Numéro de téléphone	:	224 07996829
Email	:	
Grievance Information / Informations sur la Plainte		
Type *	:	Environmental Degradation / Dégradation de l'environnement
Severity Level/Risk Niveau de gravité/Risque	:	1
Summary/Description of issue Résumé/Description du problème	:	Maria Gleta BWSC a de
List total losses incurred and/or number of occurrences Décliner les pertes totales encourues et/ou le nombre d'occurrences	:	palmier, bananier
Has a written report been previously submitted to Maria Gleta?	:	● No /Non ○ Yes / Oui

Y a-t-il eu un rapport préalable soumis?		
Proposed Solution Desired by Grievant **Solution Proposée par le Plaignant**	:	dédommagement.
Witness(es) Associated with Case **Témoin ou personne impliquée dans le dossier**		
First Person / Personne 1		
Last Name / Nom	:	ikapite
First Name / Prenom	:	jean marcel
Phone No. / Numéro de téléphone	:	241 02128291
Second Person / Personne 2		

Last Name / Nom	:	mouiry mouity
First Name / Prenom	:	jean-de-dieu
Phone No. / Numéro de téléphone	:	241 07525883

☐ **If completed by someone other than grievant**
Si le rapport est rempli par une autre personne que le plaignant

Upload Attatchments Télécharger vers en serveur des pièces jointes	:	
Received by / Reçue par	:	Social Communicator / Communicateur social
		Save / Enregistrer Reset / Remettre

ANNEX D2. RESETTLEMENT REVIEW

Maria Gleta 120 MW Power Plant, Cotonou, Benin

IPP Development Consortium

Resettlement Review

18 December 2018
www.erm.com

ACRONYMS

ABE	l'Agence Béninoise pour l'Environnement
AIIM	African Infrastructure Investment Managers
ANDF	Agence National Domain Foncier
BWSC	Burmeister & Wain Scandinavian Contractor
CA	Chef d'Arrondissement
CEG	Collèges d'enseignement général
DUP	Declaration d'utilite publique
DUP	Declaration of public utility
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
FGD	Focus Group Discussions
HH	Household
IDB	Islamic Development Bank
IFC	International Finance Corporation
IFU	Investeringsfonden for Udviklingslande
IGN	National Geographic Institute (translation)
IPP	Independent Power Producer
KII	Key Informant Interview
LR	Livelihood Restoration
MCVDD	Ministère du Cadre de Vie et du Développement Durable
MEEM	Water and Renewable Energy Ministry (translated)
MW	Mega watt
PAC	Project Affected Community
PAP	Project Affected People
PS	Performance Standard
RAP	Resettlement Action Plan
SBEE	Societe Beninoise d'Energie Electrique
SEP	Stakeholder Engagement Plan
ToR	Terms of Reference
WSEG	Wall Street Engineering Group

CONTENTS

1 BACKGROUND AND SCOPE OF THE REVIEW

At the beginning of 2015, the Government of the Republic of Benin issued a call to participate in a closed tender for the development of a new independent power producer (IPP) power plant in the town of Maria Gleta about 20 km to the west of the city of Cotonou (the Project). The town is located in the commune of Mairie d'Abomey Calavi, within Togba Arrondisement (population of 73,000 in 2013). The Project comprises construction and operation of a new 144 MW combined-cycle, thermal power generation plant.

The power plant will be built on a 20ha parcel of land located in an urbanised area with surrounding, relatively dense residential, business, and industrial development. There are six neighbouring villages located adjacent to the Project site namely: Ouéga Tokpa, Somé, Houeto, Maria Gleta, Tagbé and Fifoncé.

The government relocated people (referred to in this report as Project Affected People (PAPs)) from the site in 2016 to allow development of the Project and an adjacent project on the same 20ha parcel known as the Project site. This is a new 127MW power plant which is currently under construction (commenced 2017) referred to as the IDB Power Plant (one of the main financiers of the project is the Islamic Development Bank).

The Consortium (comprising of AIIM, IFU, BSWC and En-Power) engaged Environmental Resources Management (ERM) to provide technical and advisory support for the Project ESIA. A site visit was undertaken in February 2018, and a Gap Assessment report produced to identify gaps between the ESIA content and international standards. This audit has been undertaken as a component of the Gap Assessment, in order to verify the land acquisition process implemented and to identify gaps that may need addressing. The social baseline set out in Section 2.7 of the Gap Assessment report should be read in conjunction with this resettlement audit. ERM was commissioned to undertake an audit of the resettlement process undertaken to date, in relation to international standards, namely International Finance Corporation (IFC) PS5.

The approach adopted was two-fold:

- Site visit between 6 – 8 February 2018 to the Project site post land clearance:
    - Requesting and then undertaking key informant meetings onsite with
        - 2 PAPs

        - Chef d'Arrondissement who is the local chief responsible for the impacted communities and often a spokesperson for them
        - Headmaster of an adjacent Secondary School (~3,000 pupils)
        - the government body responsible for the expropriation process Agence National Domain Foncier (ANDF) and key governmental personnel involved in implementing the expropriation
        - Societe Beninoise d'Energie Electrique (SBEE) personnel involved in managing the compensation onsite

- Desk-based analysis of resettlement related reports including the following reference list:
    - Resettlement related content in the Project ESIA dated April 2017;
    - the Valuation Report dated January 2016, produced by the appointed resettlement consultant, Wall Street Engineering Group (WSEG)
    - lists of compensated PAPs by land only and by structures only;
    - extracts of proof of payments to PAPs;
    - minutes for resettlement committee meetings;
    - a letter from the resettlement committee to the Project; and
    - a letter from SBEE to ANDF to initiate expropriation.

This Final Post - Resettlement Review Report is based on the results from all these actions and the available information at the time.

There are two possible means by which private land in Benin can be acquired. They include Purchase or Compulsory Acquisition through the use of Eminent Domain. If land is purchased, an agreement is drawn up which binds the purchaser and the seller. This is known as the willing-buyer/willing-seller principle. The purchaser then has to undertake the registration procedure to obtain title to the land purchased.

For Maria Gleta, agreements could not be reached with all private owners regarding the sale of their land; therefore the land was expropriated by the State for the benefit of the IPP in accordance with the following procedure:

- An application was made by the Ministry wanting to initiate the expropriation process (MEEM) to the Minister of Land Tenure (ANDF). The Council of Ministers and ANDF issues the relevant Permit and a decree that contains the *declaration d'utilite publique* (declaration [of property] for public utility/ Eminent Domain). This designates all the land that is allocated to the project for Power Generation land use, and serves as the basis for expropriation in the public interest if an agreement cannot be reached with the owners;

- A public disclosure period is then opened, allowing for third parties to file claims against the *declaration d'utilite publique* (DUP);

- An administrative Commission then hears all of the claims in order to determine the indemnity to be paid to the expropriated owners. The Commission appoints an outside appraiser who then files a report on the fair value of the expropriated land;

- If an agreement is not entered into before this Commission, the Commission's opinion together with the expert report is submitted to a court, which sets the final amount of compensation. The Constitution of Benin requires that this amount is set by a Civil Court;

- After payment of the compensation, the expropriation is ordered by the Court. The ownership of the land can only be transferred after compensation is paid to the landowners;

- Once the expropriation decree is issued, notice is given to landowners/occupiers that they have six months to vacate the property; and

- The expropriated land must then be used for the project and cannot be resold.

The associated DUP arrêté for Maria Gleta was disclosed in 2009. For 7 years the Arreté de Cessabilité / transfer of land under the DUP was renewed annually until resettlement and compensation took place in 2016.

Key associated legislation referenced in the resettlement documentation provided includes:

- Year 2010 no. 2/261 / Dep-Atl-Lit / SG / SPAT;

- Year 2014 no. 0218 / Dep-Atl-Lit / SG / SPAT - Amending arrêté No.2 / 261 / Dep-Atl-Lit / SG / SPAT of October 22, 2010, relating to the transfer of buildings located in the vicinity of the thermal power station of 90MW at Maria Gleta in the commune of Abomey Calavi;

- Law No. 2013-01 of 14 August 2013 - the Code on Private and State-owned Land in the Republic of Benin;

- Law no. 2017 -15 of 10 August 2017 modifying law no. 2013-01 of 14 August 2013;

- Decree 2015-013 of 29 January 2015 on the composition and functioning type of Commodo and Incommodo survey commissions, and compensation for expropriation for public utility in the Republic of Benin; and

- L'Arreté: 2016 2016 N ° 3263 / MEF / DC / SGM / ANDF / SP of October 03, 2016 relating to the creation, composition, attributions and functioning of the final commission in charge of the compensation and the expropriation of the land for the Maria-Gleta 120 MW thermal power station in the district of TOGBA.

2.1 *APPLICABLE INTERNATIONAL STANDARDS*

Performance Standard 5 (PS 5) on Land Acquisition and Involuntary Resettlement of the International Finance Corporation (IFC) is internationally recognised as a good practice in the event of physical or economic displacement requiring involuntary resettlement due to infrastructure development interventions.

Performance Standard 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical

displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use. Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in physical or economic displacement. This occurs in cases of (i) lawful expropriation or temporary or permanent restrictions on land use and (ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail.

The key objectives of IFC PS 5 are captured in *Box 2.1* below.

Box 2.1 ***Key Objectives of IFC PS 5***

1. To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs.

2. To avoid forced eviction.

3. To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by: (i) providing compensation for loss of assets at full replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected.

4. To improve, or restore, the livelihoods and standards of living of displaced persons.

5. To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

Source: IFC PS 5: Involuntary Land Acquisition and Involuntary Resettlement (2012)

In order to comply with these objectives, IFC PS 5 requires that a Resettlement Action Plan (RAP) be developed to include measures which meet the objectives above, such that:

- affected people are fully informed and consulted on their legal rights, resettlement preferences and alternatives, and are given opportunities to participate meaningfully in the planning, implementation and monitoring of the resettlement;

- prompt and effective compensation is paid to affected people at full replacement cost, and prior to land take;

- compensation packages emphasise in-kind replacements, where possible;

- the required transitional support and development assistance is provided to affected people, to enable them to restore / improve their livelihoods and standards of living; and

- particular attention is paid to vulnerable groups among the affected population.

Section 3.10 of the Project's ESIA TOR included the need for a RAP to be completed (*Elaboration du plan d'action de reinstallation et de compensation PARC*) by the ESIA consultant. The ESIA conclusions included the recommendation for a RAP to be included as a condition in the Environmental Compliance Certificate.

The conditions in the Environmental Compliance Certificate (issued April 2017) also included the need to compensate and resettle the affected population before commencement of construction; and to allow sufficient time between compensation and construction to enable PAPs to relocate in decent conditions. The conditions were met by the Project and government agency leading the resettlement (ANDF).

During consultations onsite, ANDF noted that a RAP did not need to be developed to support the expropriation and compensation process due to the privatised nature of the land and the ease with which the Government was able to identify all owners, establish accepted compensation rates, propose offers and acquire the land. Clear documentation of the valuation and compensation process for each PAP was recorded and available for review in-situ with ANDF in hard copy only.

ANDF cited the land expropriation as a successful resettlement case study because PAPs were willing to sell land and properties at the compensation values proposed, and no forced eviction was required. The precedent of eviction occurs where PAPs are not satisfied with the proposed compensation

For PS5 Private Sector Responsibilities under Government-Managed Resettlement, it is noted that where land acquisition and resettlement are the responsibility of the government, the client will collaborate with the responsible government agency (ANDF), to the extent permitted by the agency, to achieve outcomes that are consistent with this Performance Standard. In addition, where government capacity is limited, the client will play an active role during resettlement planning, implementation, and monitoring.

This resettlement review identifies the extent to which the Government-Managed land acquisition process was undertaken in line with PS5, and recommends potential corrective actions for the Company to pursue.

3 *PERFORMANCE REVIEW FINDINGS*

3.1 *IDENTIFICATION OF PAPS AND CENSUS SURVEY*

3.1.1 *Findings*

The ESIA (*Appendix 8*) includes a full census of PAPs residing on the site at the end of April 2014. A total of 1,181 persons are reported to have been onsite. This includes 461 people identified as students and 39 people identified as apprentices. *Appendix 8* includes socioeconomic information related to household (HH) composition, gender, age, ethnicity, PAP relation to land owner, occupation, number of students/pupils/apprentices, and the date of first settlement onsite.

Figure 3.1 Extract of PAP census in ESIA

Statistique détaillée des résidents du site d'implantation du projet :

								Classe d'age							
n° de la parcelle	Nom et prénom du résident	Sexe	Age	Ethnie	Qualité	Occupation	Année de la 1ere installation	>60 ans	60-40	40-20	20-10	<10	Total	dont élèves et étudiants	et apprentis
740k	TONINYESSI Lestobi	M	61 ans	Fon	propiétaire	Guérisseur traditionnel	1995	1	5	2	3	0	11	3	1
	TONINYESSI Albertine	F	56	Fon	femme du pptaire	revendeuse									
	TONINYESSI Céline	F	45	Fon	femme du pptaire	revendeuse									

Prior to this, between 2009 - 2010, the National Geographic Institute (IGN) (1) undertook a first cadastral survey of impacted plots. IGN is part of the *Ministère du Cadre de Vie et du Développement Durable* (MCVDD) and is the national body responsible for geographical information including land ownership. They established the ownership status of 416 impacted parcels, with 277 with impacted land only and 139 with impacted structures.

IGN's survey findings were verified and updated by a private independent consultancy, Wall Street Engineers Group. WSEG undertook a census of impacted land plots between 2010 and November 2012 (other documents indicate 2012-2014). WSEG were contracted by Tractebel Engineering who undertook the ESIA.

The list of PAPs with impacted land only, provided for the review, dated 25 July 2017, indicated 253 PAPs compensated. The final list of PAPs with impacted structures only, dated 20 June 2017, indicated 121 PAPs compensated.

(1) http://ign.bj/lign/ Accessed March 2018

The identification of landowners was noted as being straight forward given the privatised urban nature of the Project area in *lotissement* or individual allotments (*Appendix 1, Figure 1*). All land was demarcated into parcels owned by households or family collectives rather than communal or village owned land. Compensation agreements were made on a parcel-by-parcel basis rather than aggregated per PAP household (HH) or per land owner of multiple parcels.

The list of identified owners was disclosed publicly (*Appendix 1, Figure 5*) including the surface area calculations of those impacted.

During the census, no differentiation was made between owners and users of the land. Consultations onsite indicated that in the majority of cases users of impacted land were owners from neighbouring impacted parcels. However, no formal identification of users was undertaken to be able to verify whether they have regained access to land post resettlement.

Consultations onsite indicated that there were tenants present onsite. A list of tenants occupying impacted properties was not provided, however they are reported to have been given sufficient notice (more than 6 months) in accordance with national legislation prior to eviction.

Tenants are reported to have only rented structures, and not land, although this could not be verified. Any subsistence or market crops grown in the gardens associated with the structures were not compensated. However, it was noted that sufficient notice was given to harvest produce.

3.1.2 Recommendation

Engage with ANDF / WSEG to clarify whether any information on users was collected, including their place of origin. If not, as part of the Focus Group Discussions (FGDs) planned for the Livelihood Restoration (LR) monitoring (further detailed under *Section 3.10*), clarify owner-user relationship, and the number of cases or frequency of users coming from outside of the impacted area to use land for subsistence or market gardening.

Clarify the number of tenants from previously rented accommodation onsite and their use of productive land for income generating activities.

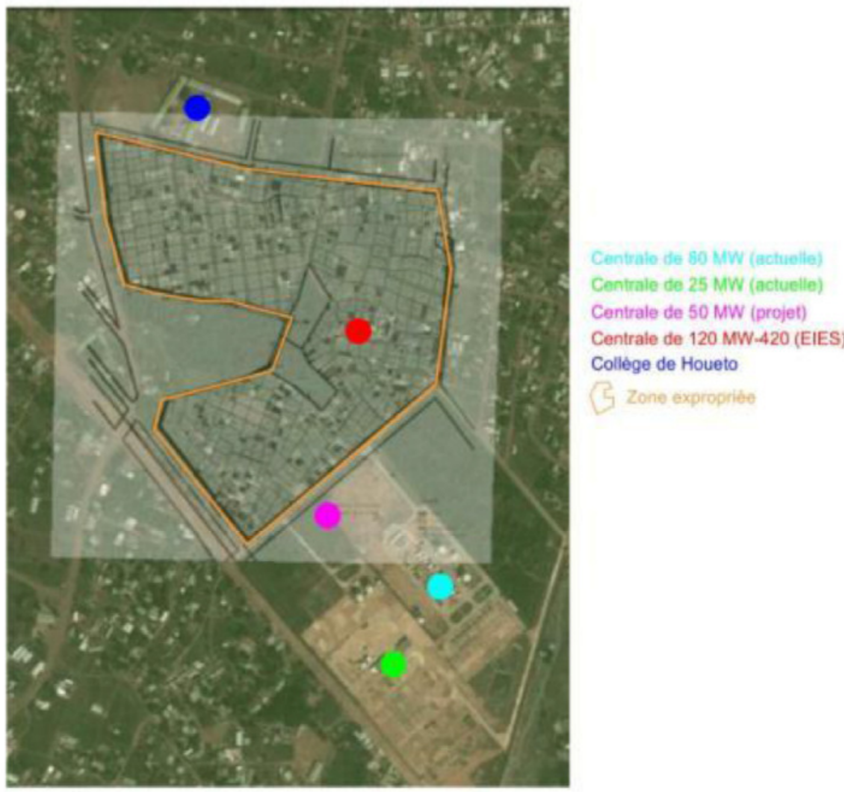
In collaboration with PAP data held by ANDF, harmonise and consolidate the ESIA PAP census data with the various lists of compensated PAPs (including any data held by WSEG from the valuation study) in electronic format. Create a list of the total number of affected owners with contact information for post resettlement follow up, focussed on livelihoods monitoring (Consortium or WSEG via SEEB and ANDF).

3.2 *DEFINITION OF IMPACTED AREA*

3.2.1 *Findings*

The impacted area is defined in the Project ESIA (April 2017). The list of impacted PAPs within the Project land take perimeter was disclosed to the community for validation (*Appendix 1, Figure 5*).

Figure 3.2 Expropriated area disclosed in the ESIA



A residual piece of land measuring 3ha within the 20ha site is currently in the process of being acquired by the Project and approval by the council of ministers has been granted in November 2017 (the land in the inlet on the left hand side of *Figure 3.3*). The landowners had initially resisted the sale of their land but have in the meantime voluntarily agreed to sell their land to the State. Two of the 3ha are owned by one owner. ANDF noted that PAPs are aware of the interest from international lenders, and therefore held out selling in the hope of higher compensation. The compensation packages have been agreed with the PAPs, following the land acquisition process implemented in 2016, and payment is pending.

Additional socioeconomic baseline was collected by ERM's local consultant, Liner Environment, in April 2018. Consultation data indicated that an additional strip of 20m around parts of the site is to be acquired for safety and security buffer purposes (SBEE, 2018) and an area within a 161-KV corridor. This remains to be verified with the IPP developers.

The ESIA and site observations note that some residents do not want to stay close to the new plant, and are volunteering to sell their land. This is thought to be partly linked to the high price of land that was provided for PAP but may also be linked to environmental impacts associated with existing and planned power plant operations in the area. As part of the supplementary ESIA environmental modelling (air quality and noise) will be re-run based on the latest designs and layouts to ensure that residual environmental impacts are not significant and do not exceed international standards. This should focus on neighbouring community receptors such as the Collèges d'enseignement général (CEG) Hueto (dark blue dot in *Figure 3.2*) as well as residential areas.

The Phase 1 IDB design includes noise mitigation such as contained engines in a covered powerhouse. However, initial modelling scenarios shared by the Contractor onsite for the IDB Project (BWSC) showed that night-time noise limits may be exceeded outside of the current fence line. Additional land acquisition could therefore be required.

Construction work to upgrade the access road to be used for the Project is due to be carried out by September 2018 as part of the IDP. This will be made from paved roadblocks (rather than bitumen to facilitate drainage) and will be used by the IPP for fuel delivery. No physical resettlement is envisaged to accommodate the total cross section of the road of 9m +/- 2m either side. There is no strategy in place for any economic displacement or temporary loss of access induced.

The increase in evacuation capacity from the existing CEB substation will be managed within the existing plant fence line (green dot on *Figure 3.4*) using transmission lines currently in place for import from Nigeria. No land acquisition is envisaged.

WSEG reportedly evaluated the entirety of all impacted parcels within the Project footprint. For any parcel where more than 50% of a parcel was impacted, the whole parcel was acquired for the Project. However, where less than 50% was impacted, responsibility for compensation was left to the Local Mayor and was to be managed by SBEE. *Appendix 2* contains a letter provided during the review by PAPs, to indicate that 11 parcels of land remain to be compensated by the local authority (following identification by ANDF that the majority of the parcels were not impacted by the Project land take).

3.2.2 *Recommendations*

- Track closure of outstanding claims with Local Mayor and SBEE.

- Obtain the design and plans from the Mayor or BSWC for the access road from Ila and Tankpe junctions (may be covered by SIA update).

- Clarify the ESIA process for the access road with *l'Agence Béninoise pour l'Environnement* (ABE) and BSWC to ensure that international standards are met. Ensure that relevant provisions are included in the ESMP.

- In collaboration with ANDF, establish a compensation strategy for the access road as necessary, and for any additional land take required by the Project including for any economic displacement induced.

- Consider setting up a Monitoring and Evaluation convention between ABE and the Consortium to reinforce ABE capacities to monitor ESMP implementation, and any economic displacement during access road construction.

- Update and rerun environmental modelling (noise and air emissions) based on updated plant design (based on worse case HFO scenarios) and layout, and the cumulative assessment to inform any land acquisition buffer zone needed.

- Verify that air and noise impacts at the CEG College along the Northern border of the Project site meet international standards for Community Health and Safety (H&S).

3.3 *INVENTORY OF ASSETS AND ELIGIBILITY*

3.3.1 *Findings*

A cut-off date for eligibility was established and communicated when the initial Arrête was passed in 2009 and the first census of impacted parcels completed. No extensions or improvements to the land after IGN's baseline in 2009 were compensated for in 2016; although WSEG updated the inventory between 2010 – 2012 (dates are not clear).

A detailed land and asset survey was completed. All physical structures (including non-residential structures) across the 396 parcels were listed in individual PAP asset inventories (*Appendix 1, Figure 4*). Land owned was measured and included in the inventory. WSEG categorised impacted assets into three categories: *non-bati* / land; *bati* / structures; and high value agricultural assets such as plantations or fruit trees.

As of April 2017 the Project noted the final count of:

- 396 parcels expropriated of which 121 contained physical structures (noted as of 20 June 2017) and 253 were impacted land only (noted as of 21 July 2017);
- Amongst the 396, 4 properties had formal land titles, most had informal sale agreements, known as *convention de vente*;

- 361 compensation files were issued and paid in full as of April 2017;

- 3 compensation files with cheques awaiting collection by PAP (as of 25 July 2017); and

- 18 files not yet closed due to absent owners / lack of response or provision of identification documentation (as of 25 July 2017).

The reason for the discrepancy in 14 files is unknown.

The government-run land and asset survey included persons who did not have formal legal rights, but had a claim recognised under national law to the land or assets they occupied (individuals who were only land users and not land/asset owners, were not considered). All parcels were registered in the inventory, so assistance to those without land titles was provided.

Several community facilities including a small church, several small private health clinics, and a private school named Mondukpè were located onsite prior to resettlement.

An inventory of agricultural crops on impacted land was not undertaken.

Compensation of assets was provided to owners only, even if users had been cultivating their land informally e.g. banana tree plantation.

3.3.2 Recommendations

- Confirm with ANDF whether IGN's inventory formed the official cut off in 2009 given that WSEG later updated the inventory. Confirm how this was disclosed to PAPs;

- Obtain the updated cadastral plan used by WSEG for the inventory. The ESIA (*Section 6.7.2*) notes that the Water and Renewable Energy Ministry (MEEM) was awaiting a revised plan from IGN as the initial plan contained errors;

- Reconcile the discrepancy in 14 compensation files unpaid and not accounted for in the above breakdown of the status of the 396 impacted PAP files;

- In line with the recommendation under *Section 3.1.2*, engage with ANDF / WSEG to clarify whether any information on users was collected, including their place of origin to verify whether the majority were owners who were compensated; and

- As part of the Focus Group Discussions (FGDs) planned for the Livelihood Restoration (LR) monitoring (further detailed under *Section 3.10*), clarify owner-user relationships and prevalence onsite prior to resettlement.

3.4 *VALUATION OF ASSETS AND ENTITLEMENTS*

3.4.1 *Findings*

WSEG undertook a comprehensive evaluation of assets in 2014. ANDF noted that the national *barème* (pre-determined value scales) were not used as they would have been insufficient to meet market replacement cost and would have resulted in impoverishment.

The value of the impacted assets including land and structures was established via a market study. The study was led by the 'independent international expert in building evaluation' WSEG. As documented in their Valuation report (January 2016) they contracted several entities to estimate replacement costs at prevailing market values.

The valuation method for determining replacement cost was documented. The valuation assumed that the prevailing market rates determined needed to enable purchase of replacement housing. No depreciation of asset values was applied.

The initial valuation study undertaken between 2010 - 2012 noted compensation rates at 8000 FCFA/m^2. However, this was disputed by PAPs via the established resettlement committee. After consultation, a revised study was undertaken and the valuation was re-run, resulting in a final rate of 10,000FCFA/m^2. It was noted that inflation was high at the time of the valuation and that the rates established were advantageous to the PAPs. The PAPs interviewed during the site visit noted that the valuation was fair and enabled replacement structures and land to be bought by all PAPs if they chose to do so. Multiple stakeholders noted that on average parcels onsite were bought at between 500,000 – 2 million FCFA, and sold or compensated at 4.5 – 5,000,000 million FCFA.

The rates are reported to have been the highest compensation rates used nationally for resettlement. The ANDF is concerned that the rates set for Maria Gleta have set an unrealistic precedent for other projects. PAPs across Benin are now referring to Maria Gleta as a benchmark, including neighbouring projects in Cotonou such as the airport expansion and deep-water port (who are not seeking international financing).

Local inflation has been observed, not only due to compensation circulating in the local economy, but due to the perceived benefit of Project related improvements to local infrastructure (e.g. access roads upgrade, electrification) and due to speculation in response to the lag in compensation payment (2009-2016).

Agricultural plantations and trees were compensated for at a fixed rate e.g. for palm oil, cocoa, orange and mango trees present onsite. The rates were not based on productive potential or maturity. The valuation process for plantations and trees was not provided. It should be noted that during the additional socioeconomic data collection undertaken as part of the Supplementary Information Package (SIP) in April 2018, a lack of compensation for fruit tress was noted by several PAP consulted.

Evidence of Cash crops present onsite in 2018


Source: Liner Environnement, March 2018

Subsistence and market gardening production was not compensated for. However, the Project and PAPs interviewed noted that sufficient time was given for production to be harvested prior to displacement. It appears that a few PAPs were able to translocate seedlings and shoots of cultivated crops to replacement land, given transportation restrictions.

No disturbance allowance or inconvenience payment was provided, nor relocation allowance provided for the resettlement. Many school pupils (neighbouring CEG Hueto) now have longer journeys to school and are unable to go home for lunch as was previously the case. For some students who had to move school it is unclear whether ANDF paid for their new entrant fees (as noted in the ESIA mitigation measures *Section 8.3.11.2*).

Transition costs were not considered for the delayed start of expropriation (2009-2016).

No evidence was provided to indicate that legal services were provided to assist PAPs.

A resettlement 'bonus' or *prime de dépaysement* is sometimes paid in Benin where expropriation rates are considered to be below actual replacement costs (this was the case for the adjacent CEG power plant). Given the inflated nature of the final compensation rates for Maria Gleta no such bonus was provided by ANDF. The PAPs are aware that they were not paid this additional top up. However, the consultations and observations onsite indicated that none of the PAPs were significantly adversely impacted by resettlement. This should be verified as part of livelihood restoration monitoring.

An example asset inventory is contained in *Appendix 1, Figures 3 and 4*.

3.4.2 Recommendations

- Run targeted PAP based FGDs to verify the ability of those dependent on small-scale subsistence agriculture or market gardening to restore their livelihoods as their crops were not compensated for. Determine potential LR programmes needed.

- Obtain information from ANDF or WSEG via SBEE to verify the valuation process applied for plantations and trees.

- Clarify the compensation for community facilities onsite such as the private school, health clinic and church.

3.5 ENGAGEMENT AND CONSULTATION

3.5.1 Findings

There is no Stakeholder Engagement Plan (SEP) in place for the Project ESIA nor formally documented resettlement engagement process. However, disclosure procedures were in place during key stages of the resettlement process. The issuance of the Expropriation Decree was disclosed in the Project area, and public input including grievances was solicited. A poster board with a map of the impacted area was displayed onsite, and a town cryer was used to disseminate information in 2009. ANDF notified the Mayor and the Chef d'Arrondissement (CA) of the DUP, who then disseminated the information to the Chefs de village and Chefs de quartier. When consulted onsite, the CA noted that PAPs felt informed on project progress.

An information point was provided onsite for a month with Government of Benin (GoB), ANDF and SEEB representatives during the inventory process (*Appendix 1, Figure 6*). For two weeks the list of impacted PAP owners with the total surface area of their impacted assets was also displayed publicly (*Appendix 1, Figure 7*) at the Abomey-Calavi Mayor's office and onsite (accessible to PAPs). Grievances were registered at this point. The ANDF holds these records but they were not available for review.

It is reported that a Grievance mechanism or *Cahier de Doleance* was in place during payment of compensation. This was not available for review. SBEE noted that all grievances they collected were sent to ANDF.

The Government-led resettlement process includes the establishment of a PAP Committee. For the Maria Gleta site this was referred to as the *Comité des 20ha* or *Comité des expropriés.* This association or committee engaged with an Inter-ministerial Commission which was formed to lead the expropriation process under ANDF. The committee reportedly consisted of 17 elected locals including community leaders, women's representation, local authorities such as the village chief, and was consulted on a monthly basis. Many meetings with the State were held, to the extent that PAPs reported business activities suffering as a result. PAPs interviewed noted that grievances were also sent to the ministerial committee but rarely responded to.

The valuation process was revised based on grievances raised by PAPs. This indicates that effective consultation was in place and that the inter-ministerial committee, which was project specific, addressed and managed key grievances.

The ESIA notes that complaints were received during the ESIA consultation and that the Resettlement Committee did not provide written records of engagement undertaken on behalf of the PAPs.

Negotiation sessions with the Project PAPs started on 24 November 2016 at the Abomey - Calavi Town Hall, and payments to PAPs were made on December 1, 2016. Details of community engagement undertaken by the Committee were provided for 12th and 19th October 2016 ahead of compensation payment. The minutes noted that due to delays in the operational schedule, meetings would be held every Wednesday with the PAP Committee indicating a good level of communication between the Project and PAPs in the latter stages of the resettlement process. It was agreed that signing of approved minutes would take place, and attendees would sign attendance forms. It was noted that the establishment of a 'sensitisation mechanism' should be implemented to improve communication. It is not clear whether this was implemented.

Commencement of land clearance and construction was publicised on the radio and via the above mentioned public meeting.

3.5.2 *Recommendations*

- As per PS1 Stakeholder Engagement recommendation, a Project grievance mechanism should be established (for ongoing ESIA and resettlement related issues). The mechanism should be made available to affected communities, landowners and land users and must be adapted in part to specifically deal with resettlement related complaints in an independent and accountable way and so that complaints can be recorded, tracked and monitored;

- Document high-level engagement and grievance process undertaken during the compensation process as part of the ESIA SEP development. Outline the engagement plan with PAPs for ongoing project activities and livelihood restoration monitoring until resettlement closure;

- Obtain example of grievances registered by SEEB and sent to ANDF; and

- Ensure that all future Project related engagement is documented and entered into an electronic Information Management System.

3.6 *REPLACEMENT HOUSING AND INFRASTRUCTURE*

3.6.1 *Findings*

The Project did not provide a host resettlement site or replacement housing. PAPs were able to select their preferred location to purchase land or property. Observations and interviews conducted onsite indicated that all PAPs have been able to secure land and houses, and that most PAPs are now in housing of a far higher quality than prior to displacement (*Appendix 1, Figure 5*). Over 75% are thought to be rehoused within the same arrondissement of Togba, according to the CA. As a result many of the children have remained in the same schools (albeit with increased daily journeys). The additional socioeconomic data collected in March 2018 for the SIP noted that some PAP may not be housed in comparable or better conditions than prior to resettlement. This remains to be verified. Comments raised during the March 2018 consultations, included that the community is now disbanded across the commune, and that some of the PAP had not used their compensation as expected.

Some PAPs have chosen to buy land and have constructed properties themselves, others are renting and have bought land in the Commune (where land is cheaper) further away from the Project and Cotonou centre, and some have bought replacement houses in the same arrondissement. It should be noted that the status of PAPs post resettlement has not yet been verified.

No information on access to Social Services or integration with Host communities post resettlement was available. It is not clear whether assistance was provided to those who may have needed support in identifying replacement housing or land (*see Section 3.9* on Vulnerables). No relocation assistance was provided as part of the compensation.

More than 50% of demolished materials are reported to have been recovered for reuse by PAPs.

3.6.2 Recommendations

- Obtain contact information for PAPs from ANDF or WSEG via SBEE and verify post resettlement status of PAPs as part of the follow up livelihood restoration monitoring program; and

- Identify the geographical distribution of PAPs post-resettlement in relation to their livelihoods, sources of income, and social infrastructure.

- Recruit an NGO to verify that all PAPs have been able to buy or construct properties of comparable or better quality to those acquired.

3.7 REPLACEMENT LAND AND TENURE

3.7.1 Findings

The baseline available indicates that PAPs owned small plots with their houses, on which they undertook small-scale subsistence cultivation.

As noted in *Section 3.6* PAPs were not moved to a resettlement host site, and no replacement land was identified. The majority of PAPs purchased land plots within the same arrondissement or commune after payment of compensation.

Many of the parcels impacted had informal but locally recognised land sales agreements instead of private land titles. The security of tenure for replacement properties and land is unknown. However, it was noted that the compensation packages were sufficient for all PAPs to secure like-for-like or comparable replacement land and to build or buy properties. Those renting land are said to be doing so by choice, having bought a larger plot of cheaper land further from the centre of the Arrondissement near the Project site. Some PAPs are noted to have spent some of their compensation and bought cheaper land elsewhere as a result. Some PAP owners already had second properties and were renting out those on the Project site. It was reported that there was sufficient land and property within the commune for PAPs to find comparable conditions. However, no follow up to confirm the restoration of access to productive land has been undertaken. In addition, the additional SIP socioeconomic data collected in March 2018 indicated that certain PAPs were involved in disputes over land transactions. It was reported that this may have prevented them for acquiring replacement land and property, and restoring their livelihoods. This should be verified.

As noted in previous sections no information regarding informal land users was provided. Users were not included in the compensation process, however it was noted that many were from neighbouring households who were compensated individually for their owned assets and could therefore purchase replacement land.

Tenants on impacted land were given sufficient statutory notice (6 months) to find replacement rented properties. PAPs interviewed noted that tenants had been able to find other properties.

3.7.2 Recommendations

- Verify post resettlement security of tenure with PAPs during follow up engagement as part of the livelihood restoration program; and

- In line with the recommendation under *Section 3.6.2*, identify and map the location of PAPs post resettlement, including any associated replacement land.

3.8 LIVELIHOODS RESTORATION MEASURES

3.8.1 Findings

No detailed project specific pre-impact socioeconomic or livelihood baseline is available on incomes and economic assets. No post-resettlement information has been collected. With the current information, it is not possible to determine the change in livelihoods status (ie, improvement or decline). Only the amount of land, quantity of productive fruit trees or plantations and key occupation is recorded per PAP. No Livelihood Restoration (LR) Plan or

livelihood support related measures were established to accompany the compensation process. Other data for PAP and PAC monitoring e.g. access to services, business and training, etc. was also not available.

The original ESIA social baseline reports that in 2006 farmers, herdsmen and fishermen represented about 11% of the working population in the Commune in which the Project is located. There is a high degree of urbanisation in the Project area and therefore land-based livelihoods are not common.

The ESIA notes that on the Project site there were 62 PAPs carrying out an economic activity at or close to their home. No large-scale businesses were reported, however, the commune and arrondissement in which the Project is located has a plentiful variety of small-scale businesses selling various products, and providing artisanal trade, craft and services. These include mechanics, bricklayers, dressmakers, carpenters, welders, and hairdressers. Some inhabitants were said to also provide motor-taxi services. The ESIA census collected information on Occupation. No land based livelihoods are listed, although this remains to be verified.

PAPs interviewed onsite noted a loss of client base since resettlement e.g. mechanics, hairdressers, workshops, boutiques, condiment food businesses who were previously working from their properties.

Stakeholders during the site visit also noted that women may be disproportionally impacted given their previous livelihoods were based from their houses and associated with a local client base such as catering for neighbouring college students. The ESIA notes that women in the project area specialised in the preparation of the traditional mustard *afitin* (using seed from néré) and transforming Cassava into g*ari*. This was often sold to the neighbouring CEG Houeto School along with other food products. It is not clear how they were compensated, unless they owned a parcel of land or house.

No baseline or post resettlement information is available on Food Security or Nutrition.

No information or monitoring related to the reintegration of resettled pupils into new schools has been undertaken. It was suggested that many remained in the same schools as PAPs resettled in the same commune, however the local head teacher noted losing ~300-400 students (the ESIA census indicates 461 pupils amongst the PAPs). It was noted that of the pupils who stayed at the same school, a significant number (100-150) are adversely impacted by the increased journeys to school (500m to 2.5km on foot, up to 7km by motor-taxi) and the inability to go home for lunch as they did previously (they now need to buy food). The teachers consulted noted that these students are often late and more tired in relation to other students.

No follow up of water provision for PAP in their resettled locations has been collected. Many previously depended on boreholes within their parcel boundary (*Appendix 1, Figure 5* – bottom right hand image).

3.8.2 Recommendations

- The Company should appoint a suitably qualified local NGO to develop a Supplemental Livelihood Plan. This should based on individual PAP level data if available, or based in FGDs (e.g. men, women, students, tradesmen, vulnerables), to identify to what extent compensated PAPs have restored their income streams post resettlement and improved their pre-Project living conditions;

- The supplemental plan may include the following key elements:

    - identification of the resettled location of PAPs;
    - identification of principal economic activities pre and post resettlement (or desired activity where livelihood has not been restored);
    - FGD / KII engagement plan to determine impact on livelihoods rather than at an individual household level if this data is not available;
    - analysis of findings to determine the support measures necessary (within and outside the Project commune) focussed on groupings of vulnerable PAPs where possible to achieve the requirements of PS5 in a way that is permitted by the responsible agency ANDF. Identify additional efforts to restore lost livelihoods, such as:
        - determining key inputs required for business start-ups in new resettlement sites in urban area e.g. skills training and workshops including for construction services that could be utilised by the Project, microfinancing and loans disbursement options, training on small scale livestock breeding, SME technical and financial training e.g. on business planning and bookkeeping; and
        - ensuring access to basic services (including HH wells, and access to markets to sell small business produce) where applicable e.g. proximity to community infrastructure including schools.
    - prioritise employment of PAPs by the Project for unskilled/semi-skilled positions, including catering services;
    - community level livelihood support programmes / measures should be implemented wherever possible, linked to the level of resettlement related impact experienced;
    - indicators for monitoring;

    - implementation time schedule; and
    - financial and implementation responsibilities of the Company in the execution of the Plan.

- After implementing the recommendation under *Section 3.1.2* to collaborate with ANDF and SBEE to collate PAP level data, filter the data by key vulnerability criteria to identify PAPs to focus LR follow up with initially. Use criteria to select the composition of key Focus Groups (e.g. women, men, young people) including occupation data (e.g. tradesmen, catering) and to filter by type of loss, to differentiate between Land Owners only and /or Property owners;

- Agree with Consortium and Lenders the required representation of PAPs for the initial LR follow up to avoid grievances from PAPs who may not be consulted;

- Consider communication of the LR study in relation to the Consortium's CSR strategy, and their follow up and monitoring of key impacted people, rather than suggesting that the compensation process is being reopened;

- Consult the *Plan de Développement Communal* (PDC) at Togba- Hueto/ Mairie d'Abomey Calavi commune level for alignment of potential LR measures and programmes. The Mayor's office can provide this or it can be provided via the CA;

- Engage with the *Association des parents et des élèves (*APE) of CEG Hueto and monitor the resettled pupils regarding a) effective reintegration into new schools b) increased distance to school post resettlement. Consider potential support measures accordingly such as provision of bicycles for transport (the resettled location of PAPs is considered too dispersed for a school bus route to be viable) or provision of a food allowance for resettled PAPs who can no longer go home over the lunch break; and

- Input into Contractor Local content Strategy and recruitment plan to ensure priority employment of PAPs for unskilled and semi-skilled roles. Clarify data available, if any, on PAP skills with ANDF. If lacking, collect as part of LR follow up studies to enable training opportunities to be provided.

3.9 *VULNERABLE PEOPLE*

3.9.1 *Findings*

No adequate data is provided to verify the absence or presence of vulnerable [1] PAPs other than age. It is not possible to differentiate between the key interest groups: for example, identifying the poorest or more vulnerable; which groups are more impacted by the Project; and which are more dependent on land or access to neighbouring communities for their livelihoods. In addition to this, gender issues and roles within the local community are not adequately described. The status of men and women is not articulated and would need to be better defined to allow for a clearer understanding of the vulnerabilities.

No differential compensation or support measures were provided to vulnerable people as part of the Government-led resettlement process.

The ANDF noted that the private allotment-based occupation of the project site indicated a certain level of affluence and self-sufficiency amongst the impacted inhabitants. They inferred and observed a basic level of wellbeing and family support, relative to other parts of the city where accommodation is informal and of a temporary nature on common shared land.

The PAPs interviewed onsite noted the presence of several blind household members living with their families.

The ESIA noted that 32 PAPs were over the age of 60. The average life expectancy in Benin is 58 (World Bank, 2009). The ESIA noted the importance of considering the elderly given their vulnerability during resettlement. It was suggested that a special resettlement plan should be developed for them. This was not developed.

As mentioned under *Section 3.8* it is believed that women and students may have been disproportionally impacted by the resettlement. The ESIA notes that the food production undertaken onsite was labour intensive and primarily occupied women grouped in associations.

It is not clear whether the recommendations for students, made as part of the 2017 ESIA, were implemented. These included issuance of a certificate of education free of charge to displaced students; and provision of a Letter of Special Recommendation from the Department of Education to each displaced student (to facilitate entry into another faculty).

(1) Disadvantaged or vulnerable status may stem from an individual's or group's race, color, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status. Factors such as gender, age, ethnicity, culture, literacy, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources should also be considered (IFC PS1)

3.9.2 *Recommendations*

- As per the recommendations under *Sections 3.1.2* and *3.8.2* collaborate with ANDF and SBEE to collate PAP level data, and filter it by key vulnerability criteria to identify vulnerable PAPs to focus the Supplemental LR plan on.

- Appoint a local NGO to:
  - Consult the Chef de quartier or Chef du village of impacted communities to support in the identification of vulnerable PAPs;
  - Consult the local resettlement committee "*comité des 20ha*" to support identification of vulnerable PAPs; and
  - Clarify status of vulnerable PAPs (including those within resettled households) with owners consulted as part of wider Supplemental LR plan and engagement.

- Specific support and attention should be provided to vulnerable people ahead of further engagement regarding the Project and resettlement process, for example:
  - Transportation support to enable participation in consultation meetings;
  - Individual explanation of important messages;
  - Support with the management of cash compensation, where needed;
  - Facilitation of the enrolment into livelihood restoration activities; and
  - Quarterly visits and semi-annual interviews during the first year after resettlement and annual interviews thereafter, to ensure that PAPs who have been identified as vulnerable fully participate in the resettlement process and restore or improve their livelihoods and standards of living.

3.10 *TIMING OF RESETTLEMENT*

3.10.1 *Findings*

As detailed in *Section 2*, the conditions in the Environmental Compliance Certificate (issued April 2017) included the need to compensate and resettle affected populations before commencement of construction and to allow sufficient time between compensation and construction to enable PAPs to relocate in decent conditions. These conditions were met by the Project and Government Agency leading the resettlement (ANDF).

The Government had permanent expropriation rights through declaration of public utility (DUP). The associated arrêté was disclosed in 2009. Resettlement activities at the project site were therefore initiated in 2009. Final negotiation sessions with the Project PAPs were undertaken on 24 November 2016 at the Abomey - Calavi Town Hall; payments to PAPs were made on 1 December 2016. The relocation was implemented in 2016.

The law on expropriation notes a statutory period of three months to be given ahead of land clearance in 2016. It is reported that nine months' notice was given and that no forced eviction was needed. Commencement of land clearance and construction was publicised on the radio and via a public consultation.

A delay of seven years after the initial cut off was observed before expropriation. It was raised at the 19 October 2016 consultation that the multiple delays in the construction date left PAP living in 'precarious conditions'. As noted in *Section 3.3*, no extensions or improvement to the land post 2009 were compensated for (although in practice the inventory was updated between 2010-2012).

Local inflation of land prices was observed due to speculation given the lag in delivery of compensation payments.

As noted in the ESIA 2017, resettlement was undertaken during School holidays, to minimise impacts on pupils and students during term time. If any further resettlement is required, such as for the 20m security buffer, compensation should be paid during the summer holiday in order for parents to enrol their children in other high schools.

3.10.2 Recommendations

- A clear timeline of activities should be detailed to document the resettlement process undertaken;
- The Project should review the resettlement implementation schedule to ensure that it is more realistic in future for any further land acquisition required (to avoid the delays observed for the IPP); and
- PACs should be provided regular updates on Project progress as per *Section 3.5*.

3.11 Documentation Process

3.11.1 Findings

As discussed in *Section 2*, no RAP was completed for the resettlement process.

Comprehensive documentation of the valuation and compensation process for PAP on the 396 parcels expropriated was provided (*Appendix 1, Figures 6 and 7*). Plans and photos of each impacted parcel were available in hard copy.

Documentation regarding the financial transactions that took place to pay compensation was available including a copy of cheques, signed PAP agreements and a copy of PAP ID (*Appendix 5*).

Data has been collected and documented at the HH level; however no electronic data was available.

3.11.2 Recommendations

- Verify location of paper based individual PAP files and any associated database currently residing with ANDF for monitoring purposes;

- Make contact and liaise with WSEG who undertook the mapping and valuation of assets as needed to obtain all PAP level data;

- Make contact with the ANDF-led inter-ministerial expropriation commission for any documented information such as minutes recorded during the resettlement process; and

- For any future resettlement required for the project (e.g. due to noise or air quality limit exceedances) ensure that a Resettlement Action Plan is developed in advance of undertaking land acquisition and that the process is entirely documented.

3.12 PAYMENT OF COMPENSATION

3.12.1 Findings

As detailed in *Section 3.10*, negotiation sessions with the Project PAPs started on 24 November 2016 at the Abomey - Calavi Town Hall; and payments to PAPs were made 1 December 2016. Payments were made 6 months prior to construction starting.

Bank accounts were set up for all PAPs via the services of Diamond Bank. All PAPs were paid by cheques. All PAPs signed an agreement and proof of receipt is provided in their individual compensation files (*Appendix 5*).

It is not clear whether compensation payments were made to Male heads of households only.

Twenty one parcels remain to be compensated for, of which three have cheques ready for collection. Ten files are being processed, and eight absentee owners have never presented themselves (they may live abroad or they may have already been compensated by CEB who bought their land previously).

The local Mayor's agents provided sensitisation on financial management when compensation was paid but no formal financial training or follow up has been undertaken with PAPs to assure the sustainable use of compensation for resettlement and livelihood restoration.

The total cost of compensation was: 2,628,125,504 FCFA

The total compensation paid for physical structures was: 1, 302, 978, 221 FCFA

The total compensation for impacted land was: 1, 324, 951, 427 FCFA

The total of cheques issued that remain to be collected is: 10, 730, 000 FCFA (as of 25 July 2017).

The outstanding total for the 18 unpaid files (as of July 2017) is: 73, 462, 940 FCFA (47 591 016 noted in April 2017 memo).

3.12.2 Recommendations

- The project needs to determine a closure process for completion of outstanding compensation payments; and

- Verify who was named on the compensation cheque, on what basis and how women HH members had access to compensation payments.

3.13 MONITORING AND EVALUATION PROGRAM

3.13.1 Findings

As noted in *Section 2*, ANDF noted that due to the urbanised nature of the land take, all delimited into private parcels no RAP was required to support the expropriation and compensation process. As a result no monitoring or evaluation program has been developed to evaluate the implementation of such plans.

The ESIA lacks a robust project specific socio-economic baseline to enable the effective monitoring of impacted PAPs.

There is no indication in the legal process of the requirement for a completion audit / verification of completion. This requirement should be implemented with the agreement of the authorities.

3.13.2 Recommendations

- Appoint a local NGO to collate available data at the PAP HH level and supplement this through LR engagement to enable post resettlement monitoring;

- Procedures and specific indicators to monitor and evaluate the implementation of LR activities should be included as a component of a Supplemental Livelihoods Plan as noted in *Section 3.8.2*; and

- A Verification or Completion audit should be scheduled to confirm implementation of the livelihoods restoration process in terms of the requirements of PS5. This requirement should be included as a component of a Supplemental Livelihoods Plan.

The ANDF noted that Maria Gleta is a successful resettlement case study as PAPs were willing to sell their land and properties at the compensation values proposed, and no eviction was required. The precedent of eviction occurs where PAPs are not satisfied with proposed compensation.

Whilst the need for a RAP was noted in the ESIA TOR, this was not completed as part of the ESIA approved in April 2017. A RAP was then not deemed necessary by the ANDF managing the expropriation process, based on the privatised nature of the land in an urban context. Owners of all impacted land could be easily identified, and the parcels valued and compensated for individually.

4.1 KEY REVIEW FINDINGS

The key findings of the review were that:

- Land and property owners were all identified. At the time of this writing, a total of 18 out of 396 parties remain to be compensated including eight absentee (non-resident) land owners;

- Land users were not identified or compensated. It was reported that they were owners of neighbouring impacted parcels but needs to be verified;

- Consultations were held with the PAPs during the resettlement process and a committee of representatives was formed to liaise with the government agency ANDF;

- A grievance procedure was in place onsite during the payment of compensation;

- The valuation process that was followed for both land and physical structures went beyond the provisions required under the local expropriation laws (use of the national *bareme*) to value lost assets at the replacement cost using local market rates;

- Fruit trees were compensated for using a flat rate (not reflecting tree maturity or production) although claims were received that not all fruit trees were compensated (2018). Other agricultural improvements to the land were not compensated. It appears though that sufficient time and notice was granted for PAPs to harvest standing crops ahead of vacating land. Other physical structures including water wells[1] and latrines found in the parcel gardens were compensated for;

[1] It should be noted that abandoned uncovered wells onsite pose a H&S risk and should be adequately covered.

- There was a seven year gap between issuance of the initial DUP in 2009 (which formed the cut-off date as per the IFC Performance Standards) and vacating the land in 2016. No transitional allowance was provided for the delay in commencement of the expropriation process;
- No relocation allowance for transport costs associated with resettlement or inconvenience payments were made;

- Sufficient notice was provided to PAPs ahead of expropriation (more than six months);

- It is reported that all PAPs have been able to secure replacement land and housing, with the majority remaining within the same arrondissement. No specific host site was designated;

- The impact on livelihood activities and revenue streams such as business activities dependent on services and/or customers around the Project site was not considered in the compensation process;

- No follow up monitoring of PAPs post resettlement has been undertaken so it is unclear the extent to which income generation activities and livelihoods have been restored. It was reported that certain PAPs, in particular women, have experienced a significant reduction in their livelihoods for example through the loss of their client base e.g., provision of informal catering services to the nearby college;

- No differential support was provided to Vulnerable People; and

- The Project is in the process of acquiring a final three hectares for the Project land take. The landowners were initially resistant to sell their land, but having seen the compensation process implemented amongst their neighbours are now willing. The project is in the final stages of compensation for this land.

4.2 RECOMMENDATIONS

4.2.1 Summary

The review recommends that the Consortium appoints a suitably qualified local NGO to develop a Supplemental Livelihood Plan, using a Community Based Needs Assessment and associated FGDs, to ensure that all compensated PAPs have restored and improved their pre-Project living conditions.

The project should undertake further engagement with PAPs to supplement the ESIA social baseline information on livelihoods prior to resettlement, and

consolidate the ANDF PAP database to allow assessment at a household scale of livelihood restoration post resettlement. This would enable coordinated planning to address any post resettlement livelihood impacts that may be caused by the Power plant development, and outline the approach for any further land acquisition needed (such as for a 20m security land buffer).

Based on the key review findings, *Table 4.1* summarises the recommended actions to supplement the resettlement process undertaken to date.

Table 4.1 Recommended Supplementary Resettlement Actions

Index	Topic	Issue	Action	Risk Rating	Completion Indicator
1	Storage of existing data	Existing resettlement data (for PAP impacted assets and compensation) is not collated in one place in an electronic /accessible form, this reduces the ability to undertake follow-up monitoring.	Collate available data at the PAP HH level (to enable post resettlement monitoring), from both ANDF and WSEG. Filter by key vulnerability criteria to focus Supplemental LR Plan.	Medium	Information Management System or database of PAP level information.
2	Information to be confirmed	Gaps requiring clarification.	In order to inform the Supplemental LR Plan (see Item 3), clarify the following: • Obtain updated cadastral plan used by WSEG for the inventory • Reconcile discrepancy in 14 compensation files unpaid and not accounted for. • Verify valuation process for plantations and tress • Clarify the compensation process for community facilities (e.g. school, health clinic and church) • Details of any land users (non-owners), including their place of origin • Number of rental tenants and use of productive land for income generating activities	Medium	Component of Information Management System and Supplemental LR Plan
3	Livelihoods Restoration	Lack of confirmation that PAPs have restored or improved their pre-Project living conditions.	Appoint suitably qualified NGO to develop a Supplemental Livelihood Plan. This plan should include:	High	Supplemental Livelihoods Plan

			• identification of the resettled location of PAPs including replacement land; • verify post resettlement security of tenure; • identification of principal economic activities pre and post resettlement (or desired activity where livelihood has not been restored); • analysis of findings to identify additional efforts necessary to restore lost livelihoods with support measures focussed on groupings of vulnerable PAPs where possible to achieve the requirements of PS5 in a way that is permitted by the responsible agency ANDF; • prioritisation of PAP employment by the Project; • indicators for monitoring; • implementation time schedule; • financial and implementation responsibilities of the Company in the execution of the Plan; • verification/ completion audit to confirm implementation. The above should be based on individual PAP level data or if not available gathered through FGD/KII's.		
4	Stakeholder Engagement	No Stakeholder Engagement Plan developed for the Project	Develop a Stakeholder Engagement Plan in line with PS1 requirements, with a Grievance Mechanism. This should document at a high-level the	High	Stakeholder Engagement Plan

			engagement and grievance process undertaken during the resettlement process, as well as plan for future engagement. The Grievance Mechanism should be made available to affected communities, landowners and land users. All future engagement should be documented and recorded in an Information Management System. Vulnerable people should be supported in future engagement activities.		Component of supplementary work being undertaken
5	Resettlement related to the access road upgrade	Details of the process followed for the access road upgrade were not available/provided	Clarify the process followed for the upgrade of the access road from Ila and Tankpe junctions related to resettlement and engagement, including obtaining design plans from the Local Mayor or BWSC. As needed develop a compensation strategy (in collaboration with ANDF) for displacement associated with the access road. Consider setting up a monitoring and evaluation convention between ABE and the Consortium to reinforce ABE capacity for monitoring.	Medium	Compensation strategy if PS5 is triggered
6	Impact of air and noise quality on surrounding communities	Additional land acquisition may be required if impacts associated with air and noise quality exceed the best practice limits in the vicinity of the plant.	Update and rerun air and noise modelling to confirm impact and requirement for additional land acquisition.	High	Updated environmental studies to inform any additional land acquisition requirements

					Component of supplementary work being undertaken
7	Compensation payment	Compensation payments have not yet been fully completed for all PAP	Determine a closure process for completion of outstanding compensation payments including for absentee owners and claims on the Project perimeter (<50% of land impacted) managed by the local Mayor and SBEE.	Medium	Completed compensation payment.

APPENDIX 1: RAP RELATED PHOTO LOG

Figure 1 Parcelled nature of land take

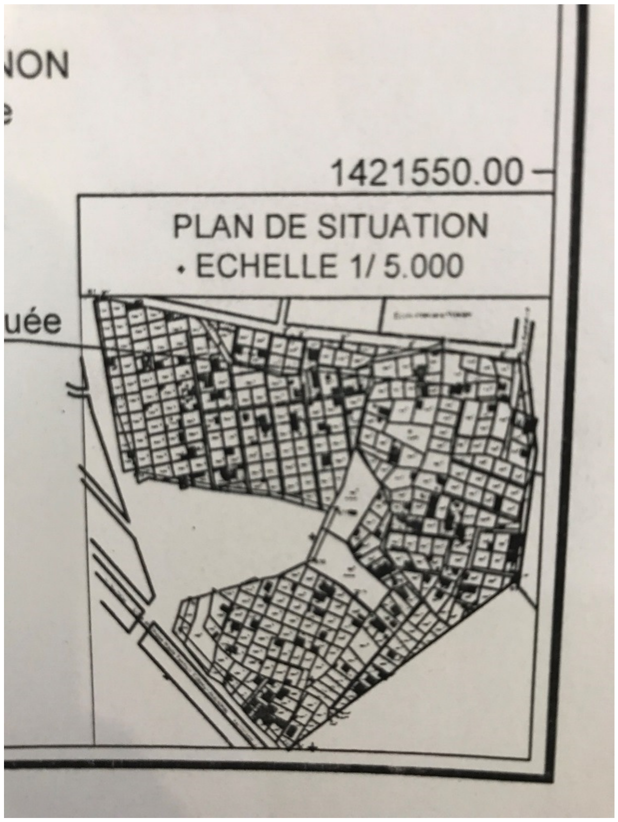


Figure 2 PAP compensation file and asset inventory photos

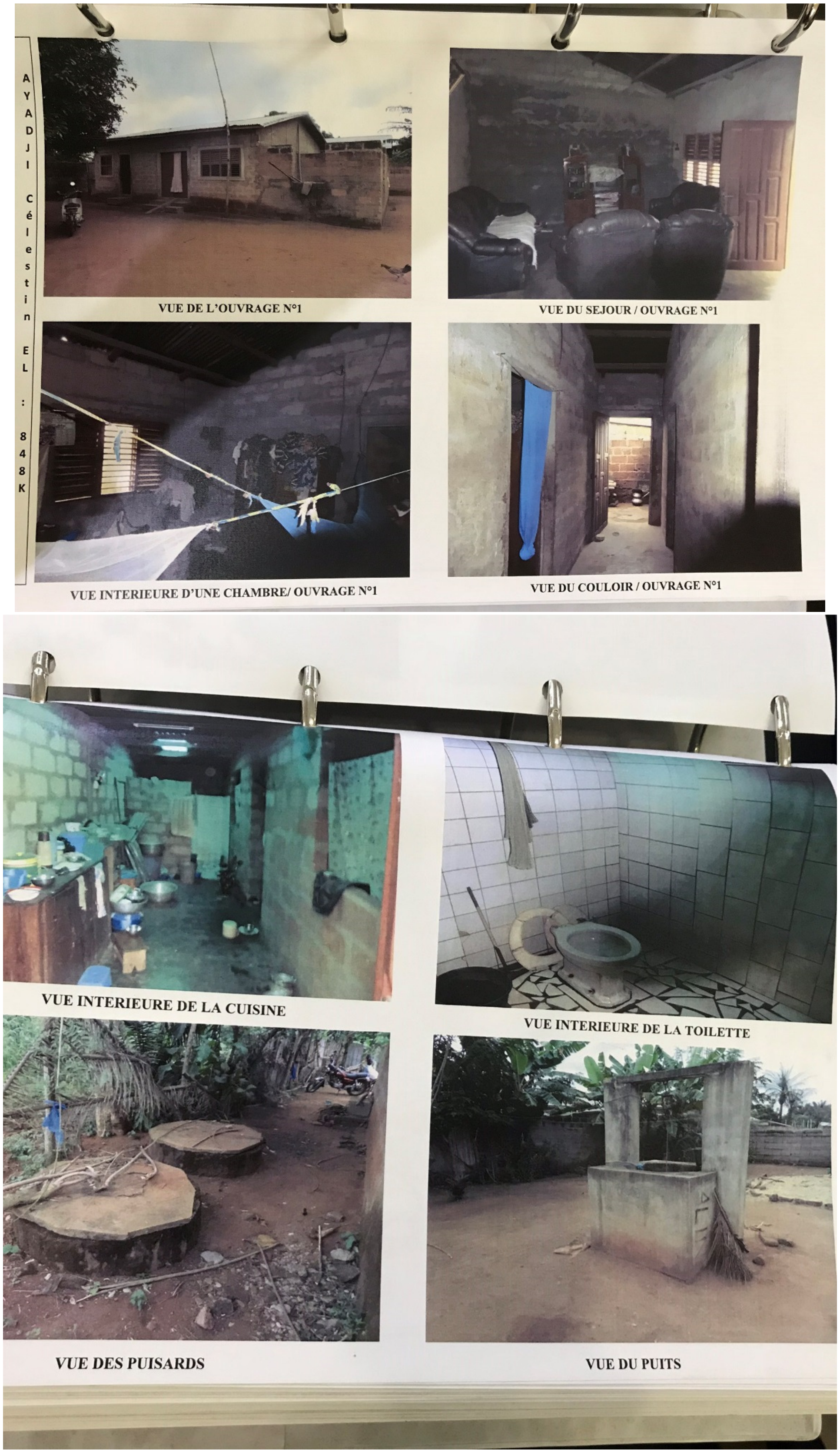
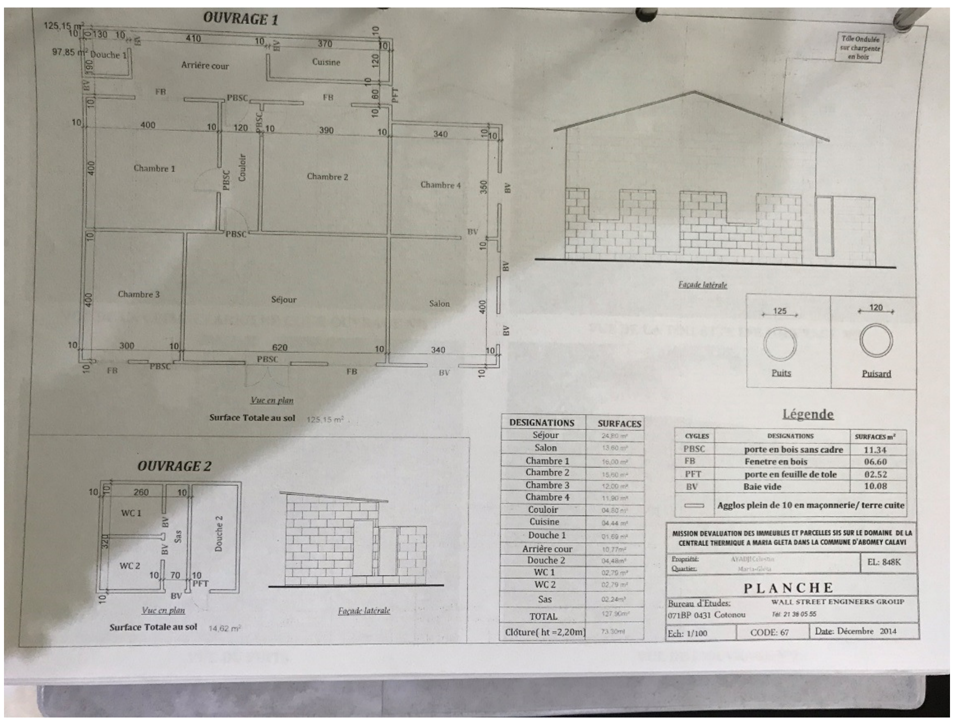


Figure 3 PAP asset inventory in Compensation file – land take and structure layout



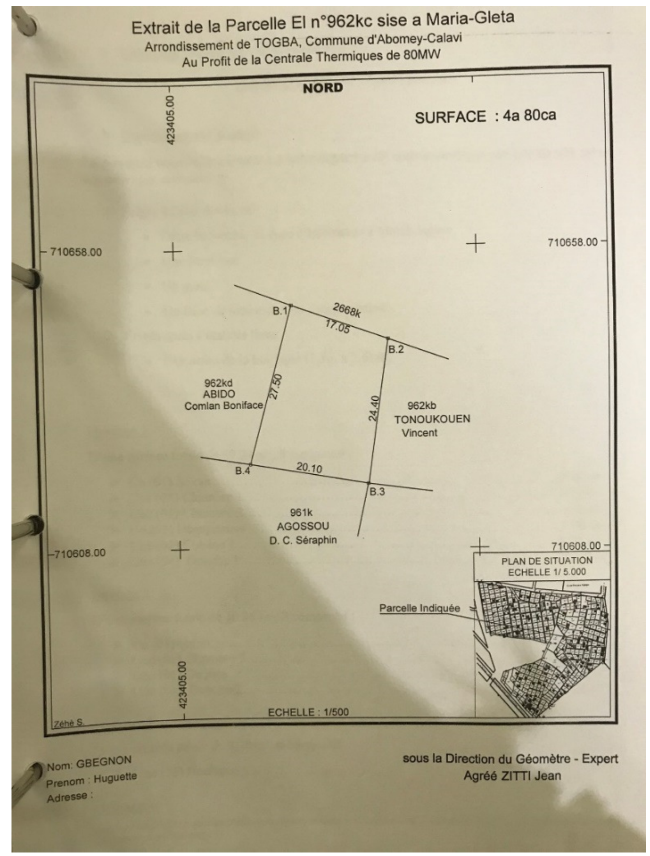
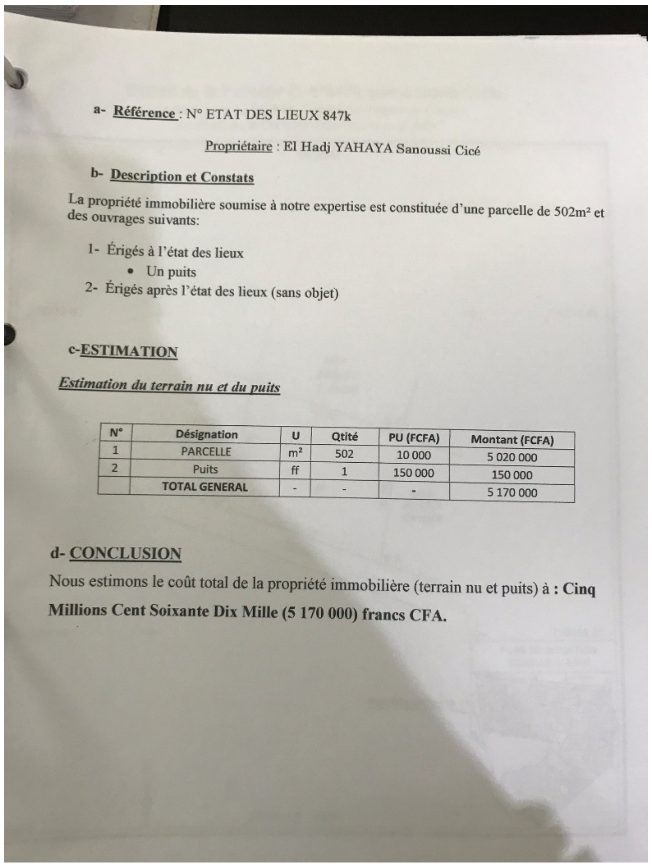


Figure 4 PAP asset inventory in Compensation file – calculation of compensation for assets lost



a- Référence : N° ETAT DES LIEUX 847k

Propriétaire : El Hadj YAHAYA Sanoussi Cicé

b- Description et Constats

La propriété immobilière soumise à notre expertise est constituée d'une parcelle de 502m² et des ouvrages suivants:

1- Érigés à l'état des lieux
   - Un puits
2- Érigés après l'état des lieux (sans objet)

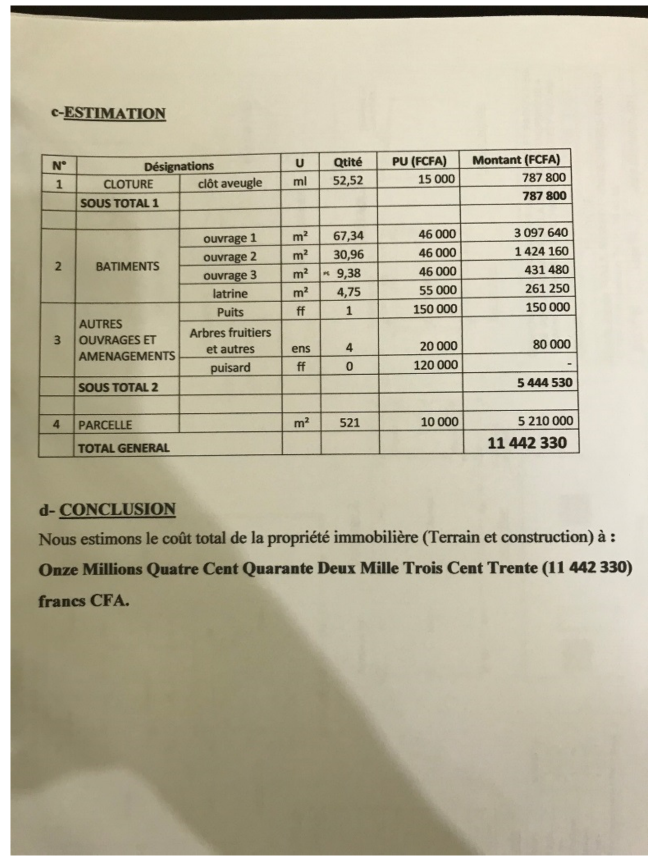
c-ESTIMATION

Estimation du terrain nu et du puits

N°	Désignation	U	Qtité	PU (FCFA)	Montant (FCFA)
1	PARCELLE	m²	502	10 000	5 020 000
2	Puits	ff	1	150 000	150 000
	TOTAL GENERAL	-	-	-	5 170 000

d- CONCLUSION

Nous estimons le coût total de la propriété immobilière (terrain nu et puits) à : **Cinq Millions Cent Soixante Dix Mille (5 170 000) francs CFA.**



c-ESTIMATION

N°	Désignations		U	Qtité	PU (FCFA)	Montant (FCFA)
1	CLOTURE	clôt aveugle	ml	52,52	15 000	787 800
	SOUS TOTAL 1					787 800
2	BATIMENTS	ouvrage 1	m²	67,34	46 000	3 097 640
		ouvrage 2	m²	30,96	46 000	1 424 160
		ouvrage 3	m²	9,38	46 000	431 480
		latrine	m²	4,75	55 000	261 250
3	AUTRES OUVRAGES ET AMENAGEMENTS	Puits	ff	1	150 000	150 000
		Arbres fruitiers et autres	ens	4	20 000	80 000
		puisard	ff	0	120 000	-
	SOUS TOTAL 2					5 444 530
4	PARCELLE		m²	521	10 000	5 210 000
	TOTAL GENERAL					11 442 330

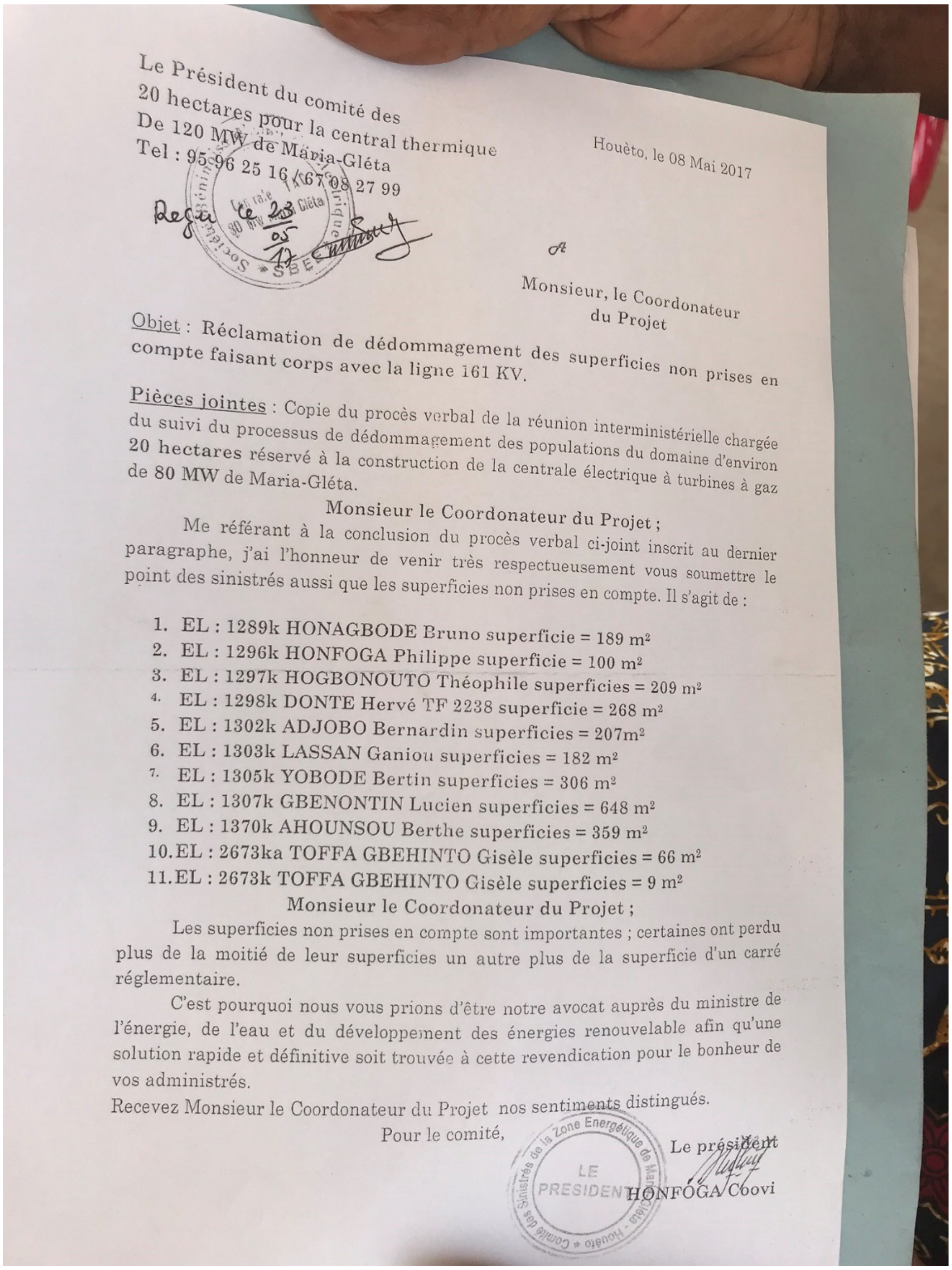
d- CONCLUSION

Nous estimons le coût total de la propriété immobilière (Terrain et construction) à : **Onze Millions Quatre Cent Quarante Deux Mille Trois Cent Trente (11 442 330) francs CFA.**

Figure 5 Eligibility disclosure in the local community and Mayor's office

*Figure 0	Grievance registration process in the local community during compensation*

APPENDIX 2: OUTSTANDING CLAIMS



Le Président du comité des
20 hectares pour la central thermique
De 120 MW de Maria-Gléta
Tel : 95 96 25 16 / 67 08 27 99

Houèto, le 08 Mai 2017

Reçu le 23/05/17

A

Monsieur, le Coordonateur
du Projet

Objet : Réclamation de dédommagement des superficies non prises en compte faisant corps avec la ligne 161 KV.

Pièces jointes : Copie du procès verbal de la réunion interministérielle chargée du suivi du processus de dédommagement des populations du domaine d'environ 20 hectares réservé à la construction de la centrale électrique à turbines à gaz de 80 MW de Maria-Gléta.

Monsieur le Coordonateur du Projet ;

Me référant à la conclusion du procès verbal ci-joint inscrit au dernier paragraphe, j'ai l'honneur de venir très respectueusement vous soumettre le point des sinistrés aussi que les superficies non prises en compte. Il s'agit de :

1. EL : 1289k HONAGBODE Bruno superficie = 189 m²
2. EL : 1296k HONFOGA Philippe superficie = 100 m²
3. EL : 1297k HOGBONOUTO Théophile superficies = 209 m²
4. EL : 1298k DONTE Hervé TF 2238 superficie = 268 m²
5. EL : 1302k ADJOBO Bernardin superficies = 207m²
6. EL : 1303k LASSAN Ganiou superficies = 182 m²
7. EL : 1305k YOBODE Bertin superficies = 306 m²
8. EL : 1307k GBENONTIN Lucien superficies = 648 m²
9. EL : 1370k AHOUNSOU Berthe superficies = 359 m²
10. EL : 2673ka TOFFA GBEHINTO Gisèle superficies = 66 m²
11. EL : 2673k TOFFA GBEHINTO Gisèle superficies = 9 m²

Monsieur le Coordonateur du Projet ;

Les superficies non prises en compte sont importantes ; certaines ont perdu plus de la moitié de leur superficies un autre plus de la superficie d'un carré réglementaire.

C'est pourquoi nous vous prions d'être notre avocat auprès du ministre de l'énergie, de l'eau et du développement des énergies renouvelable afin qu'une solution rapide et définitive soit trouvée à cette revendication pour le bonheur de vos administrés.

Recevez Monsieur le Coordonateur du Projet nos sentiments distingués.

Pour le comité,

Le président

HONFOGA Coovi

APPENDIX 3: OUSTANDING COMPENSATION PAYMENTS

POINT DES DOSSIERS NON TRAITES ET DES DOSSIERS DONT LES CHEQUES SONT EMIS ET EN ATTENTE D'ETRE PERCUS AU 25 JUILLET 2017

Tableau1. Dossiers traités dont les chèques sont déjà émis et en attente d'être retirés par les ayants droit

N° D'ORDRE	ETAT DES LIEUX	NOMS ET PRENOMS	Montant
1	2612k	TODE Zinsou Cosme	1 210 000
2	949k	DEGLA Z. Denis	4 510 000
3	1326k	AKPOVO Denis	5 010 000

Tableau2. Dossiers non traités

N° D'ORDRE	ETAT DES LIEUX	NOMS ET PRENOMS	MONTANT
1	1334k	ADEOSSI Maurice	4 980 000
2	1370k	AHOUANSOU Berthe	1 930 000
3	995k	ALLADE I. Martys	900 000
4	1281k	ANAGO Ablawa	2 530 000
5	1274k	DEDJIHO D. Dominique	6 050 000
6	1369k	Mme ANGO Mariame et ACACHA Emilienne	4 470 000
7	1239k	PRUDENCIO Damien	610 000
8	1240k	PRUDENCIO Damien	290 000
9	994k	SOKOU K. Patrice	870 000
10	2429k	VODOUNNON Nelson David	4 730 000
11	2442k	VODOUNNON Nelson David	4 600 000
12	2443k	VODOUNNON Samuel	3 060 000
13	2610k	VODOUNNON Samuel	300 000
14	1573k	VODOUNNON Stanislas	4 380 000
15	2441k	VODOUNNON Stanislas	4 860 000
16	820k	BOKO Baï Ambroisine	5 090 000
17	815ka	Htiers BOB Lucie épse OUENDO	17 180 000
18	1499k	HOUNSOU Michel	6 632 940

APPENDIX 4: DOCUMENTATION OF COMPENSATION PAYMENTS

REPUBLIQUE DU BENIN

COUR SUPREME

G R E F FE

CERTIFICAT D'INDIVIDUALITE N° 309 /GCS/P-N/2016

Le Greffier en chef par intérim de la Cour suprême du Bénin séant à Porto-Novo soussigné ;

-**Vu** la Déclaration d'acte de Naissance n°644 en date à Lomé Tokoin du 13 avril 1973 au nom de **WOSSINA Atsu-Kokou ;**

- **Vu** la Carte Nationale d'Identité de la République Togolaise n°0270-149-3064 établie le 31 octobre 2016 et qui expire le 30 octobre 2021 au nom de **WOSSINA ATSU KOKOU ;**

-**Vu** la Convention de Vente N°21/AD de la Sous-Préfecture d'Abomey-Calavi en date à Houêto du 08 février 2001 sur laquelle est écrit **OSSINA Kokouvi ;**

-**Vu** le Certificat de Non-Litige en date du 12 mars 2001 délivré par le chef du village de Houêto d'Abomey-Calavi à monsieur **OSSINA KOKOUVI ;**

Certifie formellement que les nom et prénoms suivants :

1°/ WOSSINA Atsu-Kokou

2°/ WOSSINA ATSU KOKOU

3°/ OSSINA Kokouvi

4°/ OSSINA KOKOUVI

Désignent une seule et même personne qui est née le 14 mars 1973 à Lomé de WOSSINA Kokou Mèléwomè et de Adjamamagbo Afiwa.

En foi de quoi, le présent certificat d'individualité lui a été délivré pour servir et valoir ce que de droit.

Porto-Novo, le 06 décembre 2016

Rép. du Bénin - COUR SUPREME - Le Greffier en Chef

Calixte A. DOSSOU-KOKO

REPUBLIQUE DU BENIN

CARTE NATIONALE D'IDENTITE
NATIONAL I.D. CARD

Nom / *Surname*
OUTON

Prénom / *Given names*
FLORENT TCHEMAGNIHODE

Sexe / *Sex*	Nationalité / *Nationality*	Taille / *Height*	Teint / *Complexion*	Date de naissance / *Date of birth*
M	BEN	1m73	NOIR	1956

Cheveux / *Hair*
GRISONNANTS

Adresse / *Adress*
GBESSOUDE
M/OUTON

Yeux / *Eyes*
MARRON

Signes particuliers / *Specials marks*
NEANT

Tél N° / *Phone N°*
95 74 47 23

Acte de naissance N° / *Birth certificate No*
JS.169/DANGBO

du / *on*
28/05/1979

N° du Doc / *Doc No*
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COTONOU

A COTONOU le 27-03-20

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SIGNATURE(S)

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Pour acquit cotonou le 27/03/2017

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ANNEX E TRANSPORTATION MANAGEMENT PLAN

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

This Transportation Management Plan (TMP), in conjunction with the Construction and Operation Environmental and Social Management Plans (ESMPs), will function as a framework document for the establishment of an IFC and AfDB-conformant Environmental and Social Management System (ESMS), and associated action plans for the Project.

The key objective of this TMP is to outline strategies to avoid, or where this is not possible, to minimise negative impacts from transportation activities associated with the Project, including (but not limited to) regular transportation of Heavy Fuel Oil (HFO) from the Port of Cotonou to the Project site.

1.2 LEGISLATIVE FRAMEWORK

1.2.1 International Standards

The Project is required to conform to the IFC Performance Standards, as well as the associated General Environmental, Health and Safety (EHS) Guidelines for Community Health and Safety.

IFC Performance Standards 2 (Labor and Working Conditions) and 4 (Community Health, Safety, and Security) are generally applicable to traffic and transport safety. Performance Standard 4, Section 6 (Infrastructure and Equipment Design and Safety) specifically requires projects "that operate moving equipment on public roads and other forms of infrastructure [to] avoid the occurrence of incidents and injuries to members of the public associated with the operation of such equipment"(IFC 2012).

Section 3.4 of the IFC EHS General Guidelines addresses traffic safety, and states that:

"traffic safety should be promoted by all project personnel during displacement to and from the workplace, and during operation of project equipment on private or public roads. Prevention and control of traffic related injuries and fatalities should include the adoption of safety measures that are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents" (IFC 2007).

Safety measures specifically described in Section 3.4 include driver training, fatigue management and regular maintenance of vehicles and collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns).

IFC Performance Standards and Guidelines also address the transportation of hazardous materials. In particular, Section 3.5 of the IFC Environmental Health and Safety (EHS) Guidelines describe requirements related to identification of hazardous materials and the requirement to have mobile response resources available in case of spills (IFC 2007).

1.2.2 National Standards

The following national standards are relevant:

- Benin Environmental Framework Law (La Loi Cadre pour l'environnement)—Loi n°98-030 (1999).

2 EXISTING ROAD CONDITIONS

Project construction and operation would require frequent truck trips between the proposed Maria Gléta IPP power plant and Cotonou. This section discusses existing conditions on the affected road network.

The route from the Port of Cotonou to the Project site identified by the Project is a total of 23.1 kilometres (km) along major highways, secondary roads and local roads. The current condition of the roads that would be used are listed in *Table 2.1*.

Table 2.1 Route from Cotonou Port to Project Site

Road Name	**Road Segment Distance**	**Road Segment Start and End Points**	**Road Description**
Port Roads	2.1 km	From Cotonou Port to Boulevard de la Marina	2 lane paved
Boulevard de la Marina	1.6 km	From port road to Rue 440	2 to 4 lane paved with central median and shoulders
Rue 440	0.2 km	From Boulevard de la Marina to Avenue Jean Paul II	2 lane with central median
Avenue Jean Paul II	2.4 km	Rue 440 to roundabout at Rue 390	4 lane with central median and shoulders
Route de Lomé	3.3 km	Avenue Jean Paul II to RNIE 1.	4 lane with central median and shoulders
RNIE1	4.5 km	Route de Lomé to RNIE 2. (RNIE 1 and RNIE 2 meet at a grade separated interchange)	4 lane with central median and shoulders
RNIE 2	2.4 km	RNIE1 to the road to IIta and Tankpe	4 lane with central median and shoulders
Route normale de Ita à Tankpe	3.2 km	RNIE 2 to intersection with Maria Gléta Road at Tankpe crossroads	2 lane paved
Route de Maria Gléta	1.2 km	Route de Maria Gléta west to Route du Gazoduc	Unpaved
Route du Gazoduc	0.6 km	Route du Gazoduc northwest to the south corner of the site of Substation Maria Gléta 1	Unpaved
Route du Gazoduc	0.6 km	Continuation of Route du Gazoduc northwest along the southern edge of current power generation site (Maria Gléta 1)	Unpaved
Unnamed	0.5 km	Entry road for project site: proceeds northeast between the Maria Gléta 1 and Maria Gléta 2 sites	Unpaved
Total distance	**22.6 km**		

The entire transport route passes through densely settled areas. Areas near the port are industrial and commercial, while the remainder of the route passes through mixed urban development in Cotonou. The RNIE 1 and RNIE 2 are paved roadways, generally without at-grade intersections. From RNIE 2 northwest to the Project site, the roads travel through villages and settlements with a mix of residential, business and civic uses. Buildings are close to the road and there is little distinction between the roadway and adjacent parking or driveway areas. Roads carry a variety of traffic, including pedestrians, mopeds and motorcycles as well as cars and trucks.

There has been no detailed study of traffic patterns in the area of interest.

The Original ESIA for the Project identified three areas that presented obstacles or constraints for the truck transport necessary to the Project:

- Access is only by dirt road from the Tankpe crossroads to the Project site. The Original ESIA indicated that the applicant proposed to improve and pave these road sections.
- The interchange between RNIE1 and RNIE2 due to congestion and a risk of accidents.
- A bridge on the RNIE2, 1.5 km north of the RNIE1 interchange due to bridge design.

It should be noted here that the road upgrades are being undertaken for the neighbouring power plant which is currently under construction (referred to as the IDB Project).

3 TRANSPORTATION IMPACTS

3.1 PROJECT ACTIVITIES GENERATING TRANSPORTATION IMPACTS

The Project will generate a substantial volume of additional truck traffic on the roads described in Section 2 during two phases: construction and initial operation.

3.1.1 *Construction (Cotonou to site)*

During construction, materials will be transported from Cotonou to the Project site. The original ESIA estimated that approximately 80 vehicles per day would be expected during busy periods of the construction process. For purposes of analysis, it is assumed that most large modules, components, and bulk supplies would be transported from the Port of Cotonou, while smaller-quantity supplies and materials would travel from other parts of Cotonou. As a result, construction traffic would primarily impact the roads identified in *Table 2.1* above.

The Project estimates that there will be up to 400 workers engaged in the Project construction. The workforce would not be housed onsite, but would instead travel to the site from local communities.

It is assumed that the amount, direction, and frequency of Project construction transport—including modules, materials, supplies, and personnel trips—would be similar to the current construction traffic associated with construction of the IDB Power Plant. Assuming that the Project construction will be begin soon after the completion of the IDB Power Plant, the Project would not increase existing traffic, but would instead extend the duration of existing traffic associated with IDB Power Plant construction.

3.1.2 *Operations: fuel transport from port to site*

The Project and the IDB Power Plant will initially use HFO as their feedstock until pipeline-delivered natural gas is available. Per agreement with the government of Benin, the government is responsible for procuring fuel. The government will likely contract a commercial supplier for this activity. The supplier will be responsible for delivery of the fuel to the Project site.

Based on information provided by the Project, each power plant will require approximately 40 truckloads of HFO per day when operating at full capacity. Cumulatively therefore, operation of the two power plants (the Project/IPP Power Plant and the IDB Power Plant) would require 80 tanker truck round-trips per day between the Port of Cotonou and the Project site. Fuel deliveries will be during off-peak hours and the fuel will be transferred to storage facilities that will be built on the Project site.

The route for transportation of fuel is indicated in *Figure 3.1*.

Figure 3.1 ***Fuel Truck Transport Route to the Site***

The three fuel storage tanks of 3,500 m^3 each will undergo an ever repeating sequence for each power plant of three cycles:

- Filling: 3 days fuel unloading bay operations;
- Quarantine: 7 days where the fuel in the sealed tank cannot be utilized prior to receipt of acceptable fuel test result; and
- Emptying: 5 days of power plant fuel consumption.

While the fuel in one storage tank is being used, the recently emptied tank is being refilled, and the recently filled tank is sealed and awaiting the fuel testing result.

3.1.3 *Road Improvements*

Road improvements are currently underway and are being undertaken by the IDB project, these involve upgrading the existing unpaved roads from the Tankpe crossroads to the project site. The approximately 3 km section of road from the crossroads to the site is being widened and paved, it is anticipated that the work will be completed during the first half of 2019.

The section of road being upgraded paved is depicted in *Figure 3.2*. The Route de Maria Gléta will be paved from the roundabout at the Tankpe crossroads approximately 1.2 kilometres west to Route du Gazoduc. A further 1.2 km of

road leading toward the site to the northwest, plus a further 500 m road to the north of the power plant site are also being paved. The improved road would be nine meters wide (two travel lanes) with gutter and approximately two-meter wide sidewalks on both sides.

Intersections are also being improved, including the Tankpe crossroads and the intersection between Route de Maria Gleta and Route du Gazoduc. In addition, the road upgrades would include paved aprons for the approaches to intersections with other unpaved roads, to provide a functional transition between the paved and dirt road sections.

Figure 3.2 Road Upgrade from Tankpe Intersection to Project Site

Source: BWSC, 2018. Adpated from Google Earth

3.2 *POTENTIAL TRANSPORTATION IMPACTS*

The Project would generate three types of transportation impacts: increased traffic congestion and delay, road infrastructure degradation, and increased transportation safety risks. The sections below describe these impacts. Implementation of the transport management measures listed in the Original ESIA, as well as in the Project's general Transportation Management Plan would reduce the Project's potential impacts on traffic, congestion, road infrastructure degradation, and transportation safety.

3.2.1 *Traffic Congestion and Delay*

The 80 truck round-trips associated with Project construction would comprise a small share of existing traffic volumes, particularly on major roads such as the RNIE 1 and RNIE 2 in Cotonou. Worker trips could result in larger traffic volumes during peak periods (i.e., shift changes), although these trips would be distributed over a wider area than deliveries from Cotonou. During construction, worker trips could generate some additional traffic delays on

local roads northwest of the RNIE 2. These impacts would be similar to those already experienced as a result of construction of the IDB Power Plant.

Fuel oil deliveries for the operation of both power plants could result in up to 20 HFO truck trips per hour. As stated above, these trips would not occur during peak travel hours.

Overall, truck trips associated with Project construction and operation would have a negligible impact on traffic congestion in Cotonou.

3.2.2 Road Infrastructure Degradation

The anticipated volume of heavy truck transport would result in incrementally faster wear and deterioration of roads. On paved roads and highways within Cotonou, this incremental increase would not likely be measurable. Along the dirt roads northwest of RNIE2, wear from trucks would likely be noticeable. However as described above, road upgrades are underway as part of the IDB Project construction activities. As a result, overall road degradation associated with Project construction and operation would be minimal and the condition of local roads leading to the Project would be improved.

3.2.3 Transportation Safety Risks

The anticipated increase in truck volume would lead to additional transportation safety risks. This would particularly be true in areas northwest of the RNIE 2, due to the location of buildings close to the road and the intensive use of roads and road edges for pedestrian travel, bicycles, and parking. The proposed widening and paving of Route de Maria Gléta and other roads west of the Tankpe intersection would improve pedestrian safety on this road segment.

RNIE 1, RNIE 2 and the roads within Cotonou are built for high traffic volumes and large vehicles. Traffic safety concerns are less central, but remain important due to the variety of vehicles and pedestrians travelling on the roads within the city, and the gap in driving skills between professional truck drivers and ordinary vehicle operators.

3.3 MITIGATION AND MANAGEMENT MEASURES

In order to mitigate the impacts identified above, a Framework Transportation Management Plan has been developed and is provided in *Table 3.1*.

Table 3.1 Framework Transportation Management Plan

Ref. No.	Description of Impact / Issue	Mitigation / Management Measure	KPIs and Related Actions	Timeframe/Frequency	Responsible Party
1	Overall construction transportation impacts	Prepare a Construction Contractor Transport Management Plan that identifies: • the routes that will be used for Project construction traffic, along with the estimated numbers of traffic movements, speeds and times of travel; • how existing road development plans have been taken into account in the identification of routes and road restoration measures; • procedures to reduce the exposure of Project and non-Project road users (whether in vehicles or on foot) and populations along the route, from the hazards of road-related accidents; • procedures to reduce the exposure of populations along the route to nuisance and disturbances due to traffic; and • details of audits and reviews of the components of the project transport system.	Preparation of Construction Contractor Transport Management Plan.	Prior to start of construction	HSE Manager/Contractor
2	Overall operation transportation impacts	Prepare an Operation Contractor Transport Management Plan that identifies: • the routes that will be used for Project operational traffic, along with the estimated numbers of traffic movements, speeds and times of travel; • the programme of road restoration measures that are likely to be required once fuel oil shipments have ceased (note that given the road upgrades underway the impact to existing roads is likely to be minimal and limited road restoration measures are anticipated);	Preparation of Operation Contractor Transport Management Plan.	Prior to start of operation	HSE Manager/Contractor

Ref. No.	Description of Impact / Issue	Mitigation / Management Measure	KPIs and Related Actions	Timeframe/Frequency	Responsible Party
		• how existing road development plans have been taken into account in the identification of routes and road restoration measures; • procedures to reduce the exposure of Project and non-Project road users (whether in vehicles or on foot) and populations along the route, from the hazards of road-related accidents; • procedures to reduce the exposure of populations along the route to nuisance and disturbances due to traffic; and • details of audits and reviews of the components of the project transport system. Fuel transportation plan to be developed and included in the contracts with the fuel service provider. This plan should include the following: • Emergency response plan for dealing with accidents and fuel spills, including reporting requirements; • Driver training requirements; • Monitoring requirements.			Fuel Oil Supplier
3	Worker road safety	Provide a safe transportation programme to assist workers to travel securely and reliably between their residence and their workplace. As part of this programme, consider providing employee buses for workers who live beyond walking distance.	Number of worker related traffic incidents.	Quarterly	HSE Manager
4	Safety of road users	Identify key pedestrian crossing locations along the fuel haul route, and construct pedestrian improvements, such as crosswalk markings and signage.	Identification of key crossing locations. Number of community grievances recorded.	Prior to start of fuel shipments	Fuel Oil Supplier and HSE Manager
		Ensure all drivers are qualified, trained to drive their vehicles safely, and have required licenses.	Audit of drivers licenses. Records of driver training attendance.	Quarterly	Fuel Oil Supplier and HSE Manager

Ref. No.	Description of Impact / Issue	Mitigation / Management Measure	KPIs and Related Actions	Timeframe/Frequency	Responsible Party
		Install speed-monitoring devices and/or speed governors on all Project vehicles.	Speed monitoring to detect exceedance of project speed limits.	Reviewed weekly	Fuel Oil Supplier and HSE Manager
		Maintain all vehicles standards consistent with IFC EHS Guidelines (see EHS Guidelines Sections 2.3 and 3.4).	Maintenance checks on all vehicles used for Project activities. Preventative maintenance.	Daily Monthly, as needed	Fuel Oil Supplier and HSE Manager
		Maintain road and safety related signage.	Regular audits to check all signage is in place.	Weekly	Fuel Oil Supplier and HSE Manager
		Community information sessions around road safety and Project related road usage.	Meeting records of awareness campaigns in all affected communities.	Quarterly	Fuel Oil Supplier and HSE Manager

ANNEX F OCCUPATIONAL HEALTH AND SAFETY PLAN

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GLOSSARY OF KEY ACRONYMS AND TERMS

Term/ Abbreviation	Definition/ Meaning
ALARP	As Low As Reasonable Practicable
Audit	Systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.
CESM	Community Engagement and Stakeholder Management Plan
EHS	Environment, Health and Safety
EPRP	Emergency Preparedness and Response Plan
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
E&S	Environmental and Social
FFP	Fall Protection Plan
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
GIIP	Good International Industry Practice
ha	Hectares
Hierarchy of Controls for Health and Safety	The following hierarchy, which is normally referred to as part of identifying the most preferred control measures for occupational health and safety hazards: • Elimination; • Substitution; • Engineering controls; • Signage/warnings and/or administrative controls; • Personal protective equipment.
H&S	Health and Safety
HSE	Heath, Safety and Environment
IFC	International Finance Corporation
Incident	A work-related event in which injury or ill health or harm to people or the environment did occur, or could have occurred.
Km	Kilometres
Km/h	Kilometres per hour
KPI	Key Performance Indicator
LOTO	Lockout/Tagout
LPG	Liquefied Petroleum Gas
Management System	A set of interrelated elements used to establish and implement policy and achieve stated objectives. It includes organizational structure, planning activities (including, for example, risk assessment and the setting of objectives), responsibilities, procedures and resources.
MW	Mega-watts
m^3	Cubic metre
m/s	Metre per second

Term/ Abbreviation	Definition/ Meaning
OHSP	Occupational Health and Safety Plan
Policy	A statement of the overall intentions and direction of the organisation as formally expressed by top management. It provides a framework for action and for the setting of objectives.
PPE	Personal Protective Equipment
Procedure	An established way to carry out an activity or a process. Note: Procedures can be documented or not.
Project ("the Project")	Maria Gleta IPP Project in Benin comprising construction and operation of a new 144MW combined-cycle, thermal power generation plant made up of the following: • Seven dual-fuel reciprocating engines each producing 18.2 MW for a total of 127 MW (MAN Group 18V51/60 DF units are specified), with a load factor considered to 95 percent; • Steam turbine system producing 18 MW; • Plant support infrastructure.
Project Personnel	All persons working for, or on behalf of the Project, including contractors and subcontractors.
Project Standards	All relevant legislation, including International legislation to which Benin subscribes, National Legislation and Project Permits; Equator Principles, IFC Performance Standards and international good practice
PTW	Permit-To-Work
SDS	Safety Data Sheet

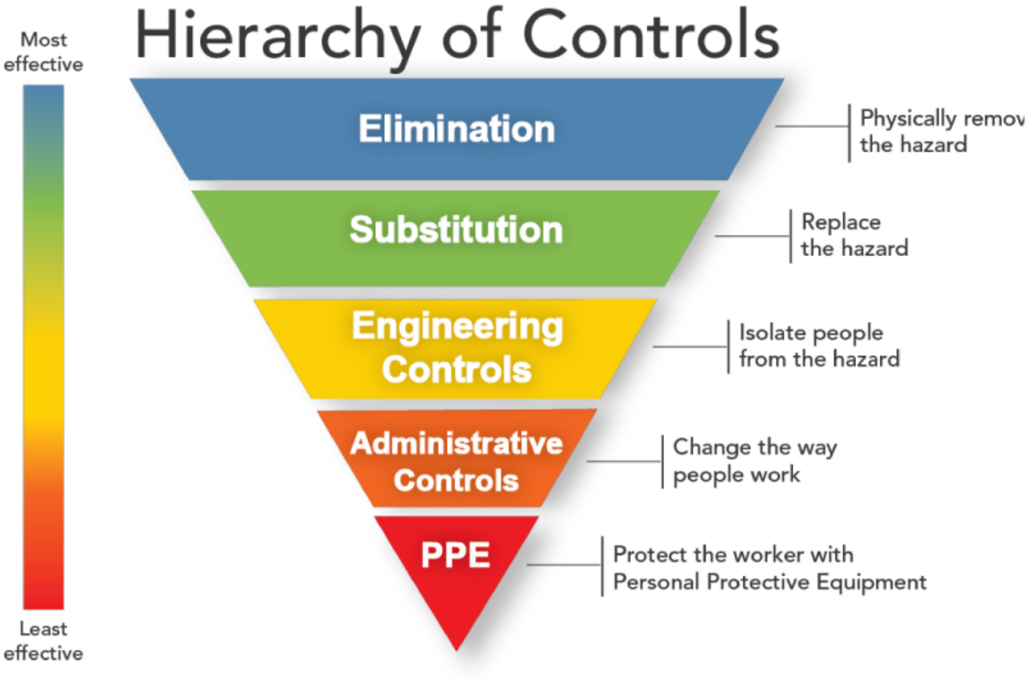
1 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document is the Construction Occupational Health and Safety Plan (OHSP) for the Maria Gleta IPP project in Benin. It applies to the construction of the Project, including site-related work areas outside the perimeter fencing. Its overarching objective is to establish and maintain safe and healthy working conditions for all personnel on site by applying the mitigation hierarchy of control for H&S risk (see *Figure 1.1*). The plan describes the health and safety (H&S) requirements which the Contractor, its sub-contractors and all service providers working for the Project must abide by and implement in order to control their H&S risks and maintain strong H&S performance and procedures. Other objectives are to:

- Establish, implement and maintain a H&S management system consistent with the Project Construction Environmental and Social Management Plan (C-ESMP);
- Ensure compliance with the Health and Safety Policy; and
- Ensure compliance with the applicable Beninese occupational health legislation.

Figure 1.1 Mitigation Hierarchy of Control for Occupational Health and Safety Risks



1.2 *PROJECT OVERVIEW*

The Project comprises construction and operation of a new 144MW combined-cycle, thermal power generation plant made up of the following:

- Seven (7) dual-fuel reciprocating engines each producing 18.2 MW for a total of 127 MW (MAN Group 18V51/60 DF units are specified), with a load factor considered to 95 percent. The plant will be designed for a minimum lifetime of 25 years or 200,000 hours of operation;
- Steam turbine system producing 18 MW; and
- Plant support infrastructure including:
  - Liquid fuel storage tanks (3 x 3,500 m3) and truck offloading station;
  - Connection to natural gas supply manifold;
  - Connection to power grid sub-station; and
  - Plant support facilities.

Associated facilities include the following:

- Improvement to a portion of the public road approaching the plant site; and
- Reconfiguration of the power evacuation lines to tie in an existing power line to the existing substation.

The power plant will be built on a portion of a 20ha parcel of land located in the town of Maria Gleta about 20 km to the west of the city of Cotonou, Benin. The parcel is located in an urbanised area with surrounding, relatively dense residential, business, and industrial development. The Project site is adjacent to other existing and planned power plants.

1.3 *DOCUMENT CONTROL*

The OHSP is a "live" document and will continue to developed and evolve throughout the construction phase. This document will be reviewed regularly to ensure the approach to H&S management remains fit-for-purpose and continues to align with relevant Good International Industry Practice (GIIP). Updates of this document may also occur due to significant management of change or in the event of new H&S management and monitoring controls being generated from other key Project sources e.g. permits.

1.4 *POLICY*

The Contractor and sub-contractors shall work in line with a Health and Safety Policy. The H&S Policy must include the following minimum management requirements:

- a clear set of aims and objectives for the effective management of H&S;
- general approach, means and measures to be adopted in order to achieve the objectives of the H&S Policy;
- commitment to identification and management of all H&S risks and their effective management through operational controls;
- commitment to legal and our other voluntary obligations;
- senior leadership commitment;
- providing the resources needed to meet H&S performance objectives including training and competency;
- establishing measurements and targets for H&S performance;
- ensuring ongoing monitoring, evaluation and reporting on H&S performance; and
- periodic review of all H&S policies (at least every 2 years).

The H&S Policy must be displayed on site, and must be communicated to all Project employees, contractors and sub-contractors.

1.5 *LEGAL AND OTHER REQUIREMENTS*

The Project Developers, in conjunction with the Contractor and any other sub-contractors, shall maintain an understanding of the full scope of H&S laws and 'other' requirements (e.g. IFC Performance Standards requirements) that apply to the construction phase of the Project. Applicable legal and 'other' H&S requirements must be documented in a register to ensure that the requirements are addressed during operational activities.

1.6 *ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM*

An Environmental and Social Management System (ESMS) will be developed as part of the construction project. The purpose of the ESMS is to provide the framework to enable environmental and social (including health and safety) risks to be identified and assessed throughout construction, and mitigation measures to be developed, implemented and appropriately managed. The ESMS is intended to be dynamic, and will

therefore be reviewed and updated periodically to continually improve the management of environmental and social impacts. Changes may be based on the Project phase, the environmental and social performance of the Project, or updated to reflect changes in operations, the receiving environment, legislation, stakeholders, and personnel.

2 ROLES AND RESPONSIBILITIES

The roles and responsibilities for implementing the OHSP are further defined in the C-ESMP document. All Project employees, as well as contractors and suppliers working on behalf of the Project are individually and collectively responsible for:

- Working safely, within the guidelines and requirements established by the Project's H&S policy, the OHSP, ESMP and its supporting procedures and programmes;
- Supporting the environmental and social policies established for the Project in the day to day performance of their work; and
- Notifying their supervisors, including of any observed spills, community issues, equipment malfunctions, unsafe or unhealthy situations or other issues that could represent non-conformance with the requirements of this OHSP.

All work shall be performed under the supervision of a competent supervisor who shall:

- Be trained to understand the hazards associated with all work he or she has to supervise;
- Have the duty to ensure that all precautionary measures required in terms of local H&S regulation are implemented; and
- If required provide employees under his or her supervision with appropriate training, including instructions relating to the safety in respect of specific work tasks and on the job training.

Specific responsibilities associated with the key H&S positions are summarized in *Table 2.1*.

Table 2.1 Roles & Responsibilities of Key H&S positions

Role/Position	Responsibility
Contractor	Ensuring compliance with the H&S Plan and local health & safety legislation. Ensuring adequate resources are available to enable the effective operation of the H&S Plan, including the appointment of qualified H&S personnel. Ensuring that significant H&S impacts and major non-conformance are properly addressed and managed. Approve communication where necessary to relevant external interested and affected parties.

Developer HSE Manager	The Developer HSE Manager is appointed as the Management Representative responsible for administering the Developers' ESMS, and will participate in the review, approval, and as necessary, update or modification of the ESMS and supporting documentation in response to changing Project conditions. The Developer HSE Manager will also provide management support to the Contractor HSE Manager and Community Liaison Officers (CLO) as necessary to ensure proper implementation of ESMS planning requirements. Responsibilities includes: 1. Establishing objectives, targets and Key Performance Indicators (KPIs). 2. Ensuring risks are appropriately evaluated. 3. Ensuring the Environmental Legal Register and Register of Other Requirements is kept up to date. 4. Ensure that significant environmental and social aspects and impacts are identified, correctly managed and communicated to all affected personnel. 5. Ensuring the promotion of environmental and social awareness of all who work for and on behalf of the Developer. 6. Ensuring that all who work for and on behalf of the Developer are aware of the relevant legal obligations and other requirements the site is required to comply with for all activities and operations conducted. 7. Identifying applicable environmental training requirements for all staff and ensuring that training is undertaken. 8. Review stakeholder engagement reports to assess issues related to environment, health and safety performance. 9. Reviewing audit results and ensuring that corrective actions are taken by the relevant parties. 10. Regularly reviewing the effectiveness of the ESMS, and ensuring that the necessary changes are made. 11. Reporting on the performance of the ESMS to the top management for review and as a basis for improvement of the ESMS. 12. Attending Project meetings. 13. Assess compliance with the Environmental & Social Management Plans (including the H&S Plan) and local health & safety legislation. The Developer HSE Manager will also have the responsibility as a Social Coordinator to oversee the social team and social performance. Social responsibilities include: 1. To supervise the implementation of Stakeholder Engagement Plan (SEP) and Grievance Mechanism. 2. To annually update the SEP, revising the stakeholder engagement programme, stakeholder map and database. 3. To undertake monitoring of stakeholder engagement every six months. 4. Participate in community resettlement Projects. 5. To review monthly stakeholder engagement reports. 6. To manage the individual CLOs, including motivating and developing the skills of the CLO team as it grows. 7. To provide updates and communicate issues and potential risks to the Technical Manager and the CEO.

Role/Position	Responsibility
	8. To be present during formal consultation meetings with authorities and communities. 9. Liaise with NGOs and government in support of the Community Development Plan. 10. Participate in Community Trust meetings.
Contractor HSE Manager	The Contractor HSE Manager will be based on site permanently and is responsible to oversee all environmental, social, health and safety aspects of the Project to ensure continuing compliance with the ESMS and the H&S Plan. Responsibilities include: 1. Providing overall co-ordination of the ESMS and the H&S Plan on site. 2. Assess compliance with the H&S Plan and local health & safety legislation. 3. Ensuring the Risk Register is up to date. 4. Ensuring the operation remains compliant with legal and other requirements. 5. Understanding the legal requirements pertaining to the site and ensuring legal requirements are incorporated into procedures and management plans. 6. Assisting with the implementation of programmes required to meet objectives and targets. 7. Ensuring that all relevant registers, records and other documentation are kept up to date. 8. Ensuring that all who work for and on behalf of the Developer are aware of all procedures. 9. Liaising with the Developer HSE Manager. 10. Ensuring incidents and complaints are suitably addressed. 11. Conducting weekly HSE site inspections. 12. Inform the Developer HSE Manager of any activity or change that will impact on stakeholders. 13. Attending Project meetings.
Sub-Contractors	Sub-Contractors will be trained in the requirements of this H&S Plan, and the applicable elements of the ESMS relevant to the respective activities undertaken on behalf of the Contractor. The Contractor will inform the sub-contractors of their responsibilities. In general, this shall include the following: 1. Ensuring their staff are familiar with the H&S Plan and ESMS requirements, including the environmental, health and safety and social policies and procedures 2. Reporting incidents and accidents and non-conformances to the Contractor HSE Manager. 3. Providing data related to performance/monitoring (e.g. water consumption) 4. Conducting Risk Assessments for all activities 5. Complying with relevant national, local and international legal requirements applicable to their activities. 6. Appointing HSE Representatives that will enable the sub-contractor to adhere to H&S requirements. Attend meetings established to discuss environmental, health and safety and social issues.

3 PROCEDURES

3.1 HAZARD IDENTIFICATION, RISK ASSESSMENT AND CONTROLS

The Project Developer (the Consortium), in conjunction with the Contractor shall ensure that all H&S aspects of the Project that may pose risk to the personnel, contractors, sub-contractors, community, and visitors are identified and evaluated, in order that they can be managed and prioritised for improvement on an ongoing basis. The Contractor shall have primary responsibility for the Project on-site H&S aspects (employees, contractor, sub-contractors, visitors, etc.).

A baseline H&S Risk Assessment shall be carried out prior to construction activities commencing on site. On-the-Job/Task based Risk Assessments should also be undertaken as part of Management of Change during the construction phase (e.g. changes to layouts, equipment, infrastructure, etc.).

The criterion and the process for the H&S risk assessment must be described in detail in a documented procedure, and the risk assessment results must be recorded in a risk register. The risk register will include additional risks that become evident during the course of the Project life cycle. The risk register is to be considered a dynamic tool.

The identified high-risk H&S impacts and risks will be used to establish objectives and targets and amendments to this OHSP and other H&S management plans relevant to this Project where required. The identified high-risk H&S impacts and risks will be used to establish sub-plans, safe work instructions, etc. where required.

The risk assessment procedure is designed to address the identification of new impacts or any subsequent additions or modifications that may be prompted by changes in construction conditions, regulatory requirements, lender requirements or other stakeholder interests, or other important considerations. In conducting an H&S risk assessment:

- Whenever possible, a multi-disciplinary team should be involved in developing H&S risk assessments to ensure that multiple perspectives are assimilated into the process;

- Community engagement is a key consideration in understanding what H&S risks might be, and the appropriate controls/actions required to manage these risks (see Stakeholder Engagement Plan);

- The H&S risk assessment must outline both controls which are in place, and those which are required to reduce risk further. These additional

controls/actions will feed into action plans to ensure that progress is made towards managing risk;

- With regard to H&S risks, a decision will be made as to whether business development, construction or operational activities can continue if the risk remains medium, high or critical after controls have been put in place;

- Projects will aim to reduce all risk to as low as practically possible (ALARP) and to take advantage of opportunities that create shared value for the business and its stakeholders; and

- For specific projects and high H&S risk areas, a specific and individual risk assessment (e.g. task based risk assessment) may be required, for example a hot work task.

The outcomes of H&S risk assessments shall be communicated to all personnel undertaking the relevant work. Unplanned, sudden and potential unexpected events or activities will be proactively identified and added to the risk and opportunity assessment as soon as possible. Surrounding landowners and land occupiers will also be provided with an overview of Project H&S risks that could affect them, and the mitigation measures in place to manage such risks.

3.2 *COMPETENCE AND AWARENESS TRAINING*

The Contractor must ensure that all persons performing tasks for it or on its behalf that may result in significant H&S risks are competent on the basis of appropriate education, training and/or experience, and shall retain associated training records.

H&S awareness training sessions shall be run for all employees on the site, which should be focussed on the H&S risks associated with the Project operations, and the requirement of this OHSP. Additional task specific H&S training should be undertaken as required.

The Contractor will identify and document H&S training needs in a Training Needs Matrix. The Contractor will develop a Training Programme to plan the H&S training interventions to address the identified training requirements. The Contractor will maintain Training Attendance Records for all H&S training provided on site.

3.3 *HEALTH & SAFETY BULLETIN BOARDS, NOTICES AND SIGNS*

The Contractor shall set up bulletin boards dedicated to H&S matters. The bulletin boards must be erected in key areas (e.g. construction site offices, meeting areas, etc.). The Contractor shall be responsible for the display in appropriate locations applicable to their construction processes, as well as for the provision and display of sufficient safety signs applicable to the construction activities being undertaken. Safety signs must be legible and appropriate to the anticipated hazards. All H&S notices in the workplace must be posted in the official language and in such language that is understood by the majority of employees.

3.4 *SUB-CONTRACTORS*

The Contractor shall demand the same level of H&S performance from its sub-contractors as it does from its direct employees. Before the commencement of the work, a copy of this OHSP and any associated H&S procedures will be submitted to all hired companies and service providers, and training will be given to them.

Prior to contracting, a sub-contractor shall be evaluated. The evaluation shall include H&S aspects, including where possible, the adequacy of each sub-contractor's H&S management programmes, recent experience between Contractor and sub-contractors, historical safety performance, willingness to make suggested improvements, ability to execute the work in a safe manner, and compliance with relevant legal requirements. If a sub-contractor with inadequate H&S performance must be utilised the Contractor shall:

- Provide a written resolution plan to improve the sub-contractor's H&S performance; and
- Provide additional resources and assistance to assure the sub-contractors compliance with minimum expectations.

3.5 *HEALTH AND SAFETY COMMUNICATION AND MEETINGS*

The Contractor shall maintain a formal procedure for communications with the regulatory authorities and communities. Meetings will be held, as required, between the Contractor and the appropriate regulatory agency and community representatives to review H&S performance, areas of concern and emerging issues. Dealings will be transparent and stakeholders will have access to personnel and information to address concerns raised.

The Project shall develop a Grievance Procedure as part of the ESMP (see Stakeholder Engagement Plan) that will be used as a mechanism whereby community members can raise any H&S issues of concern. Grievances may be verbal or written and are usually either specific claims for damages/injury or complaints or suggestions about the way that the Project is being implemented. When a grievance has been brought to the attention of the Project team it will be logged and evaluated. The person or group with the grievance is required to present grounds for making a complaint or claiming loss so that a proper and informed evaluation can be made. Where a complaint or claim is considered to be valid, then steps are required to be undertaken to rectify the issue or agree compensation for the loss. In all cases the decision made and the reason for the decision will be communicated to the relevant stakeholders and recorded. Where there remains disagreement on the outcome then an arbitration procedure may be required to be overseen by a third party (e.g. government official). Local community stakeholders will be informed on how to implement the grievance procedures.

Project meetings planned during the construction phase (e.g. weekly or monthly) shall include Health and Safety Management as a standing item on the agenda. The Contractor HSE Manager will provide feedback and raise issues to be addressed, including the following:

- Results of Risk Assessments;
- H&S training conducted and required;
- Health and Safety performance (based on monitoring results);
- Legal contraventions;
- H&S Plan non-conformances;
- Results of H&S inspections;
- H&S Accidents/Incidents;
- Safety statistics;
- Significant safety occurrences; and
- Results of internal and external H&S audits.

Representatives of the Contractor and all sub-contractors must participate in these meetings. A kick-off meeting (with specific H&S topics in the agenda) must be held with new sub-contractors/service providers prior to commencing activities at the site. The primary objectives of the kick off meeting shall be to:

- Meet key personnel (e.g. HSE Manager);
- Discuss and review H&S plans;
- Discuss and review the sub-contractor's H&S programs and resources; and
- Review the H&S performance plan of the sub-contractor, the risk analysis and the control measures.

Minutes of all the Project/H&S meetings will be maintained including the recording of decisions made and actions required.

3.6 *Incident Investigation and Reporting*

Incident investigation and reporting shall be conducted in accordance with Good International Industry Practice (GIIP) by people who have been formally trained in incident investigation and reporting. Any H&S accident or incident must be recorded using an Accident Investigation Report. The report must include a root cause analysis and corrective action(s) that must be completed. The due date for the corrective action and the person(s) responsible must also be indicated. These corrective actions must also be tracked until closure.

3.7 *Health and Safety Monitoring and Auditing*

3.7.1 *Contractor Audits*

The Contractor shall monitor and measure the H&S performance of its construction activities on a regular basis to assess whether the Project is complying with legal requirements, is meeting its policy commitments, achieving established objectives and targets, and conforming to the requirements of this OHSP and associated H&S procedures. This shall be conducted through the establishment of a monitoring programme, internal audits and inspections and a process to implement corrective action to address non-conformances.

Audits and inspections to be conducted will also cover the sub-contractors' activities. Audits shall be performed by qualified personnel. These H&S audits must be conducted on a quarterly basis, while the H&S inspections must be done on a weekly basis. The records of the results of the periodic evaluations shall be retained.

3.7.2 *Third Party Audits*

Third Party audits will also be conducted, including the following:

- Audits by local authority regulators to ascertain compliance with national legislation and Project permit approval conditions; and
- Periodic audits by the Lenders or by Lenders' representatives. Such audits will be undertaken in accordance with the predetermined protocol agreed between the Developer and the Lenders. Findings will be reported to the Contractor and the Developer.

3.7.3 *Non-Compliance and Corrective Actions*

The analysis of the non-compliances identified during monitoring and audits, is crucial for the identification of corrective actions that are to be implemented. Incidents and non-compliances relating to construction activities and H&S management within the site boundary will be managed and reported by the Contractor. The Contractor is required to establish procedures for incident reporting, investigation, corrective/ preventative action and resolution.

3.8 *EQUIPMENT INSPECTIONS*

All equipment operated on site (including tools, construction site installations, machinery and other relevant items) has to be kept in a safe operating condition at all times. For this purpose, equipment has to comply with the applicable regulations and standards and has to be regularly inspected in line with a documented inspection regime. The Contractor shall establish an Equipment Inspection Programme, which shall cover all tools, equipment and machinery used on the construction site. Types of inspection on site will include:

- Daily/ pre-start visual inspections by the user/ operator;
- Inspections by a competent person from the site personnel; and
- Inspections by a certified party, as required.

Every contractor and sub-contractor needs to designate qualified and competent persons to carry out periodic inspections of all tools, equipment and machinery before use on site and periodically (e.g. weekly). Tools, equipment and machinery whose certificates have expired or cannot be used safely shall be removed from the site, or stored in a way they cannot be used. All tools, equipment and machinery inspections shall be recorded. Inspections related to emergency response equipment shall be included in the Equipment Inspection Programme.

3.9 *EMERGENCY PREPAREDNESS AND RESPONSE*

A detailed Emergency Preparedness and Response Plan (EPRP) (refer to EPRP in Appendix 2 of the C-ESMP) will be designed to minimise the potential for accidents and emergency situations involving construction activities. The EPRP must take into account all events and incidents that could affect staff and contractors, the environment and the community, including the following:

- Fires and explosions;

- Spillage of hazardous chemical substances;
- Natural disasters (e.g. floods);
- Injuries and fatalities (including electrocution);
- Industrial action;
- Community unrest; and
- Security (e.g. in-country travel, civil conflict, etc.)

In order to create an EPRP, the following steps shall be followed:

- Step 1: Assess potential emergency scenarios, probabilities and therefore risk;
- Step 2: Ensure adequate controls to prevent an emergency are reflected within relevant operational procedures and supporting documents;
- Step 3: Develop an EPRP encompassing each scenario and how it will be managed in an easy to read and quickly accessible format;
- Step 4: Ensure that in developing responses to each scenario, all internal departments that will need to work together are consulted and outlined, all external emergency services are consulted (e.g. the fire department) and community representatives (where relevant) are consulted and their part is understood and agreed to ensure the plans are workable and effective;
- Step 5: Communicate and train on the EPRP with all relevant staff, contractors, and where applicable communities;
- Step 6: Test the EPRP regularly (as a minimum annually or more frequently for high risks), and develop lessons learnt, integrating these into any updates of the EPRPs; and
- Step 7: Conduct periodic review of EPRP's, at least annually, but for high risk scenarios more frequently.

The EPRP must be aligned with the IFC's General EHS Guidelines to include the following:
- Identification of the emergency events that may arise;
- Emergency procedure for each type of emergency event;
- Indication of the emergency equipment required on site, including fire-fighting equipment, first-aid kits, spill kits, and incorporate checklists to be used to ensure that the emergency equipment is in place, good condition, accessible and correctly stocked;
- Identification of key emergency-related appointments, roles and responsibilities (including fire-fighters and first aid personnel), and will provide direction on required responses to operational or environmental emergencies;
- Evacuation Procedures;
- Emergency contact details for internal staff and external emergency services;

- Requirements for periodic tests and drills to ensure that necessary response actions are understood by designated emergency response personnel, other Project staff, contractors, and, as appropriate for the given location, community emergency response personnel;
- Training requirements and procedures;
- Worker and community notification and communication; and
- Business continuity and contingency measures (such as Identifying replacement supplies or facilities to allow business continuity following an emergency and maintaining back-ups of critical information in a secure location).

The Contractor shall conduct weekly inspections of emergency equipment.

3.10 CONTROL OF DOCUMENTS AND RECORDS

H&S documentation, including management plans; associated procedures; and checklists, forms and reports will be controlled through a formal procedure. All records will be kept on site and will be backed up records will be kept in both hard copy and soft copy formats. Records will be archived for the life of the Project.

Furthermore the document control procedure will describe the processes that the Project will employ for official communication of both hardcopy and electronic document deliverables. In addition, it will describe the requirement for electronic filing and posting and for assignment of document tracking and control numbers (including revision codes).

The Contractor is responsible for maintaining the OHSP and any other applicable documents and making sure that this list is communicated to the appropriate parties. The Contractor is responsible for providing notice to the affected parties of changes or revisions to documents, for issuing revised copies and for checking that the information is communicated within that party's organisation appropriately.

4 HEALTH AND SAFETY STANDARDS

The Contractor shall ensure the systems and procedures are in place during the construction phase in order to ensure that these H&S standards are adhered to. The Contractor shall assess compliance with these H&S Standards on a regular basis.

4.1 HAZARDOUS WORK PERMIT

The Contractor shall develop and implement a Permit-To-Work system for all hazardous tasks, including the following:

- Confined space entry (which shall include testing of atmosphere);
- Working at heights;
- Electrical works;
- Hazardous lifting operations (objects over 10 tons and/or of large dimensions, lifts involving more than one cranes and lifts with no clear line of sight);
- Hot works; and
- Excavation works.

All Permits-to-Work must contain the at least following information:

- Description of the task to be done;
- Description of exact location;
- Details of work party and tools to be used;
- Details of potential hazards and precautions to be taken;
- Details of PPE to be worn;
- Atmospheric testing results (for confined spaces);
- Results of testing for electrical currents (for LOTO and other electrical work);
- Time of issue and period of validity;
- Signature of person in charge of the work;
- Signature of person issuing the permit; and
- Signature for handover of responsibilities between shifts.

Workers engaged in hazardous tasks shall be trained on the Permit-To-Work system. The Site Supervisors shall ensure that all work carried out by personnel in their work crew is covered by valid permits. Regular inspections on Permits-To-Work shall be conducted by the Contractor HSE Manager. All Permits-To-Work shall be maintained by the HSE Manager.

4.2 *PERSONAL PROTECTIVE EQUIPMENT (PPE)*

PPE is only acceptable as a control method in the following circumstances:

- When engineering controls are not feasible or do not fully eliminate the hazard;
- While engineering controls are being developed;
- When safe work practices do not provide sufficient additional protection; and
- During emergencies when engineering controls may not be feasible.

No person shall be subjected or exposed to a hazardous environmental condition without protection. The Contractor shall ensure that all workers are provided with adequate PPE for the eyes, face, hands and feet, protective shields and barriers whenever necessary by reason of the hazardous nature of the process or environment. Service providers and sub-contractors are expected to provide their own PPE, to the satisfaction of the Contractor. Where a service provider or sub-contractor is unable to provide the appropriate PPE then the Contractor shall assist in providing the appropriate PPE relevant to their tasks. Suitable PPE must be available for visitors. All PPE must be of the approved design and construction appropriate for the exposure and the work to be performed, and must be maintained as required. Torn/damaged PPE shall be replaced. The following minimum PPE is mandatory at all times for all personnel who enter the site:

- Safety helmet with chin strap;
- Steel capped safety shoes;
- Safety glasses; and
- High-visibility clothes.

4.2.1 *Eye and Face Protection*

Eye and face protective equipment shall be required where there is reasonable probability of exposure to hazards. In such cases, the Contractor shall furnish a type of PPE suitable for the work to be performed, and the employees shall use such equipment. Eye protection shall be provided where the processes or operations present hazards of flying objects, liquids, injurious radiation, glare or a combination of these hazards. Eye and face

protective equipment shall conform to the following minimum requirements:

- Provide adequate protection against the particular hazard for which they are designed or intended;
- Be reasonably comfortable to use;
- Fit snugly and shall not unduly interfere with the movements of the user;
- Be durable, easily cleaned and capable of being disinfected;
- Be kept clean and in good condition; and
- Be of the approved type.

Whenever eye protection is needed, persons whose vision requires the use of corrective lenses shall wear goggles or spectacles of any of the following types:

- Spectacles which provide optical correction;
- Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles; or
- Goggles that incorporate corrective lenses mounted behind the protective lenses.

4.2.2 *Respiratory Protection*

The primary corrective measure in the control of occupational diseases caused by harmful, dusts, fogs, fumes, mists, gases, smokes, sprays or vapours shall be to prevent atmospheric contamination. This shall be accomplished through the use or application of engineering control measures, like enclosure or confinement of the operation, general and local ventilation and substitution of less toxic materials, or a combination of these.

When effective engineering control measures are not feasible or while they are in process of being instituted, appropriate respirators shall be used. The Contractor must institute a respiratory protective programme which shall include the following:

- Proper selection of respirators on the basis of the hazards to which the workers exposed;

- Standard procedures for the use of respirators;

- Sufficient instruction and training in the proper use and the limitations of respirators;

- When practicable, the assignment of respirators to individual workers for their exclusive use;

- Regular cleaning and disinfecting of the respirators. Respirators issued for the exclusive use of one worker shall be cleaned after each day's use or as often as necessary. Those used by two or more workers shall be thoroughly cleaned and disinfected after each use; and

- Appropriate examination and testing of the conditions of the work area in order to assure that the allowable degree of employee exposure is maintained, and to determine the effectiveness of the control measures.

The American National Standards Practices for Respiratory Protection (ANSI z88.-21059) are considered to be industry best practice and should be used as a guide for purposes of proper selection, design, construction, testing and use of respirators.

Written procedures shall be prepared covering safe use of respirators in dangerous atmospheres that might be encountered in normal operations or in emergencies. All relevant personnel shall be familiar with these procedures and the available respirators to use. When self-contained breathing apparatus are used in atmospheres dangerous to life or health, standby personnel must be present with suitable rescue equipment.

4.2.3 *Head Protection*

Hard hats for the protection of workers from impact penetration from falling and flying objects and blows shall be provided. Hard hats shall be made of non-combustible or slow-burning materials, and when used in electrical environment, shall be non-conductive of electricity. The American National Standards Safety Requirement for Industrial Head Protection (ANSI z59-1-1969) must be used as a guide for the purpose of proper selection, design, construction, testing and use of head protectors.

4.2.4 *Hair Protection*

All persons with long hair employed around machinery shall completely cover their hair with well-fitting caps or other equivalent protection. Caps shall be of materials not easily flammable and sufficiently durable to withstand regular laundering, disinfecting and cleaning.

4.2.5 *Hand and Arm Protection*

When selecting hand and arm protection PPE (e.g. gloves, mittens, pads), consideration must be given to the hazards to which the wearer may be exposed to and the ease and free movement of the fingers. Hand and arm PPE shall:

- Be made of tough materials and where necessary provided with special reinforcement for the handling sharp edged or abrasive objects;

- Be made of suitable heat resisting material for workers handling hot metals;

- Be made of rubber or other suitable materials conforming to the test requirements on dielectric strength for electrical workers; and

- Be made of natural rubber, synthetic rubber or pliable plastic material resistant to corrosion for the handling of corrosive substances. These PPEs must:

    - Cover the forearm as much as possible;
    - Have a close fit at the upper end; and
    - Not have the slightest break.

4.2.6 *Safety Belts, Life Lines and Safety Nets*

Workmen working in unguarded surfaces above open pits or tanks, steep slopes, moving machinery and similar locations, or working from unguarded surfaces two (2) metres or more above water or ground, temporary or permanent floor platform, scaffold construction or where otherwise exposed to the possibility of falls hazardous to life or limb, shall be secured by safety belts and life lines. In situations where safety belts and life lines in guarded platforms and scaffolds or temporary floors are not feasible, suitable safety nets shall be provided.

Workmen entering a sewer, flue, duct, or other similarly confined places shall be provided and required to wear safety belts with life lines attached and held by another person stationed at the opening ready to respond to agreed signals.

Safety belts shall be made of suitable materials of sufficient strength to support the weight of the person without breaking.

Belt anchors shall be made of metal machined from bar stock, forged or heat treated, capable of supporting a pull of 2730 kg [1] without fracture applied in the direction which the anchor must withstand must a man fall. All anchors and fastenings shall be provided with means to prevent turning, backing off or becoming loose. Anchor fittings with single thread section which is merely screwed into reinforcing plates shall not be used.

Life lines shall be made of good quality manila rope of at least 1.9 cm diameter or equivalent material such as nylon rope of at least 1.27 cm diameter and shall be of sufficient strength to support a weight of 1140 kg without breaking [1].

Safety nets shall not be less than 0.94 cm diameter mesh ropes and not less than 1.90 cm diameter border ropes (perimeter) made of manila rope or other materials that can absorb the impact of a falling body (equally as nets fabricated from manila rope of the dimensions specified). The mesh shall be arranged not to exceed 15.25 cm on canters positively and securely attached to avoid wear at each crossing point and at points of contact with the border. Safety nets shall be equipped with adequately padded thimbler sockets or equivalent means of attachments. Supports and anchorages shall be of sufficient size and strength to catch any falling worker. The nets shall be attached to sufficient supports outside and beyond the area of possible fall and supported at sufficient heights to prevent sagging to any solid object beneath when cushioning the fall of a worker.

Safety belts, life lines and safety nets shall be inspected before use and at least once each week thereafter. Defective belts, lines or nets shall be immediately discarded and replaced or repaired before reuse.

4.2.7 *Safety Shoes*

Workers shall be provided with approved safety shoes and leg protection. The wearing of safety shoes with steel capped toe protection will be mandatory for all personnel and visitors present on the construction site.

4.3 *MEDICAL SURVEILLANCE*

The Contractor is required to monitor the health of those workers executing hazardous tasks. In addition, the Contractor must ensure sub-contractors also comply with such requirements in relation to the workers they provide for such special tasks. Long-term/permanent workers are required to undergo pre-employment, periodic and exit medical exams.

(1) As referenced in the UK OHS Standards, 1989.

Prior to construction a medical practitioner must be consulted in order to develop a Medical Surveillance Programme based on the anticipated tasks to be performed. A Medical Surveillance Matrix must be completed and implemented.

Medical examinations are usually conducted in a manner which is acceptable to the operational requirements of the workplace as well as to the logistic restrictions placed on the medical team (travel, work tasks, nurse or doctor availability, whether the tests are conducted by outside providers, etc.).

4.3.1 *Pre-Employment Examinations*

These examinations must be conducted prior to employment, or at least within the first 14 days of employment. The responsibility to ensure that the examination is scheduled within the prescribed time deadline rests with the Contractor. These examinations are to be documented on the appropriate company form. Additional investigations over and above the standard examination are required only for certain job categories. These job categories and additional investigations must be identified during development of the Medical Surveillance Programme.

4.3.2 *Periodic Examinations*

These are to be performed at least annually. The schedule for these examinations and occupation's inherent medical requirements must be directed by the Medical Surveillance Programme and recorded. The responsibility to ensure that the examination is scheduled within the prescribed time deadline each year is usually shared between the Contractor and the sub-contractors.

4.3.3 *Exit Examinations*

These are to be performed on employees that leave the services of the company, and who were exposed to recognised hazards. The findings are to be documented. These medicals must, within reason, be planned timeously (e.g. within a week of termination of services). The reason is that unexpected findings may require further actions (such as other tests or referrals). The responsibility to ensure that the examination is scheduled within the prescribed time deadline rests with the Contractor.

4.4 MEDICAL AND FIRST AID FACILITIES

Access to adequate medical facilities shall be provided to maintain workers' health and to provide adequate responses in case of health emergency situations. First aid shall always be available on site. All construction site vehicles shall be equipped with first aid kits.
There shall be an adequate number of qualified first aiders on the construction site at all time. Each first aid box or first aid room shall be provided with a first aid register: First aid kits shall be refilled following every utilisation. Those shall include at least the following items:

- A leaflet giving general guidance on first aid, for example HSE leaflet Basic advice on first aid at work;
- Individually wrapped sterile adhesive dressings (assorted sizes);
- Two sterile eye pads;
- Four individually wrapped triangular bandages (preferably sterile);
- Six safety pins;
- Six medium-sized (approximately 12 cm x 12 cm);
- Individually wrapped sterile un-medicated wound dressings;
- Two large (approximately 18 cm x 18 cm) sterile individually wrapped un-medicated wound dressings; and
- One pair of disposable gloves.

Suitable emergency transport shall readily available for injured employees.

4.5 CONFINED SPACE ENTRY

All confined space entries will be subject to Permit-to-Work. By definition, a confined space:

- Is large enough for an employee to enter fully and perform assigned work;
- Is not designed for continuous occupancy by the employee; and
- Has a limited or restricted means of entry or exit.

These spaces may include underground rooms, tanks/vessels, storage bins, pits, vessels, silos and other similar areas. Before workers are required to enter a confined space, adequate and appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE must be verified by Contractor HSE Manager.

A permit shall be required before any workers enter a confined space. Adequate and appropriate rescue and/or recovery plans and equipment must be in place before the worker enters the confined space. Before a worker or group of workers enter any confined or enclosed space and before any work is commenced, the following precautions and safety measures shall be taken:

- The area shall be checked visually to ensure that the water level is below 10 cm and if water is present, a dry wooden platform shall be available for use (no electrical work to be undertaken if water is present);
- The air in the area shall be checked for:
    - Explosive gases, fumes and vapours (which must not exceed 25 % of its respective Lower Explosive Limit);
    - Oxygen content and (the oxygen content must be at least between 19.5 % and 23 %); and
    - Carbon monoxide (if any burning or products of burning have been involved).
- If any of the above is present over normal levels, the area shall not be entered until ventilation by blower is implemented;
- Approved types of breathing apparatus and other personal protective equipment shall be provided and made available for use by the worker or workers entering a confined space;
- No worker or group of workers shall enter a confined space unless a watcher is available who is familiar with the job and in contact with the worker/s at regular intervals and equally provided with breathing apparatus for ready use in case of emergency;
- No smoking or open lights, torches, arcs or flames shall be permitted in confined spaces;
- No spraying or painting using volatile solvents of oil shall be undertaken in confined spaces unless the necessary respiratory and other adequate protection (e.g. fire extinguishers) is provided;
- Any manhole, tank opening, or other opening which is left unattended must be protected during the day by barricades (and at night by barricades and lights) with appropriate warning signs; and

- Adequate means of ingress and egress from any confined or enclosed space shall be provided.

The inhalation of any fumes, gases or dusts by persons welding or cutting in confined spaces shall be prevented by the provision of:

- Local exhaust and general ventilation system to keep fumes, gases or dusts within allowable concentrations or threshold limit values; and
- Provision of approved types of respiratory protective equipment.

4.6 *WORKING AT HEIGHTS*

All works at height will be subject to Permit-to-Work. Any work above two (2) meters will be considered to be working at height. A Fall Protection Plan (FPP) must be prepared by the company in charge of the works before commencement of such works. This FPP must also be reviewed and approved by the Contractor HSE Manager before commencement of such works. The FPP shall include the following:

- Risk assessment of all work to be carried out from an elevated position;
- Procedures and methods to be used to address all the risks identified;
- Evaluation records of the employees' physical and psychological fitness necessary to work at elevated positions;
- The programme for training of employees working from elevated positions (including dated training records);
- The procedures and records for the inspections, testing and maintenance of all fall protection equipment; and
- Rescue and/or recovery plans and equipment to respond to workers after an arrested fall.

Workers working in unguarded surface above open pits or tanks, steep slopes, moving machinery and similar locations, or working from unguarded surfaces two (2) meters or more above water or ground, temporary or permanent floor platform, scaffold construction or where otherwise exposed to the possibility of falls hazardous to life or limb, shall be secured by safety belts and life lines.

Appropriate training must be given and recorded to workers for the inspection, maintenance and use of the fall prevention equipment used.

The Contractor shall implement a weekly inspection programme for all fall protection equipment used (including inspection of sub-contractor fall protection equipment). Fall arrest systems must be appropriate for the

specific task and must be approved by the Contractor. Fall prevention measures may include:

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area;
- Use of ladders and scaffolds by trained employees;
- Use of fall prevention devices, including a safety harness and lanyard travel limiting device to prevent access to fall hazard areas, full body harness used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor points or suitable secured horizontal life lines;
- Suitably design man-hoists/lifting cages; and
- Safety nets in situations where safety belts and life lines in guarded platforms and scaffolds or temporary floors are not feasible.

During works at height, a suitable space around the fall area must be clearly barricaded. Where harnesses with lanyards are used, these shall be inspected to make sure that the lanyard (with shock system extended) does not exceed the fall distance.

The following is applicable to working on ladders:

- Ladders shall be inspected before use and records of these inspections shall be maintained;
- Three-point contact will be maintained at all times when climbing a ladder;
- Ladders must protrude at least 1m above the structure that it is leaning against;
- Ladders must be tethered at the top structure; and
- An up to date register of ladders shall be kept on file.

Scaffolds shall be erected, added, altered or dismantled only under the supervision of the qualified person in charge of the construction. Every scaffold shall:

- Be capable of supporting twice the maximum load to which it may be subjected without exceeding the allowable unit stresses of the materials used;
- Have all standards diagonally and horizontally braced to prevent lateral movement; and
- Have no splices between the points of support of horizontal members and secured to prevent lateral movement.

Every platform, runway, ramp or stairway shall be kept free from any obstruction, materials, rubbish and projecting nails. When they become slippery due to the nature of work, steps shall be taken by way of sanding, cleaning or by any other means to roughen the surface. All working platforms, runways and ramps from which workers are liable to fall a distance of more than two metres (2 m) shall be:

- Provided with a suitable width to allow safe passage of persons and materials; and
- Provided with strong guard rails and suitable toe-boards.

4.7 *ELECTRICAL SAFETY*

All electrical works (works on electrical installation) will be subject to a Permit-to-Work.

4.7.1 *Electrical Installations*

The Contractor shall ensure that all construction electrical installations are:

- Sufficiently ventilated so as to maintain the equipment at a safe operating temperature;
- Constructed so as to be vermin proof, leakage proof, seepage proof and protected against flooding;
- Supplied with natural light where possible, and with artificial illumination (the intensity whereof shall not be less than 300 lux), which shall be controlled by a switch adjacent to the entrance so as to prevent danger to persons and to enable all equipment to be clearly distinguished, and all instruments, labels and notices to be easily read; and
- Provided with adequate fire extinguishing appliances suitable for use on electrical equipment, which appliances shall be maintained in good working order.

4.7.2 *Portable Electrical Tools*

Maintenance and repair work on electrical equipment shall only be conducted by a suitably qualified electrician. Electrical equipment shall be disconnected from all sources of electrical energy prior to any maintenance or repair being conducted. For electrical equipment which is liable to acquire or to retain an electrical charge, precautions must be taken by earthing or other means to discharge the electrical energy.

The Contractor shall implement a weekly inspection program for all electrical tools used (including inspection of sub-contractor equipment).

All portable electric tools must be fitted with a switch to allow for easy and safe starting and stopping of the tool. All hand-held powered tools, such as circular saws, chain saws, and percussion tools without positive accessory holding means, shall be equipped with a constant pressure switch that will shut off the power when the pressure is released.

No person shall use or permit the use of a portable electric tool with an operating voltage that exceeds 50 volts to earth unless:

- It is connected to a source of electrical energy incorporating an earth leakage protection device;
- It is connected to a source of electrical energy through the interposition between each tool and the source of an individually double-wound isolating transformer, the secondary winding of which is not earthed at any point and the construction;
- It is connected to a source of high frequency electrical energy derived from a generator which is used solely for supplying energy to such portable electric tool; or
- It is clearly marked that it is constructed with double or reinforced insulation.

No person shall use or permit the use of a portable light where the operating voltage exceeds 50 volts unless:

- It is fitted with a substantial handle which is made of non-hygroscopic, non-conducting material;
- All live metal parts or parts which may become live owing to a faulty circuit are completely protected against accidental contact;
- The lamp is protected by means of a substantial guard firmly fixed to the insulated handle; and
- The cable lead-in is such that the insulation can withstand rough use.

When power operated tools are designed to accommodate guards, they shall be equipped with such guards when in use. Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded if

such parts are exposed to contact by employees or otherwise create a hazard. Guards shall not be removed from power operated tools.

4.8 *LIFTING OPERATIONS*

All hazardous lifting operations (lifted objects over 10 tons and/or of large dimensions, lifts involving more than one crane and lifts with no clear line of sight) shall be subject to Permit-To-Work. A lifting equipment shall not be operated except by a person who is trained and possesses a certificate in writing to that effect from a recognised institution, to operate that equipment (unless such an equipment is operated by a person who is under the direct supervision of a qualified person for the purposes of training). No person under the age of eighteen years shall be employed to operate any lifting equipment driven by mechanical power or to give signals to the operator of any such machine. No lifting operations shall be allowed when the environmental conditions are hazardous (e.g. winds above 14m/s).

A register, containing the particulars of the following shall be kept in every workplace with respect to all chains, ropes or lifting tackle (except fibre rope slings). Every lifting appliance including working gear and all other plant equipment used for anchoring or fixing shall:

- Be of good mechanical construction, of sound material and adequate strength for the load it will carry; and
- Be properly maintained and inspected at least once a week and the result of such inspection shall be recorded in a log book maintained by the employer or user of the equipment, open to enforcing authority.

Any anchoring or fixing arrangement provided in connection with a lifting equipment shall be adequate and secure to hold the load. Every crane and winch shall be provided with a brake to prevent the fall of the load and to control operation when the load is lowered. Every handle or lever of a lifting equipment provided for controlling its operation shall be provided with suitable locking arrangement to prevent its accidental movement, and shall have upon it clear marking to indicate purpose and mode of operation. Sides of platforms more than 2 meters high shall be provided with a suitable guardrails and toe-boards. The operator of every power driven lifting appliance shall be provided with a cabin which must:

- Ensure protection from the weather and falling objects; and

- Be constructed to afford ready access to operating parts of the lifting appliance within the cabin and shall be periodically inspected and maintained.

When lifting appliances are used on soft or uneven ground or on a slope, adequate measures shall be taken to ensure their stability or undue movement. No crane shall be used for raising or lowering loads unless it is securely anchored and adequately balanced by a weight properly placed and secured. Safe working loads shall be plainly marked on every lifting appliance and in case of a crane with variable operating radius, safe load at various radii shall be displayed in the operator's cabin or fitted with an automatic safe load indicator. The maximum load allowed shall be affixed in a place where it can be readily be seen by the lifting equipment operator. No lifting appliance shall be loaded beyond its safe working load.

Every chain or rope shall be properly secured. The hosting mechanism of a crane shall not be used to pull the load sideways unless it is ascertained that no undue stress is imposed on the crane structures and its stability is not endangered. No lifting appliance shall be used unless it has been tested and examined thoroughly initially and annually thereafter by a competent person by way of his training and experience in such work.

No lifting appliance which has undergone substantial alteration or repair affecting its strength or stability shall be used unless it is tested and thoroughly examined by a competent person and allowed by the manufacturer.

Every hoist shall be efficiently protected by enclosures and when access to the hoist is necessary, it shall be fitted with gates. A notice prohibiting overloading of the hoist shall be placed on the platform or cage of the hoist. Hoist for the carriage of goods and materials shall be of such construction that it is operated outside of the cage unless the doors of the cage and the enclosure are of the interlocked type. Hoist for the carriage of persons shall have the doors of the cage and enclosure of hoist-way of interlocked type and the cage completely covered and fitted with overrun devices. No person shall be raised, lowered or carried by a power driven lifting appliance except:

- On the driver's platform in case of a crane or a hoist, or

- On an approved suspended scaffold, or

- When the use of hoist or suspended scaffold is not reasonable, provided that:

    - The appliance can be operated from one position only;

- The winch used is so constructed that when control lever or switch is not held in operating position, brake is applied and disengages from pawl and ratchet gears;
- No person is carried except in a chair or cage, or a safe skip or other receptacle at least 1.5 meters deep, and measures are taken to prevent the chair, cage, skip or receptacle from spinning or tipping in a manner dangerous to any occupant.

After erection or alteration, every hoist shall be tested and examined every six months (or after any modifications/extensive repairs) by a competent person and the result of such tests and examination shall be recorded in a logbook maintained by the HSE Manager. Where the examination shows that the hoist or lift cannot continue to be used with safety unless certain repairs are carried out immediately or within a specified time, the person making the report, shall:

- Inform the HSE Manager within twenty-four hours of the completion of the examination; and

- Send a written notice of the examination in the prescribed form containing the prescribed particulars to the area occupational safety and health office within seven days of its occurrence.

No chain, rope or lifting gear shall be used unless:

- It is of good construction, sound material, of adequate strength, suitable quality and free from potent defects; and
- It has been tested and examined by a competent person specifying the safe working load.

A table showing the safe working loads of every kind and size of chain, rope or lifting accessory in use, and, in the case of a multiple sling, the safe working load at different angles of the legs, shall be prominently displayed on the premises.

No wire rope shall be used for lifting and lowering of any load if, in any 10 meters length, the total number of visible broken wires exceeds five percent of the total number of wires in the rope. No chain, rope of lifting gear shall be loaded beyond its safe working load except for the purpose of testing.

No chain, ring hook, link, clamp, shackle, swivel or eyebolt altered or repaired by welding shall be used unless it is tested and examined and its working load specified in the test. Hooks on lifting equipment shall have devices to prevent displacement of sling or load (e.g. safety catch).

When using double or multiple slings, the upper ends shall be connected by means of shackle, ring or link of adequate strength. Chains with knots or

chains shortened by means of bolts and knots inserted through the links or by welding shall not be used.

No chain, rope or lifting gear shall be used unless it is thoroughly examined by a competent person at intervals of six months and the result of examination recorded in a log book maintained by the Contractor HSE Manager.

When the operator of a power driven crane, shovel forklift truck, front-end loader and similar machinery is exposed to overhead hazards, a cab, screen or other overhead protection shall be provided.

When a worker is endangered by the rotation or uncontrolled motion of a load being hoisted by a crane or similar hoisting machine, one or more guide ropes or tag lines shall be used to prevent rotation on uncontrolled motion.

4.9 HOT WORKS

Hot works are any works where equipment or materials used can lead to fire due to the generation of sparks or excessive heat. This includes welding, cutting, brazing, soldering, grinding, burning and any other work involving naked flames, sparking or generation of heat. The Contractor shall abide by the following requirement regarding hot works:

- Hot works may not be conducted without a valid Permit-To-Work;
- Hot works must be properly planned and conducted in a safe manner;
- All personnel involved in hot works must be adequately trained, competent, qualified and authorized to perform their task;
- Adequate ventilation (natural, technical or local extraction) has to be provided for hot works with a potential to generate hazardous fumes or dust;
- Falling and flying sparks need to be contained and site equipment protected by the use of fire-resistant screens and/or mats. Protective screens are to be installed to prevent welding flash injuries to site personnel during electric arc welding;
- Firefighting equipment shall be made available for all hot works activities; and

- Appropriate Personal Protective Equipment (PPE) must be worn, specifically heat and flame resistant clothing.

4.10 *EXCAVATIONS AND EARTHWORKS*

The Contractor shall abide by the following requirement regarding excavations and earthworks:

- Excavation works may only be performed with a valid Permit-To-Work. It shall include the applicable control categories and detail any services that are buried within the proposed area of excavation;

- All personnel involved in excavations and earthworks must be adequately trained, competent, qualified and authorized to perform their task;

- Equipment, vehicles and machinery must be in good working condition;

- Excavations must be inspected by a competent person upon completion and on a daily basis; and

- Appropriate Personal Protective Equipment (PPE) must be worn, specifically high-visibility clothing.

4.11 *HEAVY EQUIPMENT AND CONSTRUCTION SITE VEHICLES*

The Contractor shall implement an inspection and maintenance program for all heavy equipment and construction site vehicles used (including inspection of sub-contractor equipment). Areas used by heavy construction equipment must be separated as far as practical from the areas used by pedestrians and construction site vehicles. All heavy equipment must be:

- Stable under all foreseeable operating conditions;

- Allow safe access to and from the cab and other working locations on the vehicle;

- Have effective braking systems;

- Provide adequate visibility for the driver all around the vehicle;

- Be equipped with headlights, reversing lights, a horn, windscreen wipers, seatbelts, reversing alarms (visual and acoustic), a fire extinguisher and a communication system;

- Be equipped with physical guards to protect dangerous parts such as power take-off shafts, chain drives, trapping points and exposed exhaust pipes;

- Provide protection for the driver from work hazards, e.g. falling from the vehicle, falling objects and the effects of the vehicle overturning; and

- Protecting the driver from the weather, noise, vibration, noxious fumes and dusts.

All operators must be adequately trained and qualified to operate heavy construction equipment. The following procedures regarding heavy equipment must be followed:

- Heavy equipment must be checked at the beginning of each shift to ensure that the parts, equipment, and accessories are in safe operating condition. Any defective parts or equipment must be repaired or replace prior to use;

- Operating areas of heavy equipment shall be marked as exclusion zones and shall be adequately delineated and barricaded;

- The driving speed must always be adjusted to the surface conditions and the weather;

- One or more signalmen shall assist heavy equipment operator when their view is obstructed;

- An unattended vehicle parked on sloping ground or adjacent to an excavation shall have its brakes applied and the wheels blocked to prevent movement;

- Vehicles cannot be operated in reverse with an obstructed rear view unless it has a reverse signal alarm capable of being heard above ambient noise levels or a signal observer indicates that it is safe to move;

- Vehicles loaded from the top (e.g. dump trucks) must have cab shields or canopies to protect the operator while loading;

- Vehicles used to transport workers must have seats, with operable seat belts, firmly secured and adequate for the number of workers to be carried;

- Heavy equipment must have roll-over protection and protection from falling debris hazards as needed;

- Heavy equipment are only allowed to drive on public roads if the roads are constructed and maintained to safely accommodate the equipment and vehicles involved and if it is permitted by law;

- Heavy equipment's capacity or safety features cannot be modified without the manufacturer's written approval;

- Works or other operations involving heavy equipment under overhead lines must be avoided as far as practicable;

- When construction equipment are being fuelled, ignition sources must be at least 10 m away from fuelling areas, smoking must be prohibit smoking in fuelling areas; and vehicles must be constantly attended; and

- When not in use, heavy equipment and construction site vehicles shall be parked with adequate manner with appropriate distance to each other. Engines must be turned off, keys removed and booms or similar structures lowered. Fuel caps must be locked and secured.

4.12 HAZARDOUS MATERIALS MANAGEMENT

Hazardous materials are defined as chemicals (including corrosive, oxidizing and reactive chemicals) and flammable substances. All hazardous materials must be labelled in accordance with the *Globally Harmonized System (GHS) of Classification and Labelling of Chemicals*. Hazardous material storage locations must be constructed of chemical/flame resistant material, and must be provided with secondary containment (that can contain at least 110% of the combined volume).

All staff handling hazardous substances must be trained on the specific hazards and be given appropriate PPE to wear. Eating, drinking or smoking in workplace where hazardous substances are present shall not be permitted. A suitably designed eating place must be established.

If the site transports hazardous substances, the marking, labelling and storage of hazardous substances for safe transport shall be in accordance with existing legislation. If such legislation is not in place, transport must be undertaken in accordance with the recommendations on the transport of hazardous substances or dangerous goods made by the United Nations.

The Contractor shall develop an Inventory of Hazardous Materials sheet describing all hazardous materials, the associated volumes, Chemical Abstracts Service (CAS) number, classification and storage location. Safety Data Sheets (SDSs) shall be maintained for all hazardous materials. The SDSs for all substances stored at a particular location must be kept at that

location. The SDSs shall be communicated to all relevant personnel as part of training for workers handling hazardous materials

All containers containing hazardous substances, including pesticides, which are stored, handled or used at the workplace, whether temporarily or permanently, shall properly labelled according to regulations pertaining to the classification, marking and labelling of hazardous substances. Hazardous substances shall not be stored in containers which by means of their appearance can be mistaken for containers containing harmless substances.

The concentration of airborne contaminants in the breathing zone of an employee shall be below legally specified Occupational Exposure Limits (OELs). If these are not specified in law, the US limits are to be applied. (1) Female employees who are pregnant, or who are likely to be pregnant shall not work in areas where hazardous chemical substances (e.g. lead, organic mercury, polybromophenylene, polychlorobiphenylene, arsenic, cadmium, carbon disulphide, estrogenic compounds, aromatic chlorinated hydrocarbons, organophosphate pesticides or nicotine) are stored or handled.

Incompatible chemicals shall not be stored in a common location (e.g. acids with cyanides; acids with bases; oxidizing agents with organic compounds or solvents). Compatibility charts must be provided at all areas where chemicals are stored.

The following controls shall be implemented when handling corrosive, oxidizing and reactive chemicals:

- Segregated from flammable materials and from other chemicals of incompatible class (refer to the compatibility chart);
- Stored in well ventilated areas with appropriate secondary containment to prevent intermixing during spills;
- First aid shall be available where these chemicals are handled or stored;
- Workers handling these chemicals must be provided with (and wear) appropriate PPE (e.g. gloves, apron, splash suits, face shield, goggles, etc.); and
- Safety showers and eye-wash facilities shall be provided at suitable locations where hazardous substances are stored and handled.

(1) Permissible exposure limits are published in the U.S. Code of Federal Regulations, Occupational Safety and Health Standards on Toxic and Hazardous Substances, 29 CFR 1910.1000, Tables Z-1 , Z-2 , and Z-3.

The following controls shall be implemented when handling flammable substances:

- Stored away from ignition sources and oxidizing materials;

- The flammable storage areas must:

  - Be remote from entry and exit points to the site and buildings;
  - Away from facility ventilation intakes or vents;
  - Have floor and ceiling level ventilation and explosion venting;
  - Have spark-proof fixtures installed;
  - Be equipped with suitable fire extinguishing devices; and
  - Constructed of material made to withstand flame impingement for a moderate period.

- Permanent storage vessels shall be grounded;

- All electrical apparatus and equipment which may come into contact with flammable fumes shall be flame-proof;

- All stationary metal tanks used for storage of flammable substances shall be earthed by means of electrically conductive material;

- All drums, cans or other containers used in connection with volatile flammable substances shall be kept securely closed when not in use and, after a drum, can or other container has been emptied, such drum, can or container shall be removed from the premises without delay;

- Bonding shall be provided between containers during dispensing/filling; and

- Fire extinguishers shall be close at hand during dispensing/filling operations.

All hazardous waste (spills, contaminated PPE, hazardous substance containers, etc.) shall be handled according to the ESMP.

4.13 *WORKPLACE HYGIENE*

4.13.1 *Housekeeping*

Accumulation of dirt and refuse within the construction site must be avoided. Waste must be kept in suitable containers or litter-bins which are located at convenient locations in the workplace. The containers must be emptied daily, preferably near the end of each working day. Floor covering

materials must be suitable for the work and easy to clean. Equipment, tools, containers and small items on work benches must be kept neat and arranged in an orderly fashion. Sufficient space for storage of articles and goods shall be provided. Precautions must be taken when hazardous substances are stored or used. Containers must be clearly labelled on the contents thereof. Outside storage areas and laydown yards shall be maintained in an orderly fashion in order to avoid trips, slips and falls, and in order to prevent object falling. The floor of every workroom (e.g. construction site office) shall be cleaned at least once in every week.

4.13.2 *Ventilation*

Suitable atmospheric conditions shall be maintained in workrooms (e.g. construction site office) by natural or artificial means to avoid insufficient air supply, stagnant or vitiated air, harmful drafts, excessive heat or cold, sudden variations in temperature, and where practicable, excessive humidity or dryness and objectionable odours.

The fresh air intake points of a ventilation system shall be away from any source of contaminants. An exhaust system shall be provided if harmful substances are generated. Dusts, gases, vapours, or mists generated and released in work processes shall be removed at the points of origin and not permitted to permeate the atmosphere of the workrooms.

Internal combustion engines fuelled by gasoline, diesel or liquefied petroleum gas (LPG) installed in workrooms shall be located such that exhaust gases are prevented from permeating the atmosphere of the workrooms.

Where an adequate supply of fresh air cannot be obtained by natural ventilation, or where it is difficult to get the desired amount of air at the centre of the workrooms without creating uncomfortable drafts near the inlets, mechanical ventilation shall be provided. Mechanical ventilation systems must be maintained in good working order. Re-circulation of contaminated air is not acceptable. Air inlet filters must be kept clean and free of dust and microorganisms. Visible deposit or dirt on the fans and ductwork system is likely to cause health risks and must be removed.

Heating, ventilation and air conditioning and industrial evaporative cooling systems must be equipped, maintained and operated so as to prevent growth and spreading of disease agents (e.g. *Legionnella pneumophilia*) or breeding of vectors (e.g. mosquitoes and flies) of public health concern.

The fresh air supply rate required for a workplace varies with the nature of the activities and the degree of occupancy. In general, clean fresh air shall be supplied to enclosed workplaces at an average rate of not less than 20 to

40 cubic meters an hour per worker, or at such a rate as to effect a complete change of air a number of times per hour varying from four (for sedentary workers) to eight (for active workers).

4.13.3 Lighting

The use of natural light for lighting purposes must be used where practical to do so. Windows and openings must be provided with protection from direct sunlight to avoid glare (e.g. by use of tint, curtains or blinds).

Emergency lighting of adequate intensity (not less than 0.3 lux) must be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

All glazed windows and skylights used for the lighting of workrooms shall, so far as practicable be kept clean on both the inner and outer surface and free from obstruction.

The artificial lighting provided must be such that there is no risk of accident to all employees (too dim), nor must it be damaging to their eyesight such as causing glare (too bright) or visual fatigue.

The recommended optimum average illumination values are provided in *Table 4.4.1* as referenced from the UK OHS Standards, 1989.

Table 4.4.1 Optimum Average Illumination Values

Item	Task position or Area	Optimum average illumination (in lux)
Offices	General offices	500
	Computer work stations	500
	Drawing work stations	750
	Other areas (e.g. file storage and reception, telephone operators)	300
Manufacturing/Processing	Control Rooms	500
	Handling of hazardous substances	500
	Handling of non-hazardous substances	200
	Simple assembly, rough bench, machine and inspection work	300
	Medium assembly, bench, machine and inspection work	500
	Assembly of precision components, fine bench, machine and inspection work	1 000
Distribution and storage	Loading bays	150
	Unpacking, sorting	200

Item	Task position or Area	Optimum average illumination (in lux)
	Rack storage	300
Catering	Food preparation and cooking	500
	Wash up areas	300
	Food storage	150
General building areas	Entrances, lobbies, waiting rooms, gatehouses	200
	Enquiry desks	500
	Corridors, passageways, stairs, lifts	100
	Car parks	50
	Emergency equipment locations	50
	Emergency lighting	10
Construction site	Site clearing, excavation and soil work	200

4.13.4 *Drainage*

All drainage networks (effluent and storm water) must be well maintained and under no circumstances must dirt be allowed to accumulate within the drainage network.

4.13.5 *Welfare facilities*

Suitable and sufficient sanitary conveniences and wash basins must be provided at readily accessible places within the construction site.

Sanitary facilities must be provided for men and women separately. The facilities must be maintained in a clean and hygienic manner. The conditions of cleanliness of the sanitary facilities must be inspected regularly (e.g. weekly) by appointed personnel. Breakdowns of the units, blockage of the pipes or leakage must be reported immediately for repair to the Contractor HSE Manager.

Changing rooms, if present, must be equipped with lockers. Showers with hot and cold water supply are required and must be readily accessible from workrooms (where practical).

When dangerous operations (e.g. regular handling of hazardous substances) are carried out in a workplace, an emergency shower or eye-washers must be provided at suitable locations. All the facilities must be properly maintained and be kept sanitary for use in emergency situations.

Suitable drinking water shall be provided at suitable points. The quality of the drinking water shall comply with local regulations. A supply of

drinking water which is not laid on shall be contained in suitable vessels, and shall be renewed at least daily. All practicable steps shall be taken to preserve the water and vessels from contamination. A drinking water supply shall be clearly indicated.

ANNEX G EMERGENCY PREPAREDNESS AND RESPONSE PLAN

CONTENTS

LIST OF TABLES

Glossary of Key Acronyms and Terms

Term/ Abbreviation	Definition/ Meaning
Audit	Systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.
ECC	Emergency Control Centre
EHS	Environment, Health and Safety
Emergency	A physical situation or an incident that presents an immediate risk to health, life, property or the environment.
Emergency Response	Action taken in response to an unexpected and dangerous occurrence in an attempt to mitigate its impact on people or the environment.
EPRP	Emergency Preparedness and Response Plan
ERT	Emergency Response Team
Evacuation	Temporary but rapid removal of people from building or threatened area as a rescue or precautionary measure due to an emergency.
GIIP	Good International Industry Practice
ha	Hectares
IC	Incident Controller
IMT	Incident Management Team
Incident	A work-related event in which injury or ill health or harm to people or the environment did occur, or could have occurred.
Km	Kilometres
MW	Mega-watts
m^3	Cubic metre
Policy	A statement of the overall intentions and direction of the organisation as formally expressed by top management. It provides a framework for action and for the setting of objectives.
Procedure	An established way to carry out an activity or a process. Note: Procedures can be documented or not.
Project ("the Project")	Maria Gleta 2 IPP Project in Benin comprising construction and operation of a new 144MW combined-cycle, thermal power generation plant made up of the following: • Seven dual-fuel reciprocating engines each producing 18.2 MW for a total of 127 MW (MAN Group 18V51/60 DF units are specified), with a load factor considered to 95 percent; • Steam turbine system producing 18 MW; • Plant support infrastructure.
Project Personnel	All persons working for, or on behalf of the Project, including contractors and subcontractors.
TBC	To Be Confirmed

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document is the Construction Emergency Preparedness and Response Plan (EPRP) for the Maria Gleta IPP Project in Benin. It applies to the construction of the project, including site-related work areas outside the perimeter fencing. Its overarching objective is to ensure readiness to respond to a foreseeable emergency at the construction project to minimize the impact on the safety and health of employees, the local community, and the environment. Potential foreseeable emergencies on the project site include:

- Injury/illness on-site (i.e. medical emergency);
- Material damage;
- Fire (including bush fires);
- Major spill (land or water);
- Major gas leaks; and
- Security incidents (e.g. civil unrest, bomb threats and terrorism).

This EPRP sets out the arrangements and defines the responses to such foreseeable emergencies at the construction project. The EPRP identifies the responsible controller of an emergency based on which part of the site the emergency originates. It also describes liaison and communication on- and off-site and joint response with the emergency services.

This document should be read in conjunction with the Construction Environmental and Social Management Plan (C-ESMP).

1.2 PROJECT OVERVIEW

The Project comprises construction and operation of a new 144MW combined-cycle, thermal power generation plant made up of the following:

- Seven (7) dual-fuel reciprocating engines each producing 18.2 MW for a total of 127 MW (MAN Group 18V51/60 DF units are specified), with a load factor considered to 95 percent. The plant will be designed for a minimum lifetime of 25 years or 200,000 hours of operation;

- Steam turbine system producing 18 MW; and

- Plant support infrastructure including:

  - Liquid fuel storage tanks (3 x 3,500 m3) and truck offloading station;
  - Connection to natural gas supply manifold;
  - Connection to power grid sub-station; and
  - Plant support facilities.

The power plant will be built on a portion of a 20ha parcel of land located in the town of Maria Gleta about 20 km to the west of the city of Cotonou, Benin. The parcel is located in an urbanised area with surrounding, relatively dense residential, business, and industrial development. The Project site is adjacent to other existing and planned power plants.

1.3 DOCUMENT CONTROL

The EPRP is a "live" document and will continue to developed and evolve throughout the construction phase. This document will be reviewed regularly to ensure the approach to emergency preparedness and response fit-for-purpose and continues to align with relevant Good International Industry Practice (GIIP). Updates of this document may also occur due to significant management of change or in the event of new EPRP management and monitoring controls being generated from other key Project sources (e.g. permits).

2 ROLES AND RESPONSIBILITIES

2.1 PROJECT SENIOR MANAGEMENT (OFF-SITE)

- Responsible for attending the site upon being informed of a major incident and emergency evacuation, if requested by the Incident Management Team (IMT);

- Responsible for providing initial contact with media upon being informed of a major incident and emergency evacuation; and

- Responsible for communicating with the Developers (the Consortium) Senior Management regarding the emergency and its status.

2.2 CONSTRUCTION PROJECT MANAGER

- Accountable for the implementation of this EPRP;

- Responsible for making available the required resources and support for the implementation of this EPRP;

- Responsible for assuming IMT roles as described in this EPRP;

- Responsible for declaring an emergency and evacuation in the construction area; and

- Responsible for liaising with Project Senior Management in the event of an emergency.

2.3 ENVIRONMENT, HEALTH AND SAFETY (EHS) PROJECT TEAM

- Responsible for ensuring that emergency evacuation tests are carried out for the whole site at an early stage of construction and then at least twice a year, in conjunction with site management personnel;

- Responsible for maintaining a register of emergency equipment; and

- Responsible for program of inspection and testing of emergency equipment.

2.4 SUPERVISORS

- Responsible for assuming IMT roles as per this EPRP; and

- Responsible for undertaking roll calls of employees during an emergency and liaising with the IMT and Emergency Response Team (ERT).

2.5 *EMERGENCY RESPONSE TEAM (ERT)*

- Responsible for responding to emergency calls and coordinating the response; and

- Responsible for managing incidents in line with the following objectives:

  - Protect all workers, visitors, assets and the environment;
  - Tackle fires where possible as a first response;
  - Coordinate response actions to contain and control the scene;
  - Cordon off the incident site and prevent unapproved access;
  - Inform and obtain the necessary support and resources from the IMT;
  - Integrate and coordinate assistance by external emergency agencies (e.g. emergency services) with the IMT where it affects the wider site;
  - Provide limited primary medical care support and assistance; and
  - Inform the IMT of the situation at the scene and its impact on people, the environment, assets and business continuity.

2.6 *INCIDENT MANAGEMENT TEAM (IMT)*

- Responsible for the coordination of the response to all major emergency incidents on the construction Project site;

- Responsible for coordinating the immediate response to major or severe incidents requiring external services and/or affecting multiple areas of the site;

- Responsible for coordinating external communication;

- Responsible for coordinating any evacuation in the event of a major emergency at the operational site;

- Responsible for facilitating and participating in reviews following drills or emergency incidents; and

- Responsible for facilitating the investigation of incidents leading to an emergency incident on the construction site.

The IMT shall consist of an Incident Commander, the On-scene controller, an ERT member and a Security Advisor. The Incident Commander has overall accountability and responsibility for directing an emergency response.

2.7 *ALL EMPLOYEES*

- Responsible for following the emergency procedure as set out by this EPRP;
- Responsible for notifying their Supervisors immediately of any situation or incident considered an emergency;
- Responsible for immediately evacuating areas in an emergency and preventing entry of unauthorized personnel if required; and
- Responsible for supporting the IMT with emergency response measures, as directed by the controlling IMT and ERTs.

2.8 *CONTRACTORS AND SUBCONTRACTORS*

- Responsible for appointing personnel acting as Contractor Emergency Coordinator, to aid during evacuations and to perform roll calls;
- Responsible for bringing environmental response equipment to the site for the nature and scale of works undertaken;
- Responsible for following the emergency procedure as set out by this EPRP; and
- Responsible for following instructions from the IMT in the event of an emergency.

2.9 *KEY CONTACTS UNDER THIS EPRP FOR EMERGENCY RESPONSE*

Table 2.1 Key Emergency Response Roles and Contacts and Duties

ROLE	STAFF MEMBER(S)	DUTIES
Construction Project Manager	TBC	• Declare the emergency, initiate site evacuation. • Declare the site clear of an emergency.
Incident Commander (IC)	TBC	• Overall responsibility for directing response to an emergency. • The IC will not usually attend the scene of the incident instead remaining in a position where the incident can be effectively coordinated and controlled; • Assumes control of the incident and provides the necessary central coordination and issuing necessary instructions; • Launches specific emergency response action plan(s); • Monitors situation and escalates action as appropriate; • Declares an end to the emergency and co-coordinating the recovery process; and • Oversees incident investigation and review (lessons learned).
On-Scene Controller	TBC	• Attends scene of incident; • Determines the type and scale of the incident; • Carry out duties as directed by IC; • Supports the IC to coordinate the response actions; and • Gathers information for investigation.
Emergency Response Team (ERT)	Site medical Personnel TBC Site Fire Warden TBC Specialists e.g. work at heights rescue personnel, scaffolders TBC	• Treatment of medical casualties; • Containment of fires and/or environmental releases; • Liaise with other specialists to make incident scene safe; • Provide technical advice to IC including the need for external emergency services; and • Perform pro-active activities together with EHS team such as training of personnel, inspections of areas/equipment and partaking in risk assessment and method statement development for high-risk activities.
	Fire Warden(s) TBC	• Evacuates personnel to Assembly point; provide handover report to emergency services personnel.
	First Aider(s) TBC	• Provides emergency first aid medical care as required; provide handover report to emergency services personnel.

3 EMERGENCY PREPAREDNESS REQUIREMENTS

3.1 GENERAL EMERGENCY PREPAREDNESS MEASURES

The following general emergency preparedness measures must be followed at all times:

- Establish an adequate emergency organisation able to respond to the scene of incidents which occur on site;
- Display of adequate emergency procedures on site;
- Adequate training of all personnel on the emergency procedures;
- Adequate training and amount of personnel with specific functions in case of emergencies, e.g. firefighting, first aid, natural disaster response or emergency coordination; and
- Adequate daily construction site practice, including:
  - Emergency access or egress to be kept clear at all times;
  - Waste bins to be emptied regularly and passageways to remain unobstructed;
  - Electrical control panels and switchgear to remain unobstructed at all times;
  - Flammable goods and chemicals and all other hazardous substances to be stored appropriately;
  - Firefighting equipment and any other emergency equipment to be fully operational and tested; and
  - Maps to be posted at the workplace showing evacuation routes, first aid facility/equipment; fire extinguishers and assembly points.

3.2 FIRE PREVENTION

The construction site must be equipped with adequate and strategically placed fire-protection equipment, fire-fighting equipment, emergency lighting and signage in accordance with applicable Beninese laws. Fire-prevention and fire-extinguishing equipment and installations, emergency lighting and signage must be regularly inspected. The inspections must be documented. Fire-protection or firefighting equipment may not be relocated without site management approval. Fire extinguishers must be selected according to the types of fire hazard in line with the following classification:

- Type A: Ordinary combustibles such as wood, cloth, paper, rubber and many plastics;

- Type B: Flammable liquids, such as petrol, diesel, oil, grease, tar, oil based paints, lacquer and flammable gases;

- Type C: Energized electrical equipment, including wiring, fuse boxes, circuit breakers, machinery and appliances; and

- Type D: Combustible metals including magnesium and potassium (uncommon).

The manufacturer´s operation instructions must always be followed when fire extinguishers are being used. Used extinguishers shall be replaced immediately.

3.3 EMERGENCY PREPAREDNESS AND RESPONSE TRAINING

3.3.1 *General Site Induction and Refresher Training*

The Project site induction must instruct new employees, visitors and contractors on the information contained in this EPRP in relation to their duties, the emergency arrangements and alarm sounds. Refresher training must be undertaken as required, at a minimum of once per year. Key contacts and the emergency arrangement information must be displayed in prominent locations on site, particularly near construction site office and meeting points. All supervisor shall keep documentation of key contacts and emergency arrangements information with them at all times.

3.3.2 *Emergency Communication and Response Team Training*

All members of the ICT and ERT must attend generic training covering aspects such as communications, incident response scenarios etc. In addition, each individual of the ICT and ERT must attend specialist skills training suitable for their role, including, but not limited to:

- First Aid;
- Fire wardens;
- Hazardous materials handling; and
- Confined space.

3.3.3 *Emergency Drills*

Evacuation drills for all persons must be held for all areas at least twice a year. These drills are intended to demonstrate and improve skills for safe evacuation in the event of a major emergency situation occurring.

Full-scale practical exercise shall be organised yearly based on scenarios covered in the EPRP (e.g. bomb threat, gas leak). These drills shall be conducted for viable scenarios on the site and have passive observers (these can be external observers or onsite personnel as appropriate) noting the factual aspects of the drill. These exercises shall be are organized and led by the Contractors and involve all contractors/subcontractors and external agencies as required. Following the drill, a formal review must be undertaken jointly by the IMT, ERT, contractors and any other relevant involved party in order to identify the effectiveness of the actions, training, equipment etc. and identify corrective actions if necessary. This EPRP and associated documentation shall be updated as a result of such exercises, if necessary.

3.4 *EMERGENCY ARRANGEMENTS AND EQUIPMENT*

3.4.1 *Emergency Assembly Points*

Adequate and sufficient emergency evacuation routes and assembly points must be defined throughout the various construction stages of the Project. These assembly points shall be moved to different locations when construction activities disrupt access to the established emergency assembly points. Any changes regarding assembly points (e.g. change in location) must be communicated to all personnel. All documentation related to emergency preparedness and response (e.g. site induction training) shall also be updated to reflect those changes.

3.4.2 *First Aid Arrangements*

The Contractor shall establish a first aid facility staffed by a professional nurse, paramedic or doctor based on risk assessment and applicable laws. The Contractor shall provide its personnel with adequate first-aid provisions in the workplace. A minimum of one first aider for up to 20 employees must be provided. If more stringent local requirements apply, these must be met. First-aiders shall hold an accredited first-aid certification in line with the local requirements. The Contractor shall include the names of their first-aid and/or medical personnel along with their certifications in their emergency procedures. All first aid personnel on site shall be clearly recognisable (e.g. by first aider labels on the helmet). The Contractor shall also identify external medical treatment and rescue services.

3.4.3 *Emergency Control Centre*

The Contractor shall establish an Emergency Control Centre (ECC). The ECC will be a meeting point for IMT members to manage an emergency. It will provide a central point of information for the coordination of an emergency, including coordination of access for the emergency services.

3.4.4 *Emergency Equipment*

The Contractor shall provide sufficient and adequate emergency response equipment, including:

- First aid kits;
- Firefighting equipment such as extinguishes and hoses; and
- Spill kits.

The location of the emergency response equipment shall be communicated to all site personnel, contractors and visitors. All contractors/ subcontractors are required to bring environmental response equipment (e.g. spill kits) of sufficient size/quantity to the site for the nature and scale of the works being undertaken. The quantities of these materials and resources must be determined by their own risk assessments. The EHS Team shall maintain a list of emergency response equipment. The register includes identification numbers (if applicable), test/inspection dates, location and responsible party. All emergency response equipment shall be clearly labelled. Tampering with emergency equipment without authorization shall be strictly prohibited.

Emergency equipment must be subject to a program of regular maintenance in line with the manufacturer's recommendations and/or legislative requirements. This includes:

- Testing and inspection of fire-fighting equipment including any alarm and fire water pumps;

- Testing of fire alarms at a minimum every six months to ensure they remain operational;

- Routine checking of first aid equipment to ensure the contents are in place and within expiry dates and to re-stock any missing items; and

- Regular checking of fire evacuation routes, equipment and assembly points to ensure they are clear of obstructions, that fire doors are working and not locked, and that routes are suitably illuminated.

The Contractor, with the Project Area of Influence (as defined in the C-ESMP), is responsible for maintaining any emergency response equipment on the construction site areas.

4 EMERGENCY RESPONSE REQUIREMENTS

4.1 GENERAL RULES FOR ENCOUNTERING INCIDENTS

For all personnel and contractors who discover a fire, fuel or oil spill, injured person, security incident at the construction site, in accordance with this EPRP, the individual must:

- Ensure they are not in, or do not put themselves in, danger from the harmful effects or potentially harmful effects of the emergency;

- Provide first aid if qualified as a first aider;

- Raise the alarm if applicable; and

- Call the required contact:

  - Give concise details of the nature of the emergency;
  - Advise of the approximate location and extent of the emergency and any persons involved;
  - Advise of a requirement for a trained first-aider to be present; and
  - Provide their name and contact details.

- Evacuate the area if the emergency escalates is beyond their capability to control.

Detailed emergency procedures depending on the circumstances are described in *Appendix 1* and *Appendix 3* of this document.

4.1.1 General Emergency Response Coordination

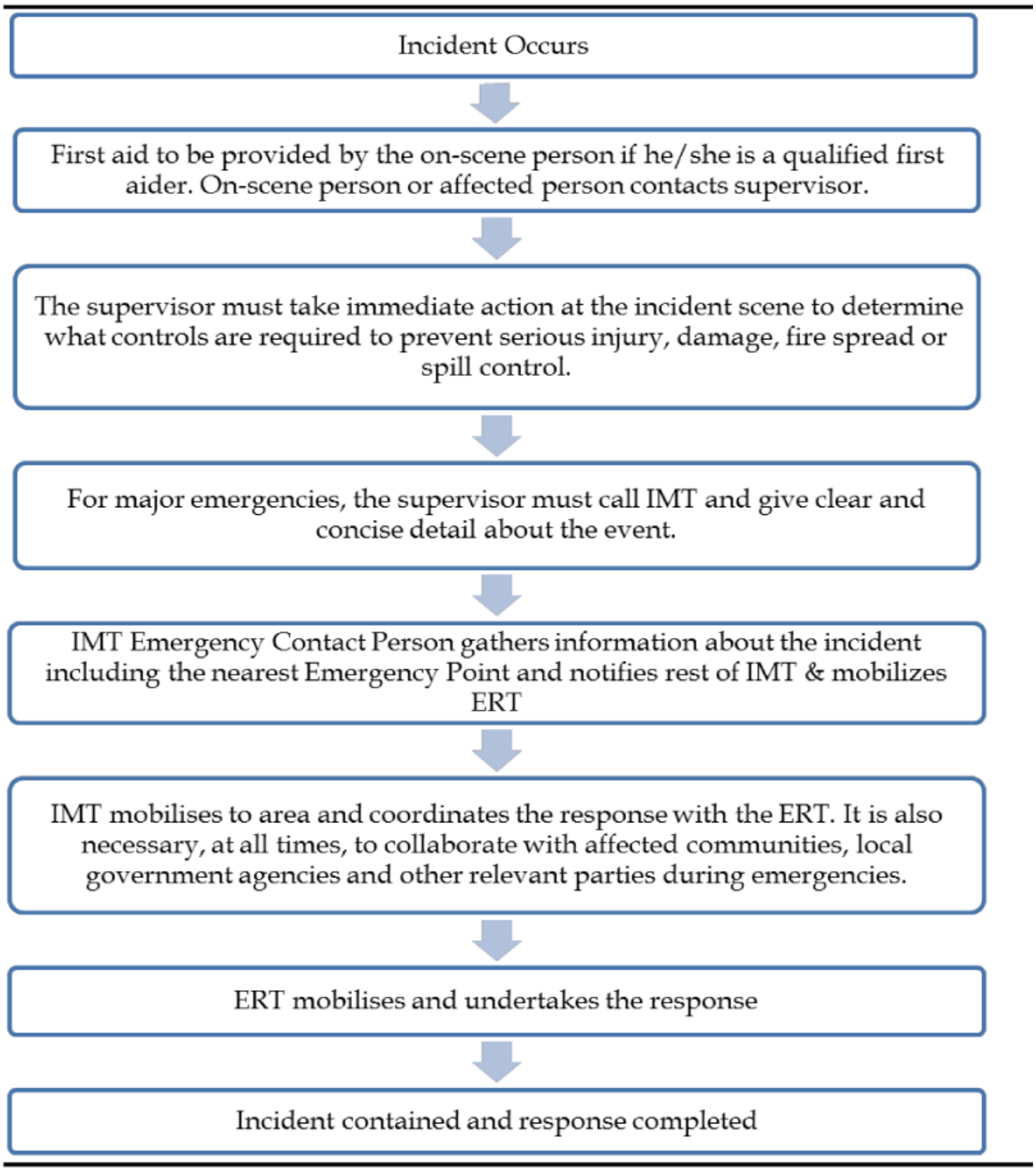
Different scenarios are presented below in *Table 4.1* for the identified potential emergency events at the construction site:

Table 4.1 General Emergency Response Procedure

Emergency Type	Who	Emergency at the Construction Site
Minor Emergency - Affects part of the construction site and does not require evacuation, nor does it affect the wider construction site (e.g. a contained minor spill or minor injury not requiring external emergency services or hospitalization).	Incident Management Team (IMT)	Not required
	Emergency Response Team (ERT)	First On-Scene Person alerts the relevant member(s) of the ERT who responds to the emergency appropriately e.g. administers first aid or cleans up the spill. Refer to *Appendix 1* Accident Procedure.
Major Emergency Affecting or potential to affect the wider site. Emergency services / doctor needed, e.g. fire or explosion, life-threatening or severe injury/disease, unconsciousness or injuries involving hazardous substances or electricity.	Incident Management Team (IMT)	On-scene person calls Supervisor who notifies IMT. IMT initiates evacuation (if required) and responds as per *Appendix 3* depending on incident type.
		IMT takes overall control of the emergency and for notifying Site Management.
		Controlling IMT communicates and liaises with respective ERT.
	Emergency Response Team (ERT)	The ERT responds to and manages the emergency on the construction site under the control and supervision of the IMT.
		As directed by the IMT, the ERT respond jointly with the objective of protecting lives, the environment and company assets and reputation. Note: If a fatality or serious injury has occurred, it is essential that the scene is preserved as much as possible to assist in any subsequent investigation by both internal and external investigators (if required). This includes any material objects such as equipment that may have been in use and for fatalities the person/s themselves.

Note: Further details are on specific scenarios and action cards provided in the Injury Response Procedure (Appendix 1) and Emergency Procedures for Selected Scenarios (Appendix 3).

Figure 4.1 General Emergency Response – Process Flowchart



4.2 GENERAL RULES DURING EVACUATION

4.2.1 *Evacuation on Audible Alarms*

If the IMT decides to initiate a site wide evacuation, pre-installed sirens are activated in all construction areas:

- **Short bursts of the horns - prepare to evacuate.** When hearing this alarm people should stop work, take actions to make the work area safe (turn off gas bottles etc.), and descend from height/exit confined spaces; and
- **One (1) long horn – evacuate.** Move to the evacuation assembly point turning off gas bottles and equipment if it is safe to do so.

Upon hearing the evacuation alarm on the construction site, all persons (employees, contractors or visitors) proceed to their appointed assembly route via a safe route and wait for further instruction as follows:

- Movement to the assembly points takes place as quickly as possible in a safe and orderly manner;
- Equipment and machinery is switched off in a safe state, ignition / access keys are left in locks;
- Visitors are accompanied to the assembly point by their nominated site contact;
- Evacuated persons stay at the assembly points until told otherwise by the IMT or nominated delegate;
- Do not delay evacuating the buildings;
- Ensure escape routes do not become blocked by their actions; and
- Follow the instructions given by the IMT without delay to assist in the emergency response.

4.2.2 *Site Security*

In the event of an evacuation, the construction Site Security will deny site access to all vehicles (except Emergency Services) until clearance has been given by the IMT.

4.2.3 *Roll Call*

In the event of an evacuation, a roll call shall be conducted by the Contractor for its employees, visitors and contractors, and the results shall be communicated to the IMT. Search activities for unaccounted personnel on the construction site shall be performed under the direction of the IMT only. No person shall be allowed to leave the assembly point unless authorized by the IMT to do so. In the event that the assembly point is not reachable safely, an alternative safe point has to be reached and the IMT informed accordingly.

4.2.4 *Scene made Safe and Clearance*

Once the emergency situation has been stabilized and affected person(s) are accounted for, the controlling IMT will declare the emergency is over. The scene will be made safe by the respective ERT /external emergency services (if present). The scene will remain a controlled area for the purpose of collecting evidence and for any remedial or clean-up activity that may be required. The IMT will declare resumption of normal operation once the scene has been made safe and the area is controlled. The IMT and ERT may stand down when the site has returned to a safe condition and all people have been accounted for.

4.3 *EMERGENCY COMMUNICATION*

Primary communication is established with mobile phones. Contact details for internal and external emergency services are listed in *Appendix 2*. The mobile contact telephone and emergency numbers shall be updated and kept by the Construction Project Manager so that they are available whenever required. In case the emergency extends and / or affects beyond the wider site boundaries, the relevant authorities and communities shall be informed by the IMT. If required, communication with next-of-kin of personnel affected by the emergency shall be established by Site Management.

5 DOCUMENTATION REVIEW

All emergency incidents, changes to site activities and any other changes (e.g. in relation to neighboring land uses and political situation) trigger a review and update of this EPRP. Post-incident review shall be undertaken in order to evaluate the effectiveness of this EPRP and implement actions to improve procedures where necessary. In all other circumstances, the plan must be reviewed on a bi-annual basis to ensure it reflects current practices, as well as:

- Changes to Beninese laws and regulations;
- Changes in the wider project – new construction phase.

The plan will need to be revised for use during the operational phase.

Implementation of this EPRP must be reviewed through internal and external (when applicable and available) audit results and other inspection processes.

Appendix 1: Injury Response Procedure

Injury Response Procedure **Behavior in case of injuries at Maria Gleta 2 IPP construction site**	
Procedure for minor accidents (no emergency services needed; if in any doubt, refer to procedure for major accidents)	**Procedure for major injuries and injuries under unclear conditions** (emergency services / doctor needed, e.g. life-threatening or severe injury/disease, unconsciousness, disorientation, seizure, fracture, amputation, injuries involving hazardous substances or electricity)
 1. Conduct first aid measures if first aider 2. Inform Supervisor and Company's Emergency Response Team (ERT) first aider 3. Accompany injured person to Site Clinic	 1. Conduct first aid measures if first aider 2. Inform Supervisor and Company's Emergency Response Team (ERT) first aider (ERT first aider or Supervisor will immediately inform Site Clinic and Incident Management Team (IMT)). 3. Inform Site Management
Emergency Call WHO is calling (name and company)? WHERE did it happen? WHAT did happen (nature of accident and injuries)? Are there ADDITIONAL PERSONS threatened (e.g. by hazardous substances, electricity)? WAIT for further questions, explain means of communication!	
	IMT to organize banksmen to assist emergency services to reach location of injured person
Transportation	
Transport to Site Clinic by adequate means, transport to hospital by decision of Site Doctor	Transport to Site Clinic by Site Ambulance, transport to hospital by decision of Site Doctor

Appendix 2: Maria Gleta IPP Emergency Contact List

Maria Gleta IPP Emergency Contact Details
for alarming and organization of rescue measures for Maria Gleta IPP Construction Site

Site Emergency Contact Numbers

Emergency contact list	**Name**	**Phone number**
Construction Site Contacts		
Incident Management Team (IMT) Hotline		
Incident Commander (IMT)		
Deputy Incident Commander (IMT)		
On site Controller (IMT)		
Emergency Response Team (ERT) Hotline		
Site Security		
Site Doctor (day shift) ERT Medical Lead		
Site Nurse (day shift)		
Ambulance Driver (day shift)		
Site Doctor (night shift) ERT Medical Lead		
Site Nurse (night shift)		
Ambulance Driver (night shift)		
Project Manager		
Construction Manager		
Senior EHS Manager		
EHS Manager		
External Site Contacts		
Ambulance		112
Fire		118
Police		117

Appendix 3: Emergency Procedures for Selected Scenarios

A3.1 *Life Threatening Accident / Illness on Site*

LIFE THREATENING ACCIDENT/ILLNESS	
Person	**Action**
On-scene Person	• Ensure your own safety first • Provide lifesaving first aid if a trained first aider. • Contact Supervisor who contacts the Incident Management Team (IMT) Emergency and Site Clinic for help and provide them with the location. • Assist Emergency Response Tea (ERT) personnel as needed. • Secure the incident scene / do not disturb accident / incident area
IMT	• Contact the members of IMT and ERT and notify them of the emergency. • Assign a person from the IMT to meet the emergency service at the Emergency Point. • Mobilize ERT if rescue is required.
ERT	• Respond to the incident location and ensure scene is secured. • Accompany the injured person to the clinic or hospital and wait until an initial diagnosis is completed and results of tests are known.

A3.2 *Fire and Explosions/Gas leaks*

FIRE AND EXPLOSIONS/GAS LEAKS	
Person	**Action**
On-scene Person	• Minor fires only: utilize fire extinguisher if qualified and trained. • Notify all personnel to evacuate immediately. • If personnel are incapacitated, attempt to rescue persons in the area (if safe to do so). • Contact Supervisor and Emergency Contact using emergency contacts for help and provide incident details. • Evacuate if alarms are triggered. • In case of heavy smoke – attempt to get to the lowest point. • Provide lifesaving first aid in a safe area if trained to do so. • Assist rescue personnel as needed. • When outside keep upwind of the fire. • Retreat away from toxic fumes and falling debris and fire and wait for rescue personnel.
IMT	• Initiate Site Evacuation if required. • Contact the members of Incident Management Team (IMT) and Emergency Response Team (ERT) and notify them of the emergency. • Assign a person from the IMT to meet the emergency service at the Emergency Point. • If external medical/fire-extinguishing help is needed contact emergency services. • Ensure roll calls are performed. • Give site clearance.
ERT	• Mobilize Emergency Response Team/ Fire Truck if required. • Respond to the incident location and ensure scene is secured.

A3.3 Security Incidents

SECURITY INCIDENTS (SECURITY BREACH, BOMB THREAT)	
Person	**Action**
On-scene Person	• Assess the situation – risk to people, assets, processes or information? • If safe then inform Site Management and Site Security of the situation and mitigate the risks. • If the situation is not safe then alert Site Management and Site Security and relocate to a safe position if possible i.e. the designated assembly point. If you cannot remove yourself safely from the threatening situation then stay calm, cooperate, do not provoke the threat, do not resist, avoid sudden movements, give short and precise answers, avoid eye contact and never pursue any attacker.
IMT	• Inform the General Project Manager who will Implement the Project Security Plan response
Site Security	• Advice and support

A3.4 Electrical Accidents

ELECTRICAL ACCIDENTS	
Person	**Action**
On-scene Person	• Contact Supervisor and the Emergency Contacts and Site Clinic for help and provide them with the location and details. • Switch off the power source, if safe to do so. Do NOT touch the casualty until the power has been switched off. • Contact Site Clinic for help and provide them with the location.
IMT	• Notify rest of Incident Management Team (IMT) of the emergency and assign a person to meet the emergency service at the meeting location. • The casualty must be submitted to a medical examination at the hospital, including electrocardiography and urinalysis testing. • Contact Site Managers once the situation is under control.
ERT	• Respond to the incident location and ensure scene is secured. • Ensure defibrillator is immediately provided to the location of the injured person following any electrical incident, regardless of condition. • Initiate lifesaving first aid in a safe area. • Continue first aid until emergency responders arrive. • Assist rescue personnel as needed. • Secure the incident scene / do not disturb accident / incident area • Accompany the injured person to the clinic or hospital and wait until initial diagnosis is completed and results of electrocardiography/urinalysis testing is known to medical personnel (initial diagnosis).

A3.5 Large Spill of Oils or Chemicals, Loss of Containment of Hazardous Substances (or Spills that Potentially Enter Water Ways)

LARGE SPILLS OF OILS/CHEMICALS	
Person	**Action**
On-scene Person	• Contact Site Management and EHS team using emergency contacts for help and provide incident details. • Identify the source and shut off valves, pumps etc. to stop the spill occurring if safe to do so. • Obtain and wear correct personal protective equipment prior to attempting any clean up. • Reduce the impact of the spill and clean up to fullest extent possible by available means – follow the Safety Data Sheet information (e.g. use of spill kit, absorbents etc.) • Make every attempt to prevent contamination to bodies of water • Seal off the area to avoid other employees from exposure. • Assist rescue personnel as needed. • Secure the incident scene.
IMT	• Contact the Emergency Response Team (ERT) and notify them of the emergency. • Assign a person to meet the emergency service at the Emergency Point. • Establish an Incident Investigation Committee consisting of Site Managers, EHS Team Managers and Contractors if appropriate. • Contact environmental authority if needed.
ERT	• Mobilize Emergency Response Team and Fire Truck if required (through IMT). • Respond to the incident location and ensure scene is secured. • Ensure that spilled material and contaminated material is properly cleaned up, contained, labelled and stored in a designated hazardous waste storage facility until final disposal.

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