HERAKLES FARMS

SG Sustainable Oils Cameroon Limited

Douala - Cameroon.
C/O Dr Isidore Nse TIMTI
Tel: 77 89 13 31 / 99 37 07 01 Fax: +1 646 786 40 63 E-mail: timti@heraklesfarmscameroon.com

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

PREPARED FOR

SG SUSTAINABLE OILS CAMEROON

BY

H & B Consulting USA

Immeuble HAJAL CENTER – 6Th Floor – Suite 604
P O Box 2986 Yaoundé Cameroon
(237) 22 22 38 90 – (237) 99 92 67 07
contact@handbconsulting.com
www.handb-consulting.com

4800 Hampden Lane - Suite 200
Bethesda, MD 20814
Phone : 1-240-752-1564
Fax : 1-240-482-3759
contact@handbconsulting.com
www.handb-consulting.com

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ABBREVIATION LIST

BMWS:	Bayang Mbo Wildlife Sanctuary
BOD:	Biological Oxygen Demand
CDC :	Cameroon Development Corporation
CDM:	Clean Development Mechanism
CFC:	Chloro-Fluoro-Carbons
CH_4:	Methane
CITES:	International Trade in Endangered Species
CO:	Carbon Monoxide
CO_2:	Carbon Dioxide
COD:	Chemical Oxygen Demand
CPO:	Crude Palm Oil
EFB:	Empty Fruit Bunch
EIES:	Environmental and Social Impact Assessment
EPA:	Environmental Protection Agency
ESAP:	Environmental and Social Action Plan
ESMP:	Environmental and Social Management Plan
FFB:	Fresh Fruit Bunch
GIS:	Geographical Information System
H:	Hazardous waste
ha:	Hectare
HC:	Hydrocarbons
HCVF:	High Conservation Value Forests
HSE:	Health, safety and Environment
HSEO:	Health, safety and Environmental Officer
IFC:	International Financial Cooperation
IRAD:	Institute of Agricultural Research for Development
IPCC:	Inter Governmental Panel on Climatic Change
IUCN:	International Union for Conservation of Nature
K:	Potassium
KER:	Kernel Extraction Rate
KNP:	Kurop National Park
Mg:	Magnesium
MINEP:	Ministry of Environment and Protection of Nature
MINFOF:	Ministry of Forestry and Wildlife
MINRESI:	Ministry of Scientific Research and Innovation
MOU:	Memorandum of Understanding
MSDS:	Material Safety Data Sheets
N:	Nitrogen
NGO:	Non Governmental Organization
NH:	Non Hazardous waste
NO:	Nitrogen Oxide
NO_2:	Nitrogen Dioxide
NTFP:	Non Timber Forest Products
O_3:	Ozone
ODS:	Ozone Depleting Substances
OER:	Oil Extraction Rate
P:	Phosphorus

PAMOL:	
PET:	Polyethylene
PCB:	Poly Chloro phenyl Benzene
PM_{10}:	Particulate Matter of 10 microns
POM:	Palm Oil Mill
POME:	Palm Oil Mill Effluent
POP:	Persistent Organic Pollutants
PPE:	Personal Protective Equipment
ppm:	parts per million
RSPO:	Roundtable on Sustainable Palm Oil
SAFACAM :	Société Agricole Forestière su Cameroun
SGSOC:	SG Sustainable Oils Cameroon
SO_2:	Sulfur Dioxide
SOCAPALM :	Société Camerounaise de Palmeraies
SPFS :	Société des Palmeraies de la Ferme Suisse
UNFCCC:	United Nations Framework Convention on Climate Change
WHO:	World Health Organization

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EXECUTIVE SUMMARY

RESUME

1. INTRODUCTION

1.1. Presentation of the Promoter

SG - SUSTAINABLE OILS CAMEROON PLC, abbreviated as **SGSOC**, is the Cameroonian subsidiary of **HERAKLES FARMS,** an American multinational, which is the Investor and the Operator of the Project. The company's head office is in Douala, Cameroon.

HERAKLES FARMS Management has extensive experience in international project development, particularly in Sub-Saharan Africa. In Africa, the Management team has closed nearly USD 2 billion in transactions, including:

(i) the Global Alumina refinery in Guinea;
(ii) the Bujagali Hydroelectric Project in Uganda; and
(iii) SEACOM, which is a sub-marine fiber optic cable providing high-speed internet access to countries in East and Southern Africa.

In 2007, the Bujagali power project and SEACOM won the "Africa Power Deal of the Year" and the "African Communications Deal of the Year," respectively, from Euromoney Project Finance Magazine. In 2009, SEACOM was awarded "Best Pan African Initiative" at the AfricaCom Awards.

Since the outbreak of the global palm oil crisis in 2007-2008, SGSOC became interested in the agro-processing industry, particularly the cultivation of oil palms.

The company first had to search for suitable land in Cameroon and it relied on applicable and applied scientific data available. It conducted scientific research such as:

- suitability soil studies,
- High Conservation Value Forests (HCVF),
- Implementation Plan,
- Social Impact Assessment,
- Flora and Fauna Studies,
- Environmental and Social Impact Assessment,
- And GIS mapping / 3D mapping.

In addition, the company imported technical support by intentional experts of Oil Palm growers to supplement Cameroonian local expertise.

SGSOC was established in 2009 with a mandate to provide significant benefits relating to poverty reduction, illness prevention, improve health care and education among other positive impacts and the South-West Region of Cameroon has been targeted in view of its ecological conditions which are conducive for the cultivation of this crop.

The main objective of SGSOC is to develop an oil palm project in the Republic of Cameroon to produce commercial grade crude palm oil (CPO), palm kernel oil (PKO) and biodiesel for domestic and export sales based on market conditions.

The mission of SGSOC includes the following:

- develop an environmentally and social sustainable oil palm project in Cameroon;
- provide commercial grade palm oil for local and external markets - Cameroon imported 100,000 tons in 2009;
- produce value added biodiesel for the company internal use;
- improve social programs / amenities in the rural areas;
- encourage out growers—modern agronomic practices and improved planting materials;
- and creation of long term skilled sustainable jobs to reduce unemployment (at full build-out, the project would employ about .05% of the total population of Cameroon), poverty and rural exodus.

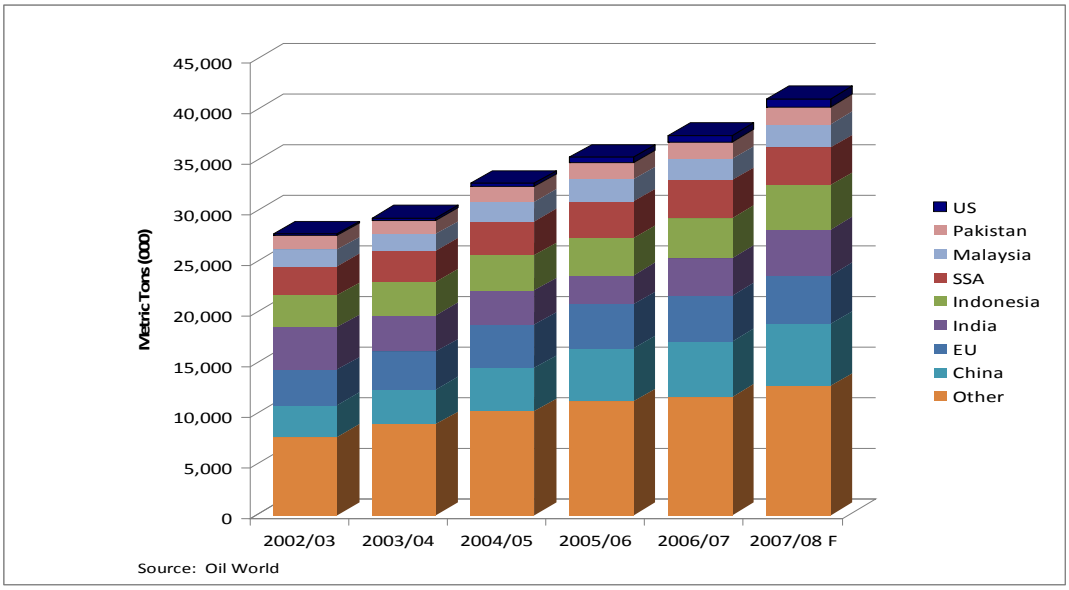
1.2. Context of Project and Environmental and Social Impact Assessment

Since 2007, the global palm oil market has been experiencing a major upheaval. In that year, prices skyrocketed due to a global decline in supply caused by a slowdown in production in Malaysia and Indonesia affected by the “El Niño” factor. It should be noted that these two countries account for 80% of world production with 15.1 and 15.2 million tons, respectively.

While supply is declining, demand for palm oil has increased considerably notably with: the growing use of vegetable oil for biodiesel production, increased consumption of vegetable oil in developing countries,

particularly in densely populated countries like China, Russia, Mexico, Brazil, Bangladesh and even Africa.

Graph 1: Palm Oil Consumption Trend by Country



(Source: SGSOC Business Plan)

It is within this context that the crisis broke out in 2008. Rising oil prices and interest rates, and the credit crunch further disrupted the market, leading to a fall in prices over the last five months of the year.

In 2009, the situation stabilized due to a recovery of prices with the price of a ton going up from USD 522 to 728 between January and December 2009. Despite the increase, the price of palm oil still dropped by 25.4% on average against a 20% increase in 2008.

Some palm oil statistics:

- being the main source of vegetable oil accounting for 36% of vegetable oil in the market;
- it surpassed soybean as the dominant edible oil since 2005;
- consumption worldwide rose by 48% from 2003 to 2008, from 28 million tons to 41 million tons;
- consumption is estimated to reach 61 million tons in 2013;
- in 2008 there was a consumption estimated at 182,000 million tons with a net deficit of 30,000 million tons (imports);
- and in 2010, Cameroon was in a deficit of more than 100,000 million tons.

According to projections, global consumption is expected to peak at 40 million tons in 2020 against 22.5 million tons in 2010.

It is within this context that HERAKLES FARMS interested in investing in the agro-industrial sector, particularly in the cultivation of oil palms. The South-West Region of Cameroon has been targeted in view of its ecological conditions which are conducive for the cultivation of this crop.

Its objective is to produce crude palm oil, palm kernel oil and biodiesel for local consumption and export depending on market conditions.

Many initiatives were carried out to tackle the oil palm crisis:

- Countries like Brazil and the USA increased their planting areas for sugar cane and maize cultivated for the production of bio-ethanol at the expense of soybean whose oil competes directly with palm oil.
- Other initiatives were also carried out to increase palm oil global supply.

It is within this context that the SGSOC project will be implemented in Cameroon, a country that has major ecological and natural conditions that are suitable for oil palm cultivation.

1.3. Project Implementation Status

Following the signing on 17 September 2009 of an agreement between the Government of Cameroon and SGSOC authorizing the latter to open an industrial palm oil plantation in Cameroon, SGSOC has acquired 80,506 hectares of land in Mundemba, Toko and Nguti in Ndian and Kupe-Manenguba divisions, respectively, in the South-West Region.

It is estimated that out of these 80,506 hectares, 70,000 will be devoted to plantations and the rest will be used to build the infrastructure necessary for operations, including the construction of six factories in the Project area.

At present, the following aspects of the project have been completed:

- On September 17, 2009, the **Government of Cameroon** and **SGSOC** signed agreements to enable SGSOC to establish and manage oil palm plantations in Cameroon.
- The Cameroon Government has allocated land to **SGSOC**.

- A soil study was carried out by **IRAD**.
- A socio-economic / needs survey was conducted by the NGO, **NATURE CAMEROON**.
- A Wildlife/Fauna study was conducted by **H & B CONSULTING**.
- A flora survey was also conducted by **H & B CONSULTING**.
- A more thorough socio-economic / needs survey was conducted by **H & B CONSULTING**.
- Plantation Implementation Plan by **AGRINEXUS.**
- Sites have been selected for oil palm nurseries.
- Consultations with the local population are ongoing.

1.4. Justification for ESIA

Palm oil is the most consumed vegetable oil in the world and 80% of it is used in the food industry; a variety of other oils with different properties used various domains can be extracted from it.

It is used primarily as a food product 77% of which is consumed. Some fatty substances are extracted from it and when mixed with other vegetable oils, produce good oil for frying. Palm oil is also used as an emulsifier in creams, sauces, soups, pastries as well as common products like margarine.

Other applications include cosmetics and bio-fuels, chemicals such as soap, perfume, cleaning products, lotions, etc. Most importantly, palm oil can be a substitute for heavy fuel oil and transformed into biodiesel, clean energy for operating generators, boats and other construction equipment.

Beyond these reasons, all projects in this sector worldwide are welcome as long as demand remains higher than supply and Cameroon is no exception to this rule.

Beyond the economic, financial and social opportunities offered by the SGSOC Palm Oil Production Project in the South-West Region of Cameroon, it is not without adverse consequences on the environment.

Thus, the Environmental and Social Impact Assessment (ESIA) is indispensable to identify the effects of this project on the physical and human environment and to propose alternative solutions.

The Environmental and Social Impact Assessment (ESIA), is a genuine tool for decision-making and environmental management that will enable SGSOC to design and implement an environmentally friendly project without compromising its technical and economic reliability and help determine crucial elements that facilitate the making of choices and decisions.

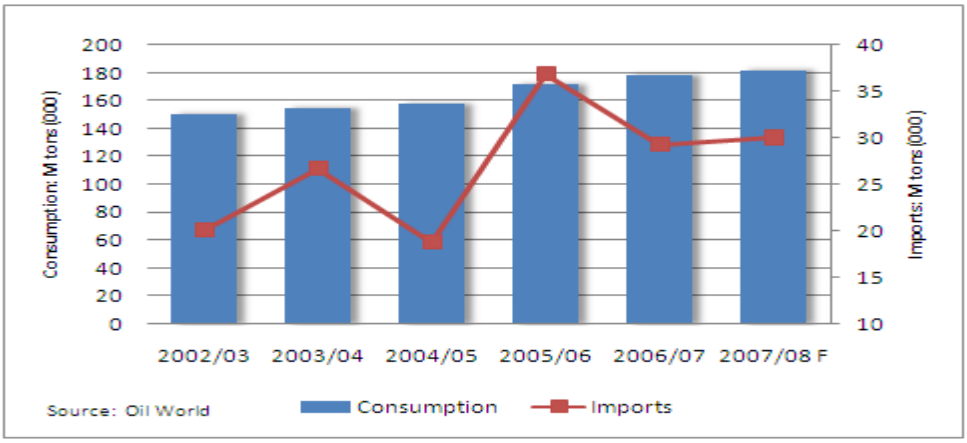
With regard to Law No. 96/12 of 5 August 1996 relates to environmental management, specifically its application Order No. 0070/MINEP of 22 April 2005 setting various categories of operations whose realization is subjected to an environmental impact study, the project of this type (plantation of more than 50,000 ha, and the construction of an industrial oil mill unit) belongs to operations whose realization is subjected to a detailed type of environmental impact assessment.

This Environmental Impact and Social Assessment (ESIA) will fall within the framework of the commitment made by Cameroon through its National for Environmental Management Plan (NEMP) to *"ensure the integration of environmental considerations in all plans and programs, economic, financial, energy, land and others"* and to *"carry out Environmental Impact Assessments in accordance with procedures and standards for all industrial and infrastructure projects."*

1.5. The Palm Oil Production Sector in Cameroon

In Cameroon, projected palm oil consumption for 2007/2008 stood at 182,100 tons with approximately 30,000 tons to be imported. In recent years, there has been a simultaneous increase in imports and domestic consumption. While local production is used for food, the share imported is primarily used by soap industries.

Graph 2: Cameroon: Palm Oil Consumption and Importation



(Source: SGSOC Business Plan)

Inadequate domestic production as well as market price fluctuations due to regular shortages and the increase in prices: in fact, domestic production is estimated at 200,000 tons per year, against 250,000 tons needed or a recurring structural deficit of 50,000 tons, easily met when prices are at their lowest level. When prices skyrocket as it is the case at the moment, imports cannot play their role of cushion.

Sales on the market are divided between edible oil used for cooking traditional dishes and industrial oil used in the production of soap and in recent years, in refining. Customers, each of which prefers oil with specific characteristics, can be divided into three categories:

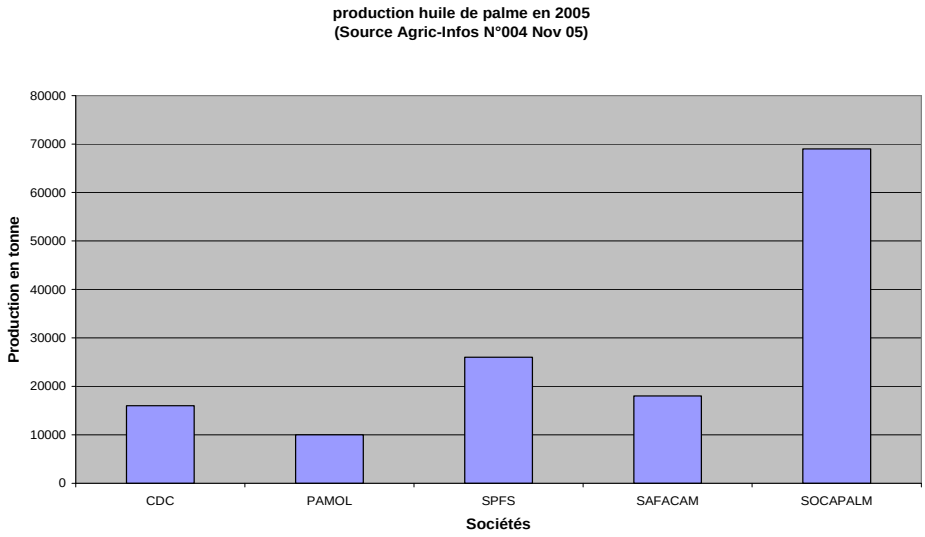
- wholesalers who prefer fresh red palm oil which does not coagulate and is tasty;
- refineries which prefer oil containing more olein and stearin and an acid level of less than 3%;
- soap manufacturers prefer any type of oil with a high acid level.

SOCAPALM owned by the Belgian multinational, SOCFIN, is the leading producer with 42% of the market share, the bulk of its production comes from plantations while smallholder plantations supply it with palm kernel oil.

Next is CDC which is a semi-public company which cultivates oil palms and rubber on approximately 38,000 hectares of land. CDC cultivates, processes and exports tropical products.

The third major agro-industry is PAMOL which mainly cultivates oil palms and produces palm oil for sale on the local market and export. It is also involved in the production of rubber and soap. It is mainly based in the South-West Region.

Graph 3: Production of palm oil in Cameroon in 2005



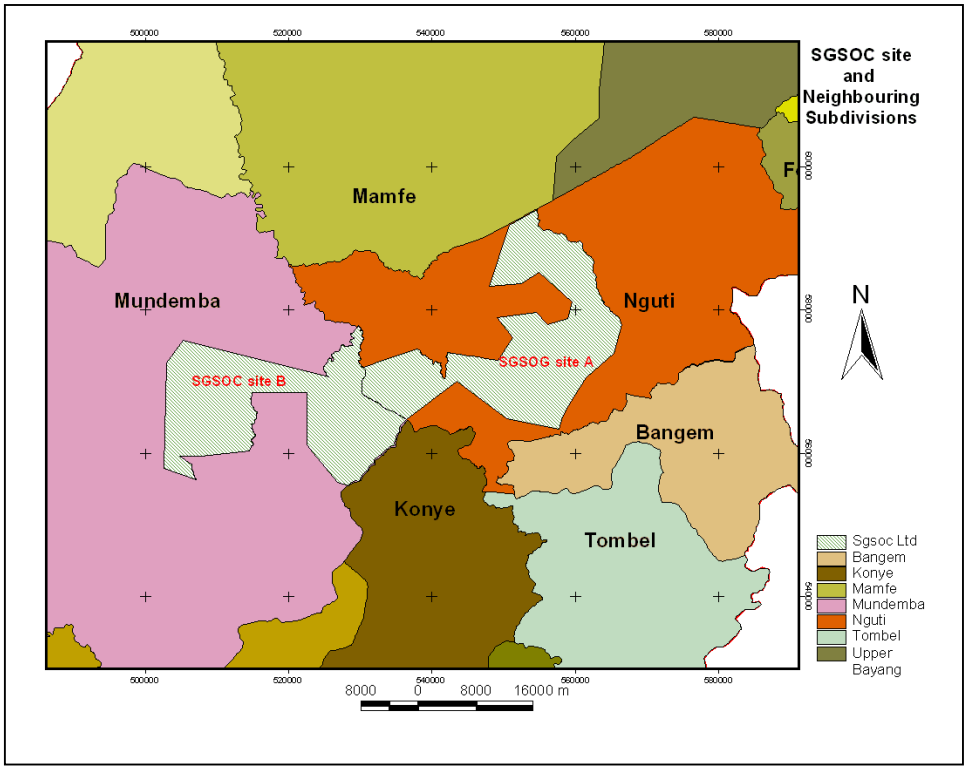
1.6. Geographical Location of Project and Choice of Site

To implement the project, SGSOC has acquired 80,506 hectares of land in Mundemba, Toko and Nguti in Ndian and Kupe-Manenguba Divisions in the South-West Region. Factories will be constructed within the SGSOC concession.

Out of the 80,506 hectares, 70,000 is planned to be devoted to plantations and the rest used to build the infrastructure necessary for operations. The South-West Region (where oil palms, bananas, rubber, cocoa, cotton, coffee, trees, pineapple are already being cultivated) meets the criteria retained by the promoter for the sustainable development of palm oil production, namely:

- availability of adequate land for the implementation of major agro-industrial projects;
- favorable climatic conditions: rainfall, fertile soil, adequate temperature;
- mature agricultural sector with available manpower and workers as well as developed logistics;
- existing infrastructure: roads, port and utilities.

Figure 1: SGSOC Site and Neighboring Subdivisions



1.7. Impact Assessment Team

To carry out the ESIA for the project, the Company solicited for this purpose the services of the Consulting Firm **H & B CONSULTING USA LLC (Consultant),** the American subsidiary of **H & B CONSULTING**, a consulting firm whose wide experience in the domain of environmental impact assessment is recognized by Cameroon's Ministry of Environment and Protection of Nature.

Given the complexity of environmental issues, H&B CONSULTING has mobilized a multidisciplinary team composed of the following:

- **HAMAN BAKO Salamatou:** Environmentalist – Project Manager
- **Dr. GUEDE GBOAZO:** Senior Environmentalist
- **FELICIANO L. Luisa:** Environmentalist/Public Health Specialist
- **EBOKO Thomas:** Safety Expert
- **Dr. ALLO ALLO Andrew:** Biodiversity Expert
- **Dr. SONGWE:** Ecologist
- **Dr. CHUYONG:** Botanist
- **ANYE NDEH Dennis:** Zoologist
- **CHI Napoleon Forpah:** Socio-economist
- **Emmanuel BAMU** SGSOC Agricultural Development Manager

1.8. Environmental and Social Impact Assessment (ESIA) Objectives

On the whole, the objective of the Environmental and Social Impact Assessment (ESIA) is to identify the sensitive elements existing in the project environment, determine the project components likely to affect the environment, assess the importance of such impacts and recommend mitigation measures and actions, where necessary.

Specifically and in accordance with Decree No. 2005/0577/PM of 23 February 2005 to lay down the methods for conducting environmental impact studies, the Environmental and Social Impact Assessment of the Project seeks *inter alia,* to:

- describe and analyze the initial state of the site and its physical, biological, socio-economic and human environment;

- describe and analyze all the natural and socio-cultural elements and resources likely to be affected by the project as well as the reasons for selecting the site;
- describe the project and reasons for its choice among other possible solutions;
- identify and evaluate the possible effects of the implementation of the project on the natural and human environment;
- identify the measures designed to avoid, mitigate or eliminate the adverse effects of the project on the environment;
- program sensitization and information and keep minutes of meetings held with the population, non-governmental organizations, trade unions, opinion leaders and other organized groups concerned by the project;
- design an environmental management plan comprising project and environmental monitoring mechanisms and the compensation plan, where necessary.

1.9. Methodological Approach

The methodological approach used to analyze the environmental risks related to the SGSOC Oil Palm Production Project in Cameroon comprises three levels (see diagram on the next page):

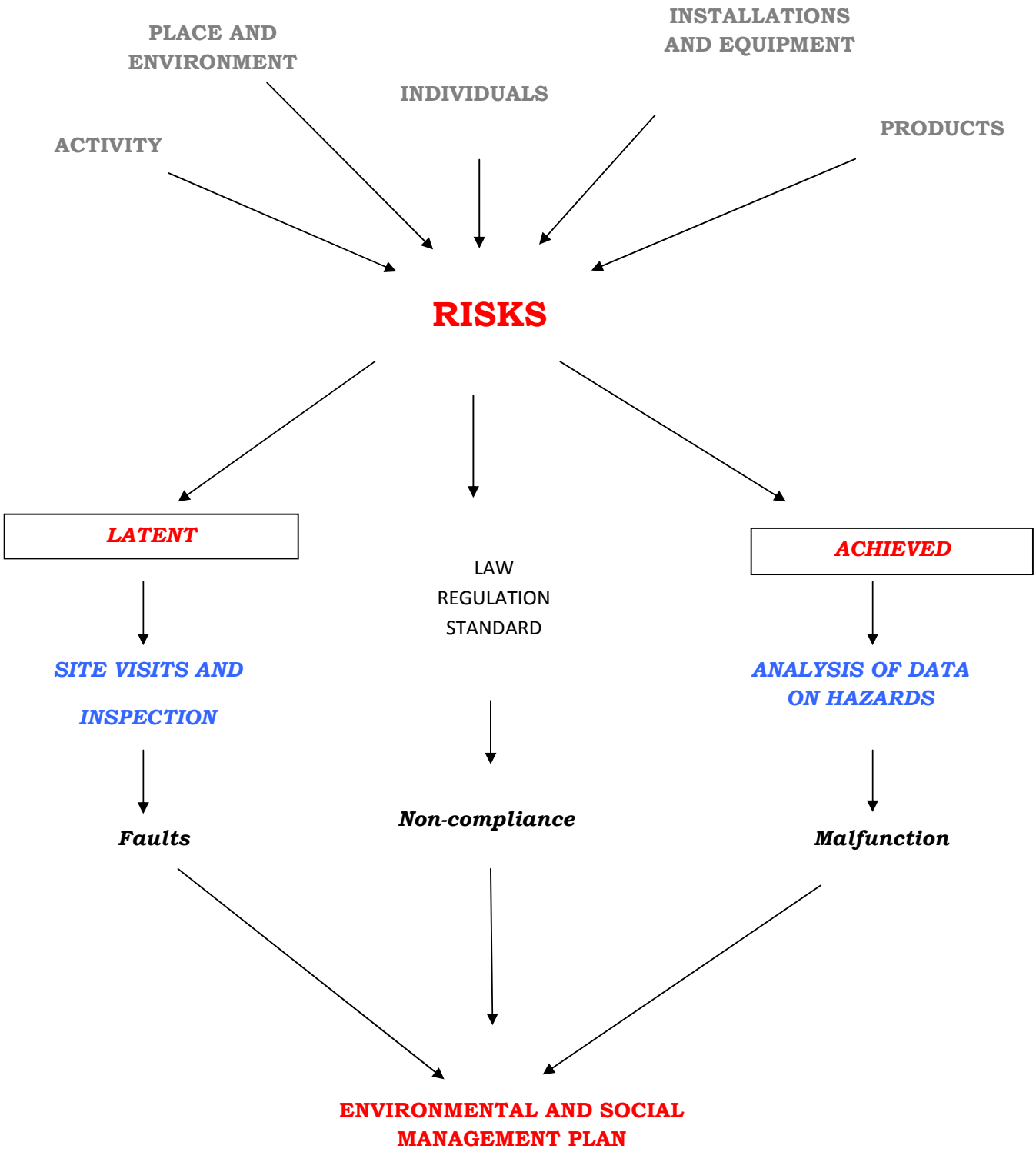
(i) The analysis of environmental factors (activities related to the project and those affected by the project, the factory and plantation area as well as their respective natural environments, project staff and local populations, installations and equipment necessary for the construction and operation of the different units, products and materials used during the different phases of the project) and of all its components helps identify all environmental risks and prepare the profile.

(ii) These risks are then studied and evaluated in accordance with the legal and regulatory framework in force in Cameroon and international standards using site visit and inspection techniques as well as socio-economic data collection and analysis to highlight negative impacts (non-compliance, irregularities and malfunction) likely to endanger the project environment and to retain the positive impacts that are conducive to harmonious development.

(iii) Ultimately, the elimination, mitigation and even intervention measures to be implemented from the start-off of works up to the operation and monitoring of the project will be recorded in a management chart or environmental management plan indicating the officials in charge, completion periods as well as the respective costs, whenever it is possible to evaluate them.

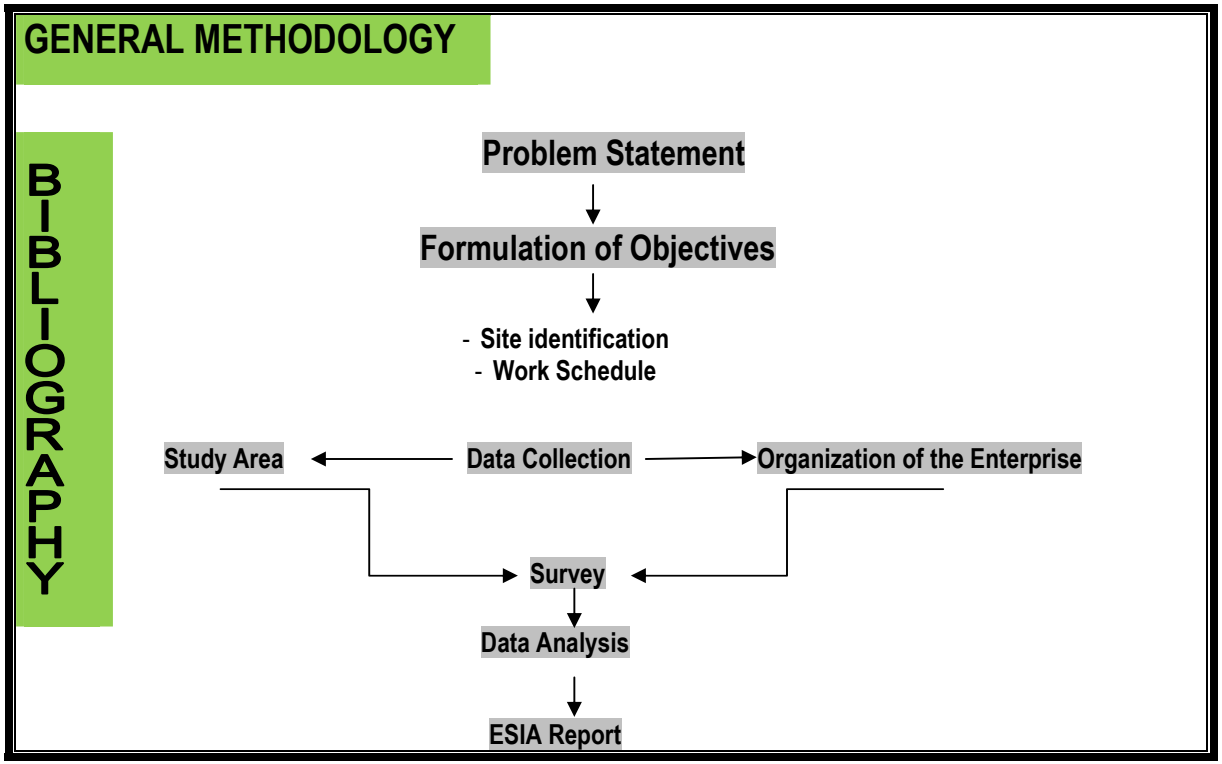
DIAGRAM

METHODOLOGY FOR THE ANALYSIS OF ENVIRONMENTAL RISKS



This ESIA was carried out in accordance with the general steps presented in the diagram on the next page, summarized as follows:

- statement of problems, formulation of objectives and establishment of the work program;
- collection of available documentation and search for further information on environmental factors and components followed by their processing;
- guided tour of areas where the factory and plantations will be set up, data collection on the ground, taking of photos, administration of questionnaires and discussions with key project actors and other stakeholders;
- identification, meetings and interview of the most influential residents of the project area for public surveys and processing of results of such surveys;
- drafting of the Environmental And Social Impact Assessment report, including an Environmental and Social Management Plan.



GENERAL METHODOLOGY FOR THE CONDUCT OF AN ESIA

The overall methodology adopted has been based on the requirements of Cameroonian Legislation as set out in the EIA Decree N° 2005/0577 of 23rd February 2005 together with international best practice, including OP4.01. Preparation of this report has included the following stages:

Scoping exercise - The scoping exercise was undertaken in May/June 2010. This involved field visits and the gathering and review of published and unpublished baseline/project data. The scope identified the key environmental and social impacts and directed the detailed assessment for the project. This ESIA therefore considers the potential environmental and social impacts of the proposed project activities, as identified within the scoping stage of the project, through construction, operation and decommissioning.

The scoping report (Terms of Reference) was submitted to the Ministry of Environment and Protection of Nature on July 29, 2010 and approved by the MINEP on August 9, 2010. A copy of the Terms of Reference and the approval letter are provided in the Annexes.

Field Visits to view firsthand the project proposals in the field and to allow input to and development of the project proposal in line with best practice. A preliminary visit was undertaken in May 2010 and additional site visits were undertaken in June, August and finally in September to undertake baseline studies and public consultations. A fauna and flora and socio-economic survey work was also undertaken in the concession area during this period.

Identification of appropriate **Cameroonian legislation and guidelines** as set out in Chapter 2.

Consultations have been held with the Ministries, government authorities and affected communities. The methodology followed for this process and the results are presented in Chapter 7. The issues raised have been addressed in the preparation of this report.

Baseline Data - Gathering and review of published and unpublished data pertinent to the project site. Baseline data, which exists for the study area, have been used for this ESIA and all key documents utilized in the preparation of the ESIA report are listed in References at the end of this report.

Potential Impacts were identified from critical analysis of the proposed operation in relation to their environment setting. The results are presented in Chapter 5.

Mitigation measures (Chapter 6) are proposed programs or processes to be implemented to eliminate or minimize the potential impacts identified for each system studied. The nature of the predicted impact is described and its significance determined by reference to appropriate standards or guidelines.

Environmental and Social Management Plan encompasses all aspects of mitigation, management, monitoring, and institutional measures, and the Environmental and Social Management Plans for the project are set out in Chapter 9.

Public Consultation

Public consultation in environmental decision-making is an important element of the ESIA process. The consultation process of the SGSOC Project adheres to World Bank and International Finance Corporation (IFC) guidelines, as specified in the terms of reference. A good consultation strategy that is both consistent and transparent ensures that concerns or problems for all stakeholders can be identified and addressed early in the process.

OP4.01 Environmental Assessment emphasizes this concept and notes that SGSOC should consult project-affected groups and local non-governmental organizations (NGOs) about the project's environmental aspects and take their views into account. For a Category A project, the project promoter provides a summary of the project objectives and potential impacts for the initial consultation. Once the draft ESIA report is prepared, SGSOC, trough the Ministry of Environment and Protection of Nature, will need to make the draft report available in a public place accessible to affected Groups and local NGOs.

An additional fundamental requirement in World Bank/IFC policies on resettlement, land acquisition and compensation is a framework for public consultation, participation, and the establishment of a process to redress the grievances of affected people. Consultation with the affected population and with officials of local government, civil society and other representatives of the affected population is essential for gaining a comprehensive understanding of the types and degrees of adverse effects.

1.10. Report Structure

In accordance with Article 4 of Decree No. 2005/0577/PM of 23 February 2005 which stipulates the content of a detailed ESIA, the report is structured as follows:

- Chapter I: Introduction
- Chapter II: Review the Legal Framework Applicable to the Oil Palm Sector in Cameroon
- Chapter III: Description of the Project and Production Process
- Chapter IV: Description of the Initial State of the Site and its Environment
- Chapter V: Impact Analysis (Identification, Description, Analysis - Prediction and Evaluation of the Environmental Impacts Induced by the Project
  Chapter VI: Measures Envisaged to Eliminate, Mitigate or Compensate for the Environmental Impacts Induced by the Project
- Chapter VI: Public Consultations
- Chapter VIII: Safety Management
- Chapter IX: Environmental and Social Management Plan
- Bibliography
- Annexes

This report also contains definitions of technical terms and acronyms and a non-technical summary in English and French with the main conclusions.

2. FRAMEWORK OF CAMEROON'S ENVIRONMENTAL LEGISLATION

This chapter outlines elements of Cameroon's environmental legislation in general and legislation governing the project on the basis of which this environmental and social impact assessment is being prepared**.**

2.1. General Framework of Cameroon's Environmental Legislation

As indicated above, the Framework Law on the Environment came into force after its promulgation by the President of the Republic on 5 August 1996. The framework law covers the following aspects:

Part I - General Provisions.

Part II - Formulation, coordination and financing of environmental action and setting up of a National Fund for the Environmental.

Part III - Environmental management (environmental impacts/audits; protection of the atmosphere; protection of continental and inland waters; erosion control; protection of human settlements; classified establishments; management of chemical and hazardous substances; noise and olfactory nuisances; management of natural biological resources; natural risks and catastrophes).

Part IV - Responsibilities and sanctions; infringements and sanctions; miscellaneous and final provisions.

The Ministry of Environment and Protection of Nature (MINEP) is responsible for issues relating to the environment (including the conduct of environmental impact assessments).

According to Law No. 96/12 of 5 August 1996 relating to Environmental Management in Cameroon, the implementation of any industrial development project in Cameroon that may endanger or impact the environment or the existing ecological system of the project area is subject to the conduct of an environmental impact assessment. It is governed by *Decree No. 2005/0577/PM of 23 February 2005 to lay down the conditions for the conduct of environmental impact assessments and Order No. 0070/MINEP of 22 April 2005 to establish categories of operations subject to environmental impact assessments.* It is the sole responsibility of the owner or promoter of the industrial development project or undertaking and is carried out at his expense.

The environmental impact assessment is subject to approval by an inter-ministerial committee comprising twenty experts. Ample time is needed by the committee to perform its duties. According to regulations, the minimum time frame for carrying and approving an environmental impact assessment is four to five months.

According to Section 20 of Law No. 96/12 of 5 August 1996 relating to environmental management, where there is no environmental impact assessment or the procedure has not been complied with, the Administration in charge may take appropriate action, without formalities, to suspend any ongoing work.

The suspension may involve a fine of between two and five million CFAF and perhaps imprisonment.
The legislation concerning the treatment of effluent and greenhouse gas emissions is of particular interest with reference to the construction of a palm oil mill as well as the management of large quantities of solid waste ensuing from the processing of palm nuts to extract palm oil.

Compliance with *Decree No. 2001/165/PM of 8 May 2001 to lay down conditions for the protection of surface and ground water resources against pollution as well as Law No. 98/15 of 14 July 1998 relating to establishments classified as dangerous, unhealthy or obnoxious and its implementing Decree No. 99/818/PM of 9 November 1995* is essential. Furthermore, serious thought should be given to greenhouse gas emissions. Though Cameroon is a signatory to the *United Nations Framework Convention on Climate Change and the Kyoto Protocol*, as a non-Annex I country, it is not required to reduce its emissions of carbon dioxide or other greenhouse gases into the atmosphere. In view of the international commitments, however, it would be considered a very bad environmental practice to emit large quantities of these gases into the atmosphere.

2.2. Basic Principles

Cameroon has a comprehensive environmental legislation. The legislation provides for the establishment of a *National Environmental Management Plan (NEMP)* adopted by the Government in 1996. This plan is specified in *Law No. 96/12 of 5 August 1996*. The basic principles for the formulation of the framework legislation on the environment include:

- Precaution principle in view of the limits of current knowledge;
- Polluter pays principle;
- Prevention and corrective action principle;
- Principle of participation;

- Principle of liability and mutual decision;
- Principle of substitution (see Section 9 of Law No. 96/12 of 5 August 1996).

Section 9 of this law lists the basic principles of the rational management of the environment and natural resources, namely:

(a) The **precaution principle** according to which lack of certainty, in view of current scientific and technical knowledge, should not retard the adoption of effective and appropriate measures to prevent risks that may cause serious and irreversible damage to the environment at economically acceptable cost.

(b) The **polluter pays principle** according to which the cost of measures to prevent, reduce and control pollution and rehabilitate polluted areas is be borne by the polluter.

(c) The **prevention and corrective action principle** seeks to minimize of threats to the environment through the use of the best techniques at economically acceptable cost.

(d) The **principle of participation** according to which:
- Each citizen shall have access to information on the environment, including information on hazardous substances and activities;
- Each citizen shall have the obligation to preserve the environment and contribute to its protection;
- Corporate bodies and private citizens shall, in all their activities, conform to the same requirements;
- Decisions concerning the environment shall be taken after consultation with the sectors of activity or groups concerned, or after a public debate when they are of a general nature.

(e) The **principle of liability** according to which any person who, through his actions, creates conditions likely to endanger human health and the environment shall eliminate or cause the said conditions to be eliminated such as to avoid the said effects;

(f) The **principle of substitution** according to which in the absence of a written general or specific rule of law on environmental protection, the identified customary norm of a given land, accepted as more efficient for environmental protection, shall apply.

The framework law on the environment is strengthened and embellished by decrees and orders, etc. to make it workable and practical in all respects.

2.3. Substitution

It should be noted that Section 9 (f) of Cameroon's Framework Law on the Environment provides for substitution where certain rules are omitted or missing in the said law.

This Section stipulates that where a general or specific rule relating the environment is not provided for in the Framework Law, a rule derived from other regulations or a rule from another context that will be more efficient with regard to the protection of the environment may be used.

2.4. National Legal Framework

Law No.96/12 of 5 August 1996 relating to environmental management

Part III of this law focuses on environmental management (protection of the atmosphere; protection of continental waters and flood plains; protection of the coast and maritime waters; protection of soils and the sub-soil; protection of human settlements; waste; classified establishments; harmful and/or hazardous chemical substances; resonant and olfactory nuisances; natural resource management and biodiversity conservation; risks and natural disasters).

Regarding environmental impact assessment, Section 17 of the Law stipulates that:

(1) "The promoter or owner of any development, project, labour or equipment, which is likely to endanger the environment, owing to its dimension, nature or the impact of its activities on the natural environment shall carry out an impact assessment shall carry out an environmental impact assessment. This assessment shall determine the direct or indirect incidence of the said project on the ecological balance of the zone where the plant is located or any other region, the physical environment and quality of life of populations and the impact on the environment in general."

(2) The environment impact assessment shall be included in the file submitted for public investigation where such a procedure is provided for."

(3) The impact assessment shall be carried out at the expense of the promoter.

According to Section 19 (2): the impact assessment shall of necessity comprise:

- The analysis of the initial state of the site and its environment;
- Reasons for choosing the site;
- Evaluation of the anticipated consequences of the implementation of the project on the site and its natural and human environment;
- Outline of the measures envisaged by the promoter or owner to eliminate, reduce and, if possible, compensate for the harmful consequences of the project on the environment and estimates of the ensuing cost;
- Presentation of other possible solutions and reasons for selecting the project from the perspective of environmental protection.

According to Section 20 (2) of Law No.96/12 of 5 August 1996, Where the impact assessment is not known or the impact assessment procedure is totally or partially disrespected, the competent Administration, or where necessary, the Administration in charge of the environment shall demand the implementation of appropriate emergency procedures to suspend the work envisaged or already initiated. These emergency procedures shall be initiated without prejudice to the sanctions provide for by this law.

Decree No. 2005/0577/PM of 23 February 2005 to lay down the conditions for the conduct of environmental impact assessments

It defines, inter alia:

- the content of the environmental impact study;
- the procedure for the formulation and approval of the environmental assessment study;
- In Article 11, it stipulates that an environmental impact study must be carried out with the participation of the population concerned through consultations and public hearings with a view to obtaining their opinions regarding the project.

Order No. 0070/MINEP of 22 April 2005 to establish categories of operations subject to environmental impact assessments

According to Article 2 of the Order, an environmental impact study must contain the following:

- a summary of the study in French and English using simple language;
- the description and analysis of the initial state of the site as well as the reasons for choosing the site;
- the description of the project;

- the presentation and analysis of options;
- the project and reasons for the project's choice among the other possible solutions;
- identification and evaluation of possible effects of the implementation of the project on its natural and human environments;
- outline of the measures envisaged to avoid, reduce or eliminate the harmful consequences of the project on the environment and their cost;
- sensitization and information of the parties involved;
- the environmental management plan related to the project;
- the terms of reference of the study as well as bibliographical references.

Order No. 00001/MINEP of 13 February 2007 to lay down the terms of reference for environmental impact studies

It gives lays down guidelines for the preparation of the terms of reference for impact assessment studies.

Law No. 98/005 of 14 April 1998 to lay down regulations governing water resources

This law defines the procedures pertaining to water and general principles for environmental management and protection of public health. Section 4 prohibits acts that could impair the quality of surface, ground or sea water, or jeopardize public health as well as marine fauna and flora, which is prejudicial to economic development and tourist activities.

According to Section 6, any natural person or owner of installations likely to pollute water must take all the necessary measures to limit or remove this effect. It also stipulates that any person who produces or stores waste must eliminate or recycle it in approved installations. Furthermore, he must inform the public on the effects of waste production, storage or recycling on water, the environment or public health, as well as on the preventive measures or compensation.

Law No. 98/015 of 14 July 1998 relating to establishments classified as dangerous, unhealthy or obnoxious

This law governs, within the framework of the principles of environmental management and protection of public health, establishments classified as dangerous, unhealthy or obnoxious. It stipulates in its Sections 5, 7, 9 and 12 that the manager of a class I establishment conducts studies on dangers in accordance with conditions laid down by regulations. Concerning the protection of the interests referred to in Section 2 of this law, the Minister in charge of classified establishments shall, under conditions laid

down by regulations, demarcate a security zone around Class I establishments within which building of homes and the carrying out of any other activity incompatible with the functioning of the said establishment shall be forbidden.

According to Sections 25 and 26, classified establishments which pollute the environment shall be liable to an annual pollution tax and those that import equipment used in eliminating greenhouse gases, carbon dioxide and chlorofluro-carbons from their production processes or products, or to reduce any form of pollution, shall be granted a reduced customs tariffs on such equipment in the proportions, and for periods determined as and when necessary by the finance law.

Decree No. 99/818/PM of 9 November 1999 to define the conditions for the establishment and exploitation of establishments classified as dangerous, unhygienic and obnoxious

This decree lays down the conditions for the approval of individuals to inspect, control and audit establishments classified as dangerous, unhygienic or obnoxious. The inspection, control and audit of establishments classified as dangerous, unhealthy or obnoxious is a prerogative of the Ministry in charge of classified establishments. However, the ministry may approve individuals to inspect, control and audit establishments classified as dangerous, unhygienic or obnoxious under the conditions lay down by this decree.

Article 11 of this decree provides that within the framework of monitoring waste in the environment, the decree lays down guidelines for the analysis and measures to control the establishments and monitor its effects on the environment.

Decree No. 039/MTPS of 26 November 1984 to lay down general measures for hygiene and safety at the work place

This decree regulates the respective obligations of employers and employees, the composition of hygiene and safety work committees, defines general terms relating to hygiene, inter alia, construction, ventilation, temperature and lighting, food, security and transport measures, dangerous substances and rules for prevention and fire fighting, and establishment of methods of control and sanctions.

Law No. 94/01 to lay down forestry, wildlife and fisheries regulations

This law repeals and all previous provisions repugnant thereto, in particular Law No. 81/13 of 27 November 1981 to lay down forestry, wildlife and fisheries regulations. The law and its implementing instruments lay down forestry, wildlife and fisheries regulations in order to attain general objectives of

forestry, wildlife and fisheries policy within the framework of integrated management to ensure the sustainable conservation and use of the said resources and of the various ecosystems.

It comprises seven parts: (I) General Provisions; (II) Protection of Nature and Biodiversity; (III) Forests; (IV) Wildlife; (V) Fisheries; (VI) Prosecution of Offences; (VII) Miscellaneous and Final Provisions. Part II prohibits the lighting, without prior authorization, of a fire that may cause damage to the vegetation of the national forest estate. The clearing of all or part of a State or council forest shall be subject to total or partial declassification of such forest while the initiation of any development project likely to perturb a forest or aquatic environment shall be subject to a prior environmental impact study, etc. Furthermore, it envisages methods for the setting up of pastures or classification of protected areas in forest zones to ensure the conservation of land or biodiversity, etc.

Part III distinguishes two main categories of forests: (i) permanent or classified forests which are lands used solely for forestry and or as a wildlife habitat; and (ii) non-permanent of unclassified forests which comprise forest lands that may be used for other purposes than forestry. Permanent forests cover at least 30 % of the total area of the national territory and comprise State forests and council forests. For their part, non-permanent forests are forests on non-permanent forest land comprising communal forests, community forests and forests belonging to private individuals.

Decree No. 94/436/PM to lay down the terms and conditions for the implementation of forestry regulations

This decree is the implementing instrument of Law No. 94/01 of 20 January 1994, particularly concerning provisions governing forests, protection of nature and biodiversity. It comprises 109 articles divided into eight parts.

Decree No. 95/531/PM of 23 August 1995 to determine the conditions of implementing forestry regulations

This decree defines the terms and conditions for the implementation of forestry, wildlife and fisheries regulations in Cameroon. It governs the exploitation of forest products in the country. It consists of 151 articles dealing with topics like the protection of biodiversity, forest management, the processing and marketing of forest products. The Decree prohibits bush fires which are subject to authorization by local administrative authorities. The decree stipulates that any individual or corporate body wishing to exploit forest resources for commercial purposes must obtain a license. However, the implementation of any project in the forest is subject to an environmental impact assessment, especially projects that are likely

to destroy the natural habitat. According to Article 151, three ministers the Ministers of the Environment and Forestry; the Economy and Finance and the Industrial and Commercial Development are responsible for the implementation of this decree.

Decree No. 95-466/PM of 20 July 1995 to lay down the conditions for the implementation of wildlife regulations

This decree lays down the conditions for the implementation of Law No. 94/1 of 20 January 1994 to lay down forestry, wildlife and fisheries regulations. It includes 88 articles divided into six parts: I- General Provisions; II - Protection of Wildlife and Biodiversity; III - Wildlife Management; IV - Prosecution of Offences and V - Miscellaneous Provisions; and VI – Transitional and Final Provisions.

Decree No. 86/1238 of 1986 to set up the Korup National Park

Decree No. 96/119/PM of 12 March 1996 to set up the Banyang Mbo Wildlife Sanctuary

Law No. 78-23 relating to the protection of national parks

The present law determines the components of infringements if perpetrated in national parks and buffer zones and lays down the methods of reporting infringements and their corresponding sanctions.

Law No. 2003/003 of 21 April 2003 relating to phytosanitary protection

This law lays down the principles and rules governing phytosanitary protection in Cameroon. Phytosanitary protection shall be carried out through:

- the setting, adoption and adaptation of norms in the domain;
- the prevention and control of plant and plant product pests;
- the use of phytosanitary products that are safe for humans, animals and the environment;
- the dissemination and popularisation of appropriate phytosanitary protection techniques;
- the control of the import and export of phytosanitary products, plants, plant products and other regulated items that may lead to the release of plant pests;
- the control, throughout the national territory, of phytosanitary products, plants and plant products that may serve as vectors of harmful organisms.

Law No. 2001/014 of 23 July 2001 relating to seed activities

This law lays down the conditions for conducting seeding activities in Cameroon. It seeks support agricultural development by enhancing the results of agriculture research with a view to improving plant diversity; prevent unfair competition; guarantee the quality of seeds distributed to farmers; promote the conservation of national phytogenetic resources. According to this law, seed activities are carried out under the control of the State, which specifies technical standards regarding seeds and ensures quality control and certification of seeds. The exercise seed activities is subject to a prior declaration; the import, production and marketing of seeds are subordinated to the conditions defined by a joint decree of the Ministry in charge of agriculture and the Ministry in charge of commerce. Any person carrying out seed activities must keep a registry of transactions per species, variety and category.

All seed and plant species are classified in three categories: basic seeds, certified seeds, and standard seeds. The basic seeds and certified seeds produced in Cameroon must be certified by the seed administration. Any seeds marketed in Cameroon must be subject to quality control by the seed administration. An Official Catalogue of species and varieties has been established in which plant varieties developed or introduced in Cameroun are registered.

A seed fund has been set up to support the development of seed activities, research as well as development and safeguarding of local seeds.

2.5. Institutional Framework

The Ministry of Environment and Nature Protection (MINEP)

The Ministry of Environment and Protection of Nature set up by Decree No. 2004/320 of 8 December 2004 is responsible for the development, coordination and implementation of the national environmental policy. It:

- coordinates and monitors regional or international co-operation regarding the environment;
- defines measures for the rational management of natural resources in conjunction with the ministries and specialized corporations concerned;
- disseminates information to stimulate participation in the management and preservation of the environment;
- develops sector-based master plans for the protection of the environment in collaboration with the interested ministries;

- negotiates agreements and international conventions relating to the protection of the environment and their implementation.

It is this ministry that approves environmental impact studies.

Decree No. 2004/320 of 8 December 2004 to reorganize the Government created within MINEP, the Sub-department of Environmental Assessment (SDEE), including the Environment Impact Studies Service (SEIE), Environmental Audit Service (SAE) and Environmental Management Plan Monitoring Service (SSPGE).

In order to assist MINEP in its development, coordination, execution, environment control, and sustainable development missions, other ministries intervene at various levels in their areas of competence within the Inter-ministerial Environmental Committee (CIE) set up by the Framework Law whose organization and functioning is governed by Decree No. 2001/718/PM of 3 September 2001. CIE also issues an opinion on environmental impact assessments before the decision of MINEP.

MINEP has formulated Guidelines on Environmental Measures which define major principles to be followed and considered during the implementing of forestry projects.

The Inter-Ministerial Committee (IMC)

Decree No. 2001/718/PM of 3 September 2001 lays down the organization and functioning of the IMC set up by the Framework Law. Under the terms of this decree, it role is to assist the Government in the development, coordination, execution and control of national policies on the environment and sustainable development (Article 2 (1)). This decree recently was modified and supplemented by decree N° 2006/1577/PM of 11 September 2006 to take into account the new structure of the Government of 8 December 2005. The IMC which comprises 17 members will have to issue its opinion on this environmental impact study.

The 17 members represent the following ministries:

- the Ministry of Territorial Administration and Decentralization (MINATD)
- the Ministry of Agriculture and Rural Development (MINADER)
- the Ministry of Defence (MINDEF)
- the Ministry of Urban Development and Housing (MINDUH)
- the Ministry of State Property and Land Tenure (MINDAF)

- the Ministry of Livestock, Fisheries and Animal Industries (MINEPIA)
- the Ministry of Energy and Water Resources(MINEE)
- the Ministry of Environment and Nature Protection (MINEP)
- the Ministry of Forestry and Wildlife (MINFOF)
- the Ministry of Industry, Mines and Technological Development (MINIMIDT)
- the Ministry of Planning, Development Programming and Regional Development (MINEPLDAT)
- the Ministry of Small- and Medium-sized Enterprises, Social Economy and Handicraft(s) (MINPMEESA)
- the Ministry of Scientific Research and Innovation (MINRESI)
- the Ministry of Public Health (MINSANTE)
- the Ministry of Tourism (MINTOUR)
- the Ministry of Transport (MINT)
- the Ministry of Public Works (MINTP).

The Ministry of Forestry and Wildlife (MINFOF)

The Minister of Forestry and Wildlife is in charge of the development, implementation and evaluation of Government's policy on forestry and wildlife. For this reason, it is responsible for:

- the management and protection of forests of the national domain;
- the development and control of the execution of regeneration, afforestation, and forest establishment and inventory programmes;
- the control of compliance with regulations in the area of forest development by various stakeholders;
- the application of the administrative sanctions when it is necessary;
- relations with professional organizations of the forestry sector;
- the setting up and management of botanical gardens;
- the application of international conventions ratified by Cameroon.

It is responsible for the supervision of the National Forestry Development Agency, the of National Forestry Commission, the National Wildlife School as well as relations with the United Nations Food and Agriculture Organization regarding the forest.

The Ministry of Industry, Mines and Technological Development (MINIMIDT)

This ministry is directly concerned with this impact study. MINIMIDT which was set up by Decree No. 2005/260 of 15 July 2005 is in responsible, inter alia for:

- the promotion of ecologically sustainable industrial development in conjunction with the administrations concerned;
- ensuring the monitoring and technical control of hazardous, harmful or inconvenient establishments regarding safety, hygiene and health together with the administrations concerned;
- the development and implementation of quality control programmes.

The Ministry of Public Health (MINSANTE)

The Minister of Public Health is responsible for the continuous development, implementation and evaluation of the Government's public health policy. For this reason:

- It ensures the organization, management and development of public hospitals as well as inspection of the private health establishments;
- It is responsible for the preventive medicine;
- It controls the activities of pharmacists and dental surgeons, medical professions and supervises the corresponding medical professional orders and public health organizations;
- It contributes to the training as well as continuous training of doctors, pharmacists and ancillary health personnel.

It supervises public health establishments and organizations. He is assisted by a Secretary of State.

The Ministry of Energy and Water Resources (MINEE)

The Ministry of Energy and Water Resources is placed under the authority of a Minister whose role is to develop, implement and evaluating Government's policy on the production, transportation and distribution of energy and water. Accordingly, it is in charge of:

- the development of governmental plans and strategies concerning energy and water supply;
- the prospection, search and exploitation of water in urban and rural areas;
- the promotion of new sources of energy, in conjunction with the Ministry in charge of scientific research.

It is responsible for the supervision of establishments and corporations of in charge of the production, transportation, storage and distribution of electricity, gas, oil and water, and the Cameroon Oil Transportation Company.

The Ministry of State Property and Land Tenure (MINDAF)

It is responsible for the management of State private property as well as goods, furniture and buildings.

The Ministry of Agriculture and Rural Development (MINADER)

The Ministry of Agriculture and Rural Development is responsible for the:

- development, planning and realization of governmental programmes related to agriculture and rural development;
- development of regulation and standards, as well as application of control;
- monitoring and protection of various agricultural chemicals; pest control;
- design of strategies and methods to guarantee food safety and self-sufficiency as well as monitoring of their implementation;
- identification and promotion of new agricultural products for export;
- collection, production and analysis of agricultural statistics;
- dissemination of information and agricultural extension to producers;
- management coordination regarding agricultural crisis situations;
- follow-up of agricultural professional organizations;
- investment promotions of average and large operations in the agricultural sector;
- agricultural and co-operative training, control of agricultural and co-operative training and control of private agricultural training, in collaboration with the Ministry in charge for vocational training concerning the rural development of farmers' managerial staff and agricultural extension services;
- participation in programme planning to improve living conditions in rural areas; promotion of community development and agricultural engineering.

The Ministry of Commerce (MINCOMMERCE)

The Ministry of Commerce is headed by a Minister, assisted by a Secretary of State. The Minister is responsible for the development, implementation and evaluation of Government's trade policy. Accordingly, he is responsible for:

- the development, implementation and evaluation of strategies for promoting Cameroonian products;
- the promotion and defence of quality control for export products;
- search for new markets for Cameroonian products;
- monitoring of international trade on national agricultural produce;
- control of compliance with standards regarding importation, in conjunction with the Minister in charge of standardization;
- development of regulations regarding prices and ensuring their application;
- monitoring of inflation;
- promotion and control of healthy competition;
- organization and supervision of trade fairs;
- development of standards of measure, quality control instruments and follow-up of their application, in conjunction with the Minister in charge of standardization;
- negotiation and follow-up of the implementation of the trade agreements;
- follow-up of trade statistics;
- follow-up of relations with international organizations operating in the domain of international trade;
- development or homologation of standards of presentation, conservation and distribution of convenience goods and ensuring that economic operators comply with standards, in collaboration with the Minister in charge of standardization;
- imposing sanctions in the event of fraud or non-compliance with set standards;
- promotion of the competitiveness of Cameroonian products on foreign markets.

The Ministry of Commerce has a Private Secretariat; 2 (two) technical advisers; an Inspection General; decentralized services; external services and a Secretary of State.

The Ministry of Labour and Social Work (MINTSS)

The Ministry of Labour and Social Security is headed by a Minister who is responsible for the development, implementation and evaluation of Government's policy and programmes in the domains of industrial relations, the status of workers and social security. Accordingly, it is responsible for the:

- ensuring the application fair labour standards act and international conventions ratified by Cameroon;
- development and implementation of the policy of safety and social security;

- relationships with the institutions of the United Nations system and the African Union specialized in the domain of labour.

It is the supervisory authority of the National Social Insurance Fund.

Article 2: For the achievement of his missions, the Minister for Labor and Social security lay out: - of a Particular Secretariat; - of two (02) Technical Advisers; - of a General Inspection; - of Police headquarters; - decentralized Services.

2.6. Cameroon's International Commitments

Cameroon is a signatory to a number of international conventions relating to the environment, climate, endangered species of wild fauna and flora, etc. The most important ones are listed below.

Convention on International Trade in Endangered Species of Wild Fauna and Flora, also known as the Washington Convention (CITES)

It is an international agreement between governments drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). The text of the convention was agreed upon in 1973, and CITES entered into force on 1 July 1975. Its aim is to ensure that international trade in species of wild animals and plants does not threaten their survival. It accords varying degrees of protection to more than 33 000 plant and animal species.

Cameroon: Accession date 5 June 1981 and date of entry in force 3 September 1981.

Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region

This Convention covers the marine environment, coastal zones and related inland waters that fall within the jurisdiction of West and Central African States, including Mauritania and Namibia, which have become Contracting Parties to this Convention.

Resolution adopted on 23 March 1981 in Abidjan. This resolution came into force in Cameroon on 5 August 1984.

Convention on the Conservation of Nature and Natural Resources (Alger, 1968)

The objectives of this Convention are:

1. To enhance environmental protection;

2. To foster the conservation and sustainable use of natural resources; and

3. To harmonize and coordinate policies in these fields with a view to achieving ecologically rational, economically sound and socially acceptable development policies and programs.

The Central African Forests Commission (COMIFAC)

COMIFAC was established in 2005, at a summit of the Central Africa Heads of State in Brazzaville, to act as a regional forum for the conservation and sustainable joint management of forest ecosystems in Central Africa. The countries include Cameroon, Central African Republic, Democratic Republic of Congo, Equatorial Guinea, Gabon, Chad, Burundi, Sao Tomé and Rwanda. The Central African Forest Commission (COMIFAC) is the primary authority for decision-making and coordination of sub-regional actions and initiatives on conservation and sustainable management of the Congo Basin forests.

Vienna Convention for the Protection of the Ozone Layer

The Vienna Convention was signed in 1985. It includes the Montreal Protocol on Substances that Deplete the Ozone Layer which was signed in Montreal in 1987. The Vienna Convention for the Protection of the Ozone Layer is a Multilateral Environmental Agreement. It was agreed upon at the Vienna Conference of 1985 and came into force in 1988. It acts as a framework for international efforts to protect the ozone layer. However, it does not include legally binding reduction goals for the use of CFCs, the main chemical agents causing ozone depletion. These are set out in the accompanying Montreal Protocol.

Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. The treaty was opened for signature on 16 September 1987, and entered into force on 1 January 1989, followed by a first meeting in Helsinki in May 1989. Since then, it has been revised seven times, in 1990 (London), 1991 (Nairobi), 1992 (Copenhagen), 1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), and 1999 (Beijing). It is believed that adherence to the international agreement will lead to the recovery of the ozone layer by 2050.

Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is an international legally binding treaty adopted in Rio de Janeiro in June 1992. The Convention has three main goals:

- conservation of biological diversity (or biodiversity);
- sustainable use of its components; and
- fair and equitable sharing of benefits arising from genetic resources

In other words, its objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often considered as the key document regarding sustainable development. The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993.

This convention came into force in Cameroon on 17 January 1995. Law No. 94/1 and its implementing instruments reflect its application at the national level.

Global Strategy for Plant Conservation

In April 2002, the parties of the UN CBD adopted the recommendations of the Grand Canarias Declaration Calling for a Global Plant Conservation Strategy, and adopted a sixteen-point plan aimed at reducing the rate of plant extinction around the world by 2010.

United Nations Framework Convention on Climate Change – UNFCCC

The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) is an international environmental treaty drafted at the United Nations Conference on Environment and Development (UNCED), otherwise known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992. The objective of the treaty is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The UNFCCC was opened for signature on 9 May 1992, after an Intergovernmental Negotiating Committee produced the text of the Framework Convention as a report following its meeting in New York from 30 April to 9 May 1992. It came into force on 21 March 1994. As of December 2009, UNFCCC had 192 parties.

Cameroon ratified the UNFCCC on 19 October 1994.

Kyoto Protocol

The Kyoto Protocol is the protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC) aimed at fighting global warming. The UNFCCC is an international environmental treaty whose goal is to ensure the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[1] The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan, and entered into force on 16 February 2005. As of November 2009, 187 States had signed and ratified the protocol.

Cameroon is also signatory to the Kyoto Protocol which entered into force in February 2005.

Participation in the Kyoto Protocol, as of June 2009; dark green indicates the countries that have signed and ratified the treaty, grey represents countries that have not yet decided and red those with no intention to ratify.

(Source: Wikipedia.org)

United Nations Convention to Combat Desertification

The United Nations Convention to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa, is a Convention aimed at combating desertification and mitigating the effects of drought through national action programmes that incorporate long-term strategies supported by international cooperation and partnership arrangements.

The Convention, the only one stemming from the direct recommendation of the Conference's Agenda 21, was adopted in Paris on 17 June 1994 and came into force in December 1996. It is the first and only internationally legally binding framework set up to address the problem of desertification. The Convention is based on the principles of participation, partnership and decentralization - the linchpin of good governance and sustainable development. It now has 193 country Parties to the Convention, giving it truly global scope.

Stockholm Convention on Persistent Organic Pollutants :

The Stockholm Convention on Persistent Organic Pollutants is an international environmental treaty that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs). Negotiations for the Convention were completed on 23 May 2001 in Stockholm. The convention came into force on 17 May 2004 with ratification by an initial 128 parties and 151 signatories. Co-signatories agree to outlaw nine of the dozen dirty chemicals, limit the use of DDT to malaria control, and curtail inadvertent production of dioxins and furans.

Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, commonly known simply as the Rotterdam Convention, is a multilateral treaty to promote shared responsibilities in relation to the importation of hazardous chemicals. The convention promotes the sharing of information and calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans. Parties can decide whether to allow or ban the importation of chemicals listed in the treaty, and exporting countries are obliged to ensure compliance by producers within their jurisdiction.

Ramsar Convention:

The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilization of wetlands, i.e. to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.

International Convention on Civil Liability for Oil Pollution Damage:

The International Maritime Organization's (IMO) International Convention on Civil Liability for Oil Pollution Damage (CLC) signed in 1969 to ensure adequate compensation for oil pollution damage resulting from maritime casualties involving oil tankers. The Convention places the liability for such damage on the owner of the ship from which the polluting oil escaped or was discharged.

It was ratified on 17 May 1984 and came into force on 12 August 1984. It is covered by Law No. 83/16 of 21 July 1983.

2.7. International Best Practices Standards and Guidelines

IFC Performance Standards

The Project will follow the IFC's Performance Standards on Social and Environmental Sustainability. The eight Performance Standards are what IFC applies to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing.

The eight standards are:

- Performance Standard 1: Social and Environmental Assessment and Management Systems;
- Performance Standard 2: Labor and Working Conditions;
- Performance Standard 3: Pollution Prevention and Abatement;
- Performance Standard 4: Community Health, Safety and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management;
- Performance Standard 7: Indigenous Peoples; and
- Performance Standard 8: Cultural Heritage.

And additional guidance is contained in:

- IFC Policy on Social and Environmental Sustainability and
- Pollution and Prevention Abatement Handbook (1998).

Environmental, Health and Safety (EHS) Guidelines

The EHS Guidelines are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of projects. This information supports actions aimed at avoiding, minimizing, and controlling environmental, health, and safety (EHS) impacts during the construction, operation, and decommissioning phase of a project or facility.

For the Project, the EHS Guidelines that apply are:

- IFC Environmental, Health, and Safety General Guidelines (April 2007);
- IFC Environmental, Health, and Safety Guidelines for Plantation Crop Production (April 2007);
- IFC Environmental, Health, and Safety Guidelines for Vegetable Oil Processing (April 2007).

RSPO (Roundtable on Sustainable Palm Oil)

SG Sustainable Oils Cameroon PLC is a member of the RSPO, which is a not for profit association that unites stakeholders from seven sectors of the palm oil industry - oil palm producers, palm oil processors or traders, consumer goods manufacturers, retailers, banks and investors, environmental or nature conservation NGOs and social or developmental NGOs - to develop and implement global standards for sustainable palm oil.

The Roundtable on Sustainable Palm Oil (RSPO) was formed in 2004 with the objective to promote the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders.

The members have several Principles and Criteria to follow for Sustainable Palm Oil Production:

- Principle 1: Commitment to transparency ;
- Principle 2: Compliance with applicable laws and regulations;
- Principle 3: Commitment to long-term economic and financial viability;
- Principle 4: Use of appropriate best practices by growers and millers;
- Principle 5: Environmental responsibility and conservation of natural resources and biodiversity;
- Principle 6: Responsible consideration of employees and of individuals and communities affected by growers and mills;
- Principle 7: Responsible development of new plantings
  (An HCV assessment has to be conducted prior to any conversion); and
- Principle 8: Commitment to continuous improvement in key areas of activity.

High Conservation Value Forest (HCVF): The forest necessary to maintain or enhance one or more High Conservation Values (HCVs):

- **HCV1.** Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species);
- **HCV2.** Forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance;
- **HCV3.** Forest areas that are in or contain rare, threatened or endangered ecosystems;
- **HCV4.** Forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control);

- **HCV5.** Forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health); and
- **HCV6.** Forest areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

2.8. Specific legislation

Protected Areas

The SGSOC project site shares common boundary principally with two protected area as listed by the World Database on Protected Areas (WDPA 2006 version) (Figure 2). These are the Korup National Park and Banyang Mbo Wildlife Sanctuary.

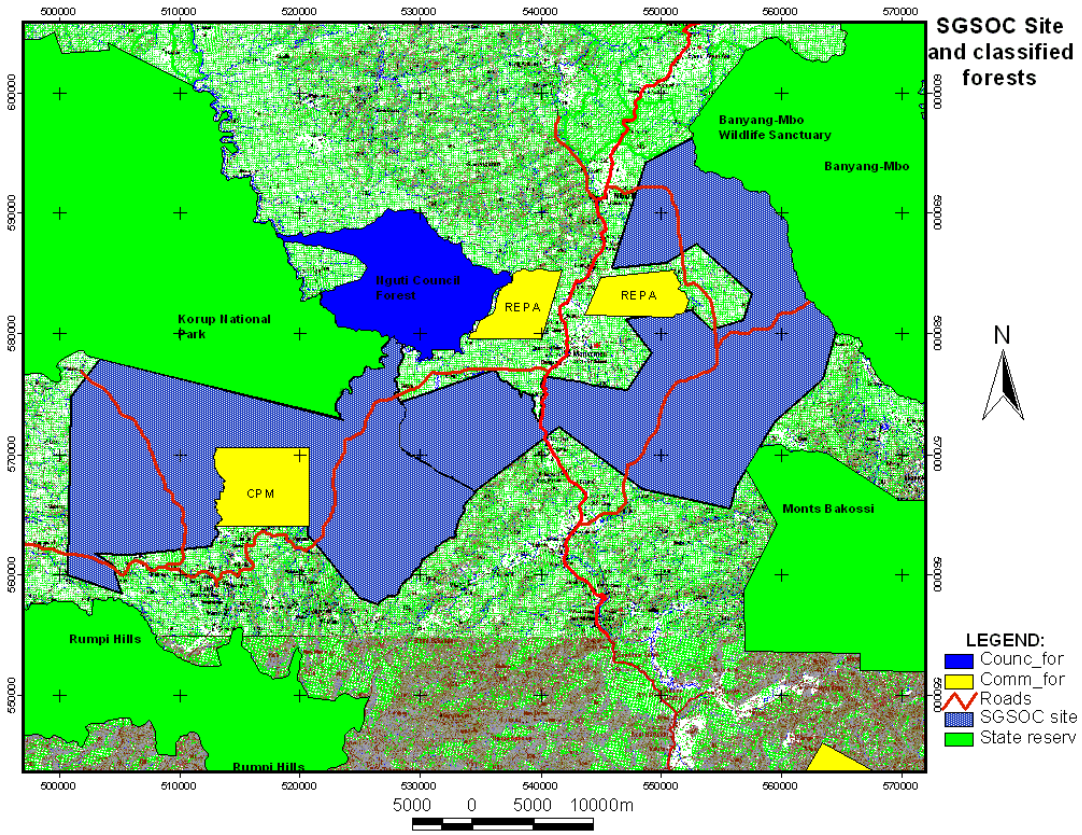


Figure 2: SGSOC Concession, the Korup National Park and the Banyang Mbo Wildlife Sanctuary

The Korup National Park is part of a Forest Reserve declared in 1937. Korup National Park (KNP) is the first park created in Cameroon's forest zone and gazetted in 1986 by Presidential Decree N° 86/1283 of October 30th 1986. Its first Management Plan was implemented by the Ministry in charge of Forestry and Wildlife for a period of five years (2002-2007) and consequently, a Ministerial Decision N° 0636/D/MINEF/SG/DFAP of 13th November 2002 to reorganize the Park was signed. The second Management Plan for the KNP and its peripheral zone (2009-2013) was implemented in December 2008. The Buffer Zone is 3 km surrounding the Park.

Air and Water Pollution

The legislation concerning liquid waste and the emission of greenhouse gas is essential in the construction of a palm oil extraction factory as well as the management of large quantities of solid waste resulting from the processing of palm nuts.

It will be necessary to consider Decree No. 2001/164/PM, Decree No. 2001/165/PM of 8 May 2001 as well as Law No. 98/15 of 14 July 1998 and its implementing Decree No. 99/818/PM of 9 November 1995.

In addition, special attention should be paid to greenhouse gases. Though Cameroon is a signatory to the United Nations Framework Convention on Climate Change and the Kyoto Protocol, as a non-Annex I country, it is not required to reduce its carbon dioxide emissions or other greenhouse gases into the atmosphere. In view of the international commitments, however, it would be considered a very bad environmental practice to emit large quantities of these gases into the atmosphere.

3. PROJECT DESCRIPTION AND OPERATIONS

3.1. Project Promoter and Overview

SGSOC, whose Head Office is in Douala, is part of an American group, HERAKLES FARM, based in the United States which aims to implement a quality palm oil production and marketing project in Cameroon.

HERAKLES FARM boasts a rich experience in project implementation at an international level, particularly in South Africa. In all, HERAKLES FARM's investments in Africa amount to two (2) billion US dollars and include the international aluminium refinery in Guinea, the Bujagali hydroelectricity project in Uganda and SEACOM, an optical fibre sub-marine cable that provides access to high-speed internet connection to East and Southern African countries.

In 2007, the Bujagali Energy Project and the SEACOM cable system respectively won the "Africa Power Deal of the Year" and the "African Communications Deal of the Year" conferred on them by the Euromoney Project Finance Magazine. In 2009, the SEACOM project was voted as "Best Pan-African Initiative of the Year", conferred by the AfricanCom Awards.

HERAKLES FARM's experience in Africa includes the key role it played in the development of the US$ 5.21 billion international aluminium refinery based in Guinea. With a capacity of 4 million tons per annum, it is one of the biggest modern aluminium production factories in the world which offers an opportunity for investors concerned with social issues in a country with a third of the world's bauxite reserves, although it is the poorest country in the world.

HERAKLES FARM management also played an important role in SEACOM: a private company with a capital of US$ 650 million which laid, owns and manages a sub-marine optical fibre cable which ensures communication between East and Southern Africa. Broadly speaking, SEACOM offers international capacity to worldwide networks via India and Europe. SEACOM brings technological improvement to the economic development and social advancement of Africa. SEACOM's financing ended in November 2007, whereas the manufacture of the optical fibre cable had already been launched to be operational by July 2009, in time for the World Cup in South Africa.

In the third quarter of 2009, HERAKLES FARM executed an agreement with the Government of Cameroon to develop 80,506 hectares of land. A significant portion is suitable for planting, excluding waterways, plantation roads and buffer zones. Land clearing commenced, and seedlings for the Nguti and Mundemba nurseries arrived in August. The site is one of the best locations for oil palm cultivation in West Africa due to the rainfall distribution, soil composition, topography and proximity to existing roads and port facilities.

HERAKLES FARM expects to provide significant benefits relating to poverty reduction, illness prevention and education among other positive impacts. As a member of the Roundtable on Sustainable Palm Oil ("RSPO"), HF is committed to promoting local community engagement, environmental protections and corporate social responsibility. From development to the build-out, local stakeholders, villagers, farmers, government officials and NGOs are engaged, and significant local economic-development and empowerment programs are being planned. The fully integrated projects are self-sustaining, including power generation, processing mills, repair facilities, employee housing, schools, medical centers and community development programs. The oil extraction mill will employ a methane capture technology, with effluent from the mill treated and utilized as a nutrient-enriched source of water for the trees.

SG Sustainable Oils Cameroon Limited
Douala - Cameroon.
C/O Dr Isidore Nse TIMTI
Tel: 77 89 13 31 / 99 37 07 01
Fax: +1 646 786 40 63
E-mail: timti@heraklesfarmscameroon.com

3.2. Project Location

The project is located in the South-West Region, and more precisely in the Ndian and Kupe-Manenguba Divisions. Important localities within the proximity of the project site are Nguti to the East and Mundemba and Toko to the West.

The site is bordered by the Korup National Park and the Nguti Council forest to the North (with rivers Madie and Bake), by the Bayang Mbo Wildlife Sanctuary to the East (with River Mbo) and by the Bakossi Mountains to the South East.

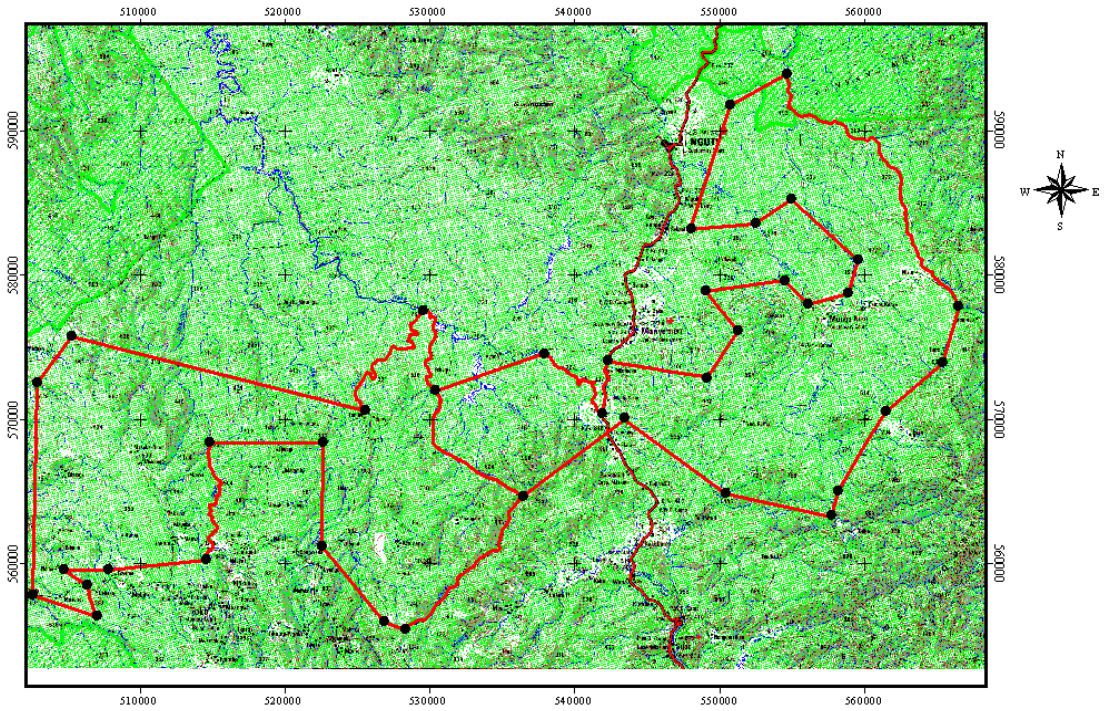


Figure 3: Location of the two site blocks

The entire project which covers 80,506 ha of land has been divided into blocks A and B: Block A, within the Kupe - Manenguba Division occupies an area of 42 486 ha and Block B in the Ndian Division, 38,020 ha.

3.3. Justification of choice of site

The following reasons account for the choice of the above project site:

- The poor state of access roads notwithstanding, the project area remains close to Kumba town (150 km from Mundemba and 76 km from Nguti) which itself is barely some one hundred km from Cameroon's economic capital (Douala), with its port and international airport;
- This part of the country is renowned for the fertility of its soil, particularly owing to its proximity to Mount Cameroon and already hosts other palm oil production structures;

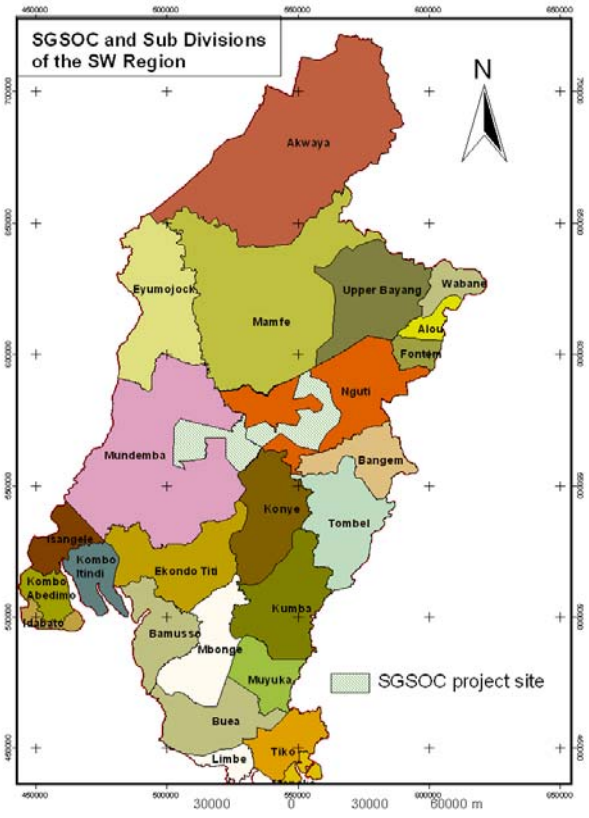


Figure 4: Project Location in the South-West Region

- the climate is also suitable for oil palm production with good rainfall and ideal temperatures;
- there is abundant, available labour;
- there is minimum infrastructure such as passable roads, reliable telecommunication infrastructure, diverse banking institutions, various Cameroonian administrations and public services are represented here.

3.4. Analysis of Project Alternatives or Options

In light of the foregoing, there was no other alternative for this project as the environment is much more suitable and there is a large number of well-known advantages through the existence of other palm oil producers currently in the region.

Furthermore, the project consists in setting up four other production units in other regions of Cameroon having the same conditions that favour the development of palm oil production.

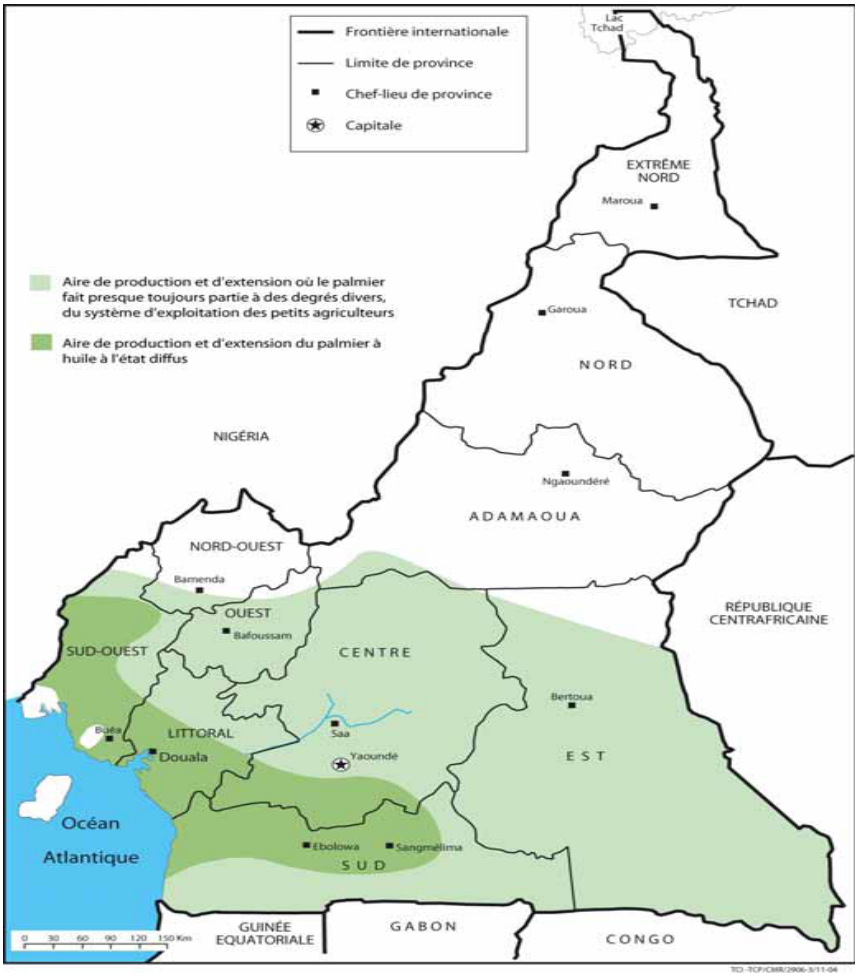


Figure 5: Map of Palm Oil Production and Extension in Cameroon

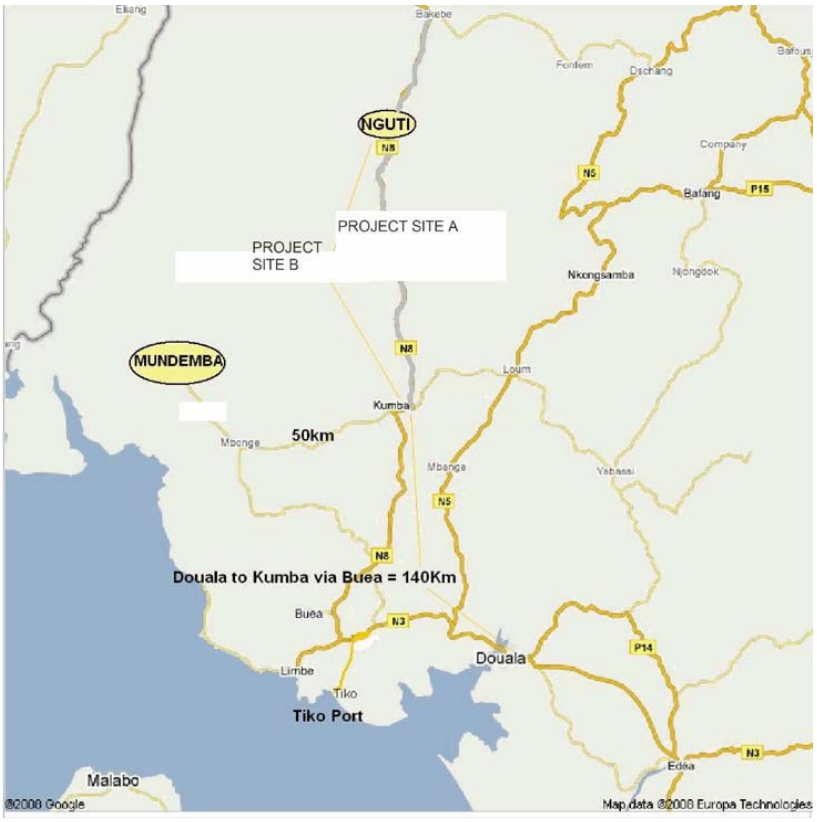


Figure 6: Road Network around the Project Site

3.5. Project Background

In 2007, prices literally exploded on the world market due to an overall drop in supply resulting from a fall in production levels in the two biggest producers, Malaysia and Indonesia, which were badly affected by the “El nino” factor.

This led countries like Brazil (sugar cane) and the United States (maize) to extend the surface area for the cultivation of these commodities to produce bio-ethanol, to the detriment of soya bean whose oil is in direct competition with palm oil.

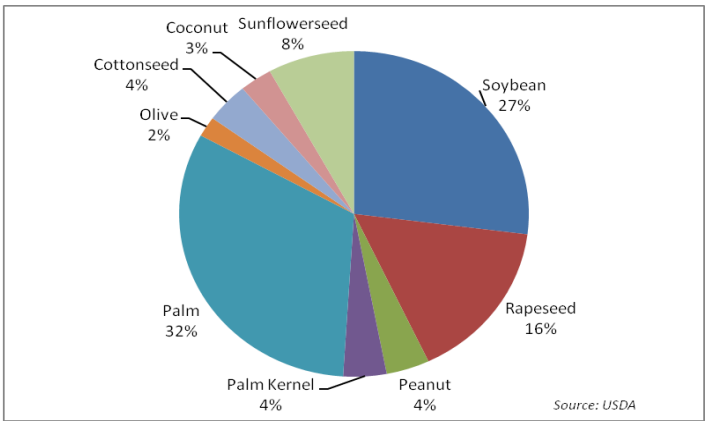
As supply shrank, demand experienced a leap with the increasing use of vegetable oil to produce bio fuel, and growing consumption of vegetable oil in food in thickly populated countries like Russia, Mexico, Brazil, Bangladesh and even Africa.

It was against this backdrop that the 2008 extra-premium crisis stepped in and further upset the market through the increase in the price of petroleum products, the rise in interest rates and the credit crunch.

We have since returned to a more familiar situation often characterized by high prices as demand is more than supply.

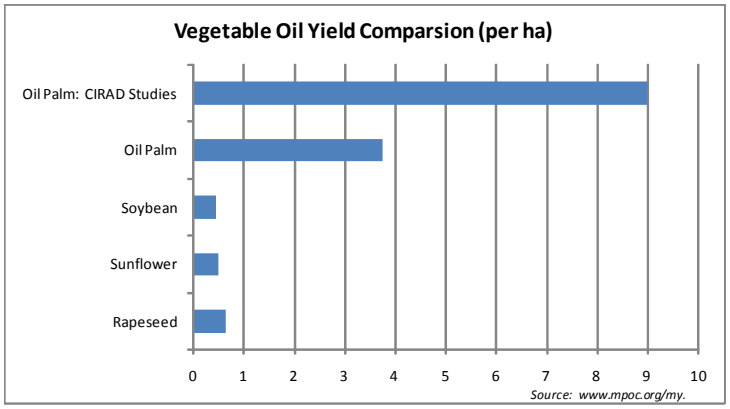
3.6. Project Justification

Palm oil is the world's main source of vegetable oil and fats, and consumption is growing steadily. Palm oil is a versatile product that can be separated into a wide range of distinct oils for use in products ranging from foods to cosmetics to fuels. Historically many of these products contained animal fat or other vegetable oils. Palm oil, however, has significantly increased its market share of the oils and fats market over the past few decades due to its superior yields (tons/hectare) and its particular health attributes (e.g. no trans-fats). Consequently, palm oil consumption has risen fourfold over the past 20 years, from 11.1 million MT in 1990 to 45.15 million MT in 2009 (Source: Oil World).



(Source: USDA)

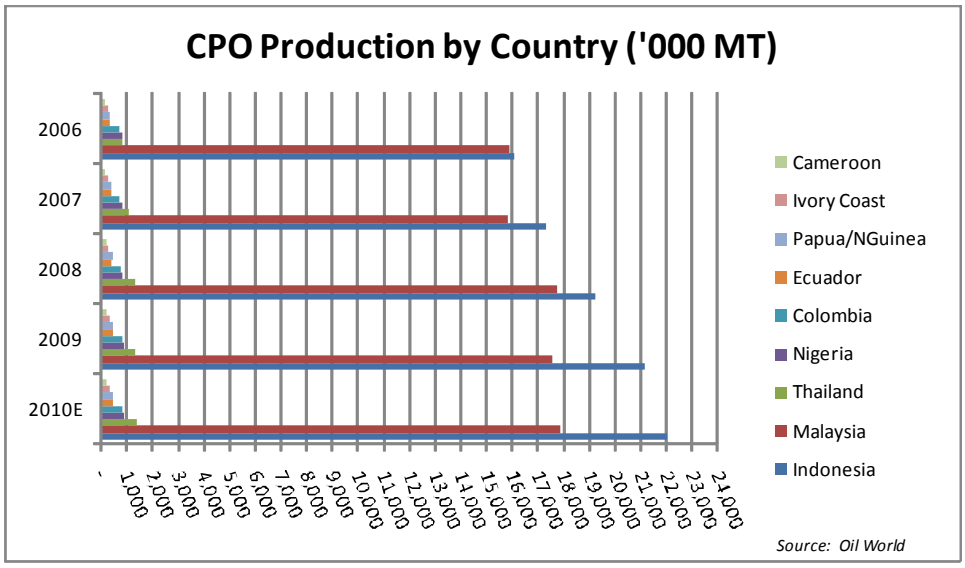
Graph 4: Global vegetable oil consumption by type



(Source: www.mpac.org/my)

Graph 5: Oil Yield per Hectare (MT)

The growing demand for palm oil has led producers to expand rapidly in recent years. However, the main regions of production, Malaysia and Indonesia, have a diminishing amount of land left for cultivation in a sustainable manner. Controversy has arisen over the expansion of palm oil plantations in Asia and South America due to the depletion of High Conservation Value Forests ("HCVF"). By contrast, in West Africa, where climatic conditions are favorable for oil palm production, there is an abundance of previously logged land available for sustainable cultivation.



(Source: Oil World)

Graph 6: Production by Major Countries

Numerous international development agencies and NGOs have advocated increasing palm oil production in West Africa due to its positive effect on employment creation and other social benefits. A report by the Food & Agriculture Organization ("FAO"), for instance, cited the industry as holding, "the key to rural poverty reduction" and that the "prolific palm oil tree provides the best raw material for starting rural industries." The World Bank also recently approved a USD$60 million Agricultural Competitiveness Project in Cameroon, with palm oil as one of the six target industries. Although palm oil is native to the region, Cameroon is a net importer of processed crude palm oil ("CPO") and palm kernel oil ("PKO"), resulting in a higher local cost for these food staples.

The potential for African Palm Oil:

- Supply of palm oil is dominated by Malaysia and Indonesia.
- In spite of the palm oil tree originating in West Africa and suitable climatic conditions, Africa imported 4 million tons of palm oil in 2009.
- Palm oil cultivation produces more jobs than most other crops.

3.7. The Palm Oil Sector in Cameroon

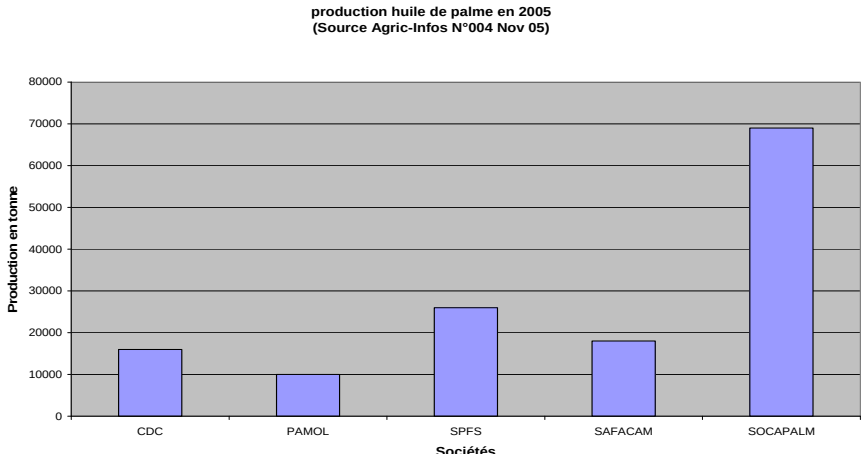
Palm oil sales in Cameroon are divided into: edible oil for cooking and for preparing traditional dishes and industrial oil for soap manufacturers and refineries.

For producers, there are three categories of customers, each corresponding to a type of palm oil with very specific characteristics:

- wholesalers who prefer fresh, red palm oil which does not coagulate and has a good flavour which they retail easily on the market.
- refineries prefer oil with more of olein and stearin and an acidity of less than 3%.
- for their part, soap manufacturers who want any type of oil provided the acidity is very high.

SOCAPALM is the largest palm oil producer of in Cameroon accounting for 60% of the market share (thanks to its four mills). The remainder is divided between weak competitors that operate in dispersed ranks. These include the CDC with 38 000 hectares of land and PAMOL.

The graph below shows the distribution of crude palm oil production in Cameroon in 2005.



Graph 7: Palm Oil Production in Cameroon in 2005

Since its privatization sector in 2000, investments made by the new owner have improved the performance of its mills. The extension of surface cultivated and improved yields have necessitated the construction of a new oil mill to avoid any bottlenecks.

3.8 Project Advantages and Benefits

One of the main socio-economic benefits of this project is provision of permanent jobs to the local population. It is expected that up to 9.000 direct jobs will have been created upon completion of the project. These will include labor, engineers, clerical workers, drivers, supervisors, maintenance workers, security guards, senior management staff and other permanent positions.

Other benefits of this project include, but are not limited to:

- rural development;
- training for employees and out growers;
- education programs;
- housing;
- access to electricity and clean water;
- healthcare;
- commercial opportunities for small-and-medium sized enterprises (SMEs);
- tax revenue for the Government; and,
- scholarships for local universities.

This project also has undeniable advantages on the environment:

- Alleviating Global Warming**:** an oil palm plantation with its perennial green cover and closed canopy displays the main features of a tropical rainforest. It is also a more efficient carbon sink than a tropical rainforest and helps absorb greenhouse gases. A study has shown that an oil palm plantation assimilates 44 tons of dry matter per hectare per year compared to 25.7 tons of dry matter per hectare per year a rainforest.
- Conserving Soil and Water Quality**:** during planting, several measures are taken to prevent soil degradation and conserve soil fertility. On hilly land, contour terracing is carried along steep slopes. Silt pits help reduce the length of slope while trapping soil and plant nutrients. Pruned fronds placed along the slope minimize soil erosion and fertilizer loss. Very often, hilly forest areas with slopes greater than 250 are left untouched.
- Leguminous cover crops fix nitrogen in the soil, recycle organic matter, improve soil structure, keep out weeds, reduce soil compaction and erosion, and promote rainfall acceptance. In oil palm plantations at least 6 species of leguminous crops are planted for the benefits they provide.

  In coastal plantings, emphasis is placed on proper drainage and water management. This prevents over-draining and deterioration of fragile acids sulphate and peat soils.
- Oxygen to the Air: Oil palm trees are unique in a way that they have higher leaf area index that allows them to have better photosynthetic efficiency. This results in the palm trees to produce more oxygen to the air and absorb more carbon dioxide from the atmosphere. A study has shown that an oil palm tree has a leaf area index of 5.6 which is comparable to that of the rainforests.
- Efficient Land Utilization: inarguably, oil palm provides the highest yield of oil per hectare per year compared to the other oil-bearing crops. A comparison study has shown that a hectare of oil palm yields 10 times more oil than other major oil crops. An average yield of 4 - 5 tons of crude oil per hectare of land with best fields give as high as 7 - 8 tons of crude oil per hectare makes oil palm the most efficient oil-bearing crop in the world.
- Positive Energy Balance: compared to other major oilseed crops, the cultivation and processing of oil palm requires less input of fertilizers, pesticides, and fuel energy to produce one ton of oil. A study has shown that oil palm requires about 19.2 GJ of energy per hectare per year to produce one ton of oil which in turn gives back 182.1 GJ of energy per hectare per year through its products. (Note: GJ = Giga joules). This gives oil palm a very favorable input-output energy ratio of 9.5 as compared to 2.5 for soybean and 3.0 for oilseed ripe.

3.9. Project Objectives and Cost

The fundamental goal of **SGSOC** is to produce crude palm oil (CPO), palm kernel oil (PKO) and bio fuel for the local market and for export depending on market conditions.

In all, **SGSOC** plans to invest the sum of US$ 760 million in Cameroon over 20 to 25 years, divided as follows:

- plantations 295;
- mills 238;
- social infrastructure 86;
- vehicles and site equipment 7;
- other equipment 8;
- offices and other buildings 4;
- miscellaneous investments 74 ; and
- financial expenses 40 (in millions US dollars).

3.10. Technical Characteristics of the Project

3.10.1. Raw material

Picture 1: Fresh Fruit Bunch

Palm oil is rich in carotenoids, (pigments found in plants and animals) from which it derives its deep red colour, and the major component of its glycerides is the saturated fatty palmitic acid; hence it is a viscous semi-solid, even at tropical ambients, and a solid fat in temperate climates.

Because of its economic importance as an high-yielding source of edible and technical oils, the oil palm is now grown as a plantation crop in most countries with high rainfall (minimum 1 600 mm/yr) in tropical climates within 10° of the equator. The palm bears its fruit in bunches (see picture above) varying in

weight from 10 to 40 kg. The individual fruit, (see figure below) ranging from 6 to 20 gm, are made up of an outer skin (the exocarp), a pulp (mesocarp) containing palm oil in a fibrous matrix; a central nut consisting of a shell (endocarp); and the kernel, which itself contains an oil, quite different to palm oil, resembling coconut oil.

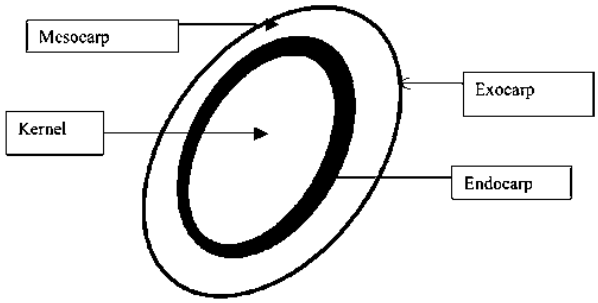


Figure 7: Structure of the palm fruit

Palm oil provides two different types of oil: Palm oil (fruit pulp) and Palm kernel oil (kernel). Uses: various foods such as fats, margarine, bakery products, confectionery, soups, cooking oils, detergents and cleaning materials, cosmetics, etc….

3.10.2. Plantations

Due to the large undertaking required for the full development of this project, the investment will require a multi-year build-out. To achieve the desired project size, many variables will need to be in place. One of the key variables is the availability of quality planting material. The hybrid planting material is in great demand and proper coordination is required between the project and seed breeders in order to secure the volume of material required. In addition, the clearing of land and the preparation of various other materials and consumables will need careful coordination in order to meet the optimal schedule.

The rate of planting will escalate in subsequent years. The first few years will afford management time to fully understand the soil conditions, the production and growth rates of the oil palms, and to provide appropriate training to employees. The initial years will also enable the company to optimize logistics and the supply chain to ensure reliable supplies.

Assuming the Establishment Convention is finished by spring 2009, the nurseries will be established in June/July 09 at Mundemba and Nguti. The nurseries will have enough seeds to plant 1,250 hectares at

each location in 2010. Another nursery planting program for 3,000 hectares will be initiated in 2010, and so forth. The following illustrates the estimated annual planting for the build out of the project:

Picture 2: Fresh Fruit Cut

Table 1: Annual Planting Estimates

Year	Nursery	Cumulative Hectares
2009	0	0
2010	630	630
2011	9370	10 000
2012	5 000	15 000
2013	5 000	20 000
2014	7 500	27 500
2015	7 500	35 000
2016	10 000	45 000
2017	10 000	55 000
2018	10 000	65 000
2019	10 000	75 000
2020	15 000	90 000

3.10.3. Plantation development operations

Table 2: Implementation plan for nurseries and estate complexes

NURSERIES IMPLEMENTATION PLAN

NURSERY BLOCK A

PHASES	YEAR	HECTARAGE	GERMINATED SEEDS REQUIRED @180/HA	REMARKS
1	2010	15	180,000	1000 HA PLANTING
2	2011	15+45=60	270,000	1500 HA PLANTING
3	2012	60+15=75	450,000	2500 HA PLANTING
4	2013	75	900,000	5000 HA PLANTING
5	2014	75+40=115	1,350,000	7500 HA PLANTING
6	2015	115	1,350,000	7500 HA PLANTING
7	2016	115	1,350,000	7500 HA PLANTING
8	2017	115	1,350,000	7500 HA PLANTING
TOTAL SEEDS			7,200,000	

NURSERY BLOCK B

PHASES	YEAR	HECTARAGE	GERMINATED SEEDS REQUIRED @180/HA	REMARKS
1	2010	-		
2	2011	-	450,000	FOR 2500 HA (using Block A Nursery)
3	2012	-	450,000	FOR 2500 HA (using Block A Nursery)
4	2013	75 (NEW SITE)	900,000	5000 HA PLANTING
5	2014	75	900,000	5000 HA PLANTING
6	2015	75	900,000	5000 HA PLANTING
7	2016	75	900,000	5000 HA PLANTING
8	2017	75	900,000	5000 HA PLANTING
TOTAL SEEDS			5,400,000	

DEVELOPMENT PHASES & COMPLEXES

BLOCK A

PHASES	YEAR	ESTATE	HECTARAGE	COMPLEX
1	2011	A1	1,000	AC1
2	2012	A1	1,500	
3	2013	A2	2,500	
4	2014	A3	2,500	AC2
4	2014	A3	2,500	
5	2015	A4	2,500	AC3
5	2015	A4	2,500	
5	2015	A4	2,500	AC4
6	2016	A5	2,500	
6	2016	A5	2,500	AC5
6	2016	A5	2,500	
7	2017	A6	2,500	AC6
7	2017	A6	2,500	
7	2017	A6	2,500	AC7
8	2018	A7	2,500	
8	2018	A7	2,500	AC8
8	2018	A7	2,500	
TOTAL			40,000	

BLOCK B

PHASES	YEAR	ESTATE	HECTARAGE	COMPLEX
2	2012	B1	2,500	BC1
3	2013	B2	2,500	
4	2014	B3	2,500	BC2
4	2014	B3	2,500	
5	2015	B4	2,500	BC3
5	2015	B4	2,500	
6	2016	B5	2,500	BC4
6	2016	B5	2,500	
7	2017	B6	2,500	BC5
7	2017	B6	2,500	
8	2018	B5	2,500	BC6
8	2018	B6	2,500	
TOTAL			30,000	

(Source: AGRINEXUS Implementation Plan)

Establishment of nurseries

Nurseries for tenera oil palm seeds obtained from **IRAD** la Dibamba will be established. Both mini bags and large poly bags will be used. The seedlings will remain in large polybags for 12 to 18 months before they are field-planted.

Site preparation

Nursery sites are to be mechanically prepared using bulldozers and will also be manually cleared. The top soil will be utilized from site in order to fill the polyethylene bags.

Field establishment

The field will be mechanically and manually cleared using dozers and field labor.

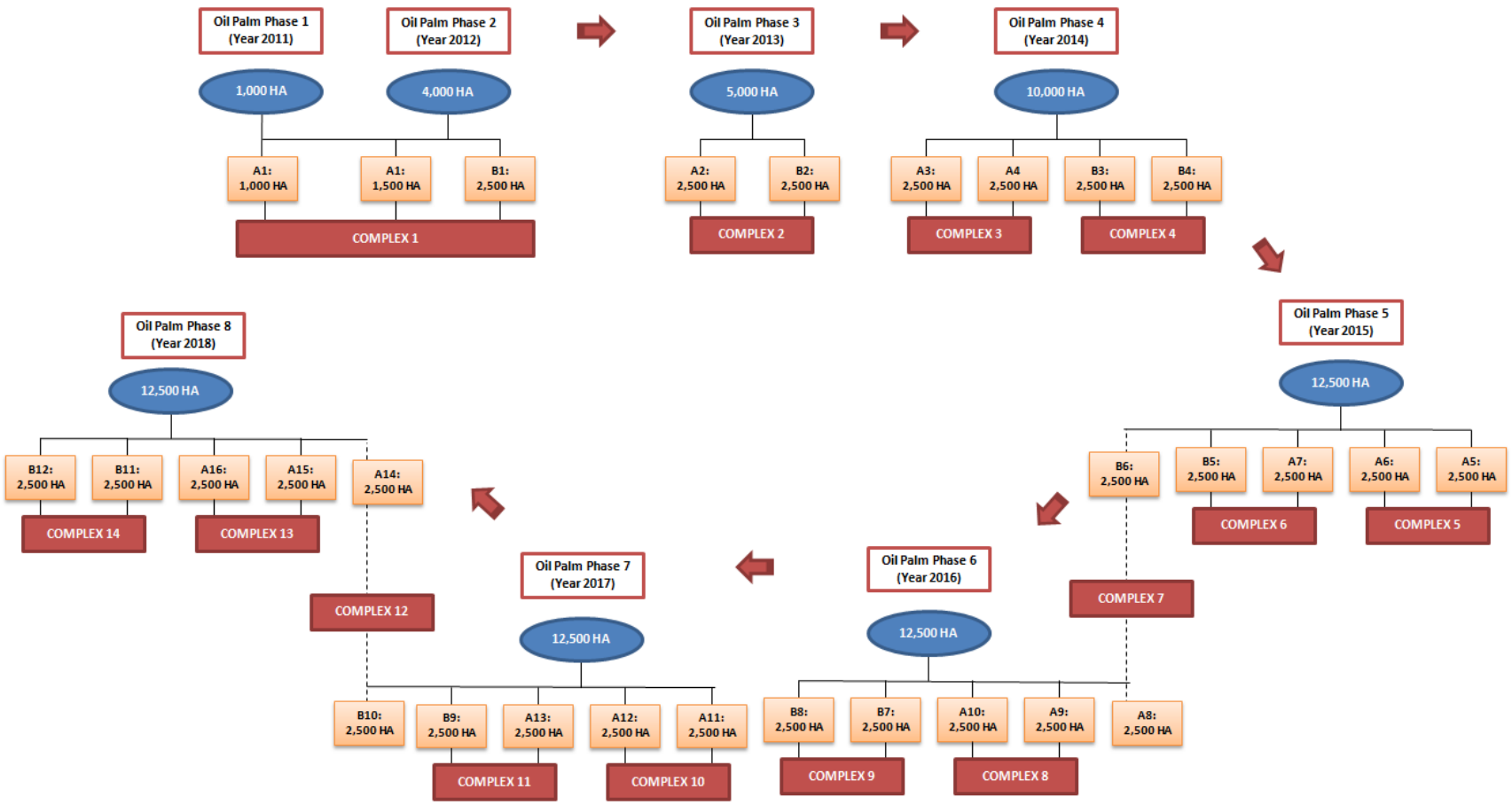
Maintenance and harvesting

Maintenance will be performed via mechanical slashing using tractors and manual use of machetes.

Re-planting

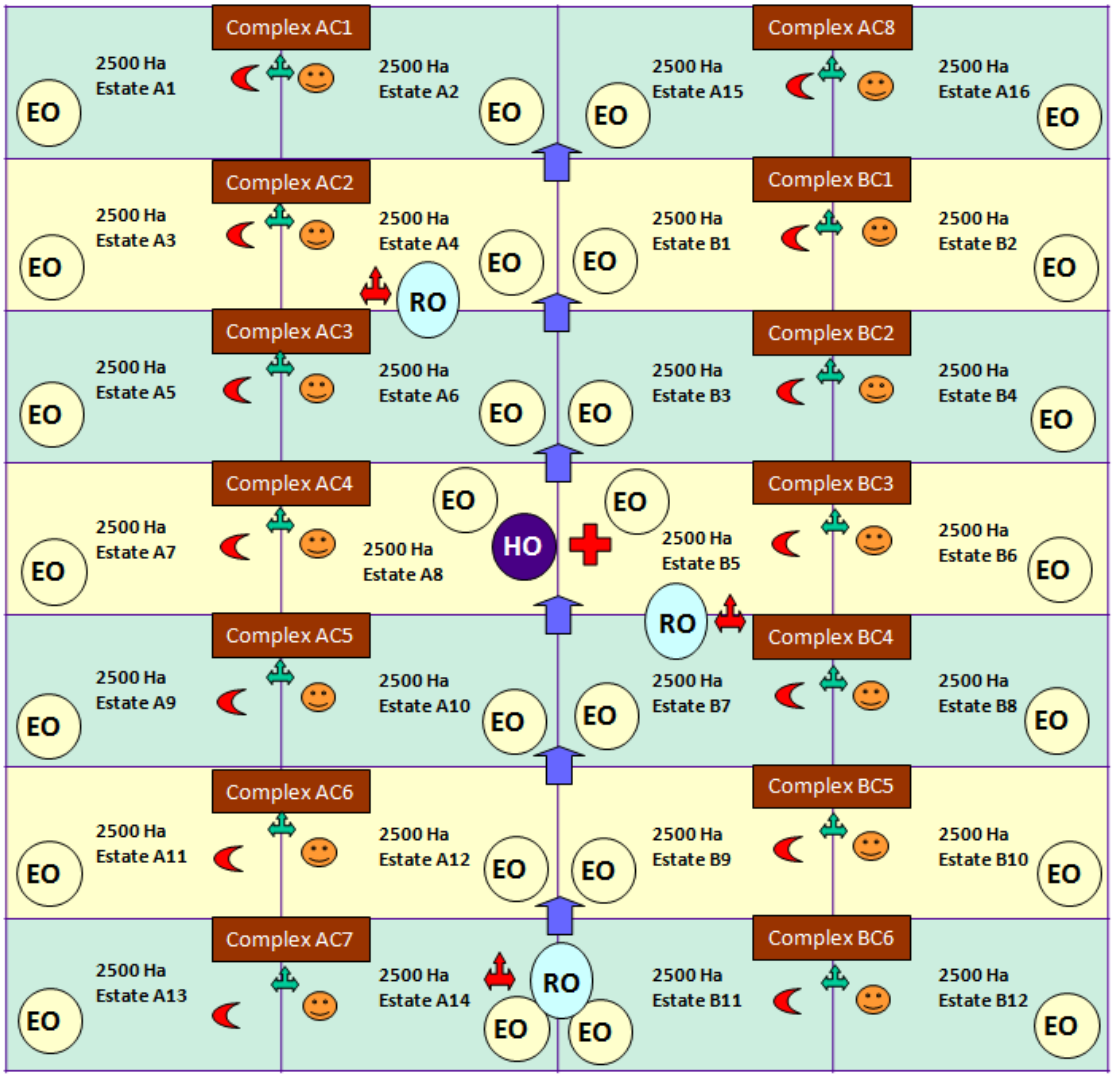
Replanting will occur after 25 to 30 years, depending on yields and planting material used.

Below is an illustration of the Implementation Plan with details and relationship between the number of complexes and planting phases.



(Source: AGRINEXUS Implementation Plan)

Illustration of the final infrastructure plan of the project:



KEY

- CLINIC FOR EVERY COMPLEX OF 5,000 HA
- PRIMARY SCHOOL FOR EVERY COMPLEX OF 5,000 HA
- 60 MT/hr PROCESSING MILL X 6 MILLS
- 1 GROUP HOSPITAL FOR 70,000 HA
- HO — 1 HEAD OFFICE FOR 70,000 HA
- RO — 1 REGIONAL OFFICE PER REGION OF 25,000 HA
- EO — 1 ESTATE OFFICE PER ESTATE OF 2,500 HA
- CENTRAL WORKSHOP EVERY REGION OF 25000 HA
- ESTATE WORKSHOP EVERY COMPLEX OF 5,000 HA

3.10.4. Production Process and Process and Description of Mill

Palm oil and palm kernel producing is classic: palm bunches are transported to the mills in trucks. After having been weighed at the weighbridge, these bunches are unloaded at the receiving dock containing hoppers provided for this purpose. This primary material then undergoes some processing: sterilization, stripping, washing, mixing, extraction, clarification, finishing, defibration and palm kernel production. (See diagrams below).

PROCESS FLOW

Crop Reception

Sterilisation

Transfer Carriage

Tipper

Threshing

Pressing

Crude Oil

Nut/Fibre

CRUDE OIL FLOW

Oil Screening

Fat Oil

Clarification tank

Crude Oil

Underflow

Purifiers

Centrifuges

Sludge

Vacuum Drier

Sludge Pit

CPO Storage Tank

Raw Effluent Pond

Despatch to Refinery

Effluent Treatment

Fruit reception

Fruit is normally delivered to a raised ramp. Tipping lorries or trailers deliver the fruit into sloping hoppers, with hydraulic doors controlling the loading of the fruit into sterilizer cages. The fruit may be stored for several hours on the ramp until the mill is ready to process it.

Sterilization

There are various types of sterilizers – vertical, horizontal and more recently spherical sterilizers. Generally, the sterilizer consists of a long, cylindrical pressure vessel, of about 1.8m diameter, with rails running along the length of the interior. The fruit is loaded into 'cages', which are approximately circular cross-section to fit inside the sterilizer. These cages, each containing 1.5–2.5 MT of fruit, are pushed on the rails into the sterilizer.

The sterilizer capacity depends on the length; a large sterilizer would hold six or more cages, and a large mill would have several sterilizers. Once the sterilizer has been loaded and closed, steam is introduced. Pressure is built to about 3 kg/cm2, i.e. to a temperature just above 130°C, and held for about 1 hour.

As mentioned above, sterilization serves two main purposes: it prevents FFA build-up in the oil, and it loosens the fruit on the bunch to facilitate stripping. In addition, it also softens the pericarp for easier digestion, and allows preconditioning of nuts to reduce breakage in the press.

Stripping

The aim of stripping is to separate the fruits from the empty bunch consisting of the stalk and spikelets. The drum stripper is standard in modern mills - this consists of a horizontal drum made of bars spaced so that fruits can fall through, but the bunches remain inside the drum. Cages of sterilized fruit are lifted and tipped into a bunch feeder; bunches are fed from this into one end of the stripper drum either manually or automatically sometimes with a feedback control from the digester. The drum rotates at about 22 rpm.

Empty fruit bunches (EFB) from the stripper are conveyed either to an incinerator or more commonly now, to an EFB hopper prior to transport back to the field for use as mulch.

Digestion

Fruit from the stripper is carried by a conveyor belt to the digester. The design of digesters has had minimal changes over the years - There is a vertical cylinder, with rotating beater arms which pulverize the fruit, loosening the pulp from the nut. The mass of nuts and pulp is heated, before passing into the press, either by a heating jacket or by live steam injection.

Pressing

Oil extraction is the core of the mill operation and press capacity normally determines the throughput of the mill. Centrifuges were used in many early mills, but hydraulic presses were introduced in the 1920s and gave greater extraction efficiencies. Screw presses were first used in the 1950s and although there was much debate to the merits of screw and hydraulic presses, it is now universally used.

The advantages of the screw press over the hydraulic press are detailed below:

- continuous operation – hence, less labor required; the hydraulic press was a 'batch' process;
- higher throughput – hence, less investment in buildings and machinery;
- less power required for a given throughput;
- nut/fiber separation is easier because of the lower oil content after pressing; and
- screw presses can handle a wide range of throughput rates.

A variety of different screw press designs is in use with single screws or double screws and throughputs of up to 20 MT of fresh fruit bunches (FFB)/h. The digested mixture of fiber, oil, and nuts is forced through a perforated press cylinder by the rotation of the screw, or counter-rotating screws in the double screw press. Adjustable cones restrict the exit of the mass so that pressure builds up in the press cylinder. In some designs, the pitch of the screw is gradually diminished thus increasing the pressure.

Clarification, drying and storage

The crude oil from the press consists of a mixture of oil, water, and other 'non-oily solids' (NOS: mainly dirt and fiber). The exact composition depends on how much water was added prior to pressing. Where the content of water and non-oily solids is low, simple physical settling is quite effective. In continuous settling tanks, the oil/water mixture is fed into the middle of the tank while separated oil is steadily removed from the top and waste (sludge) from the bottom. The oil and waste fractions are then centrifuged. More recently, decanters have been introduced which can handle oil straight from the press without the need for a settling tank.

Finally, the oil must be dried by the use of vapor extraction units or vacuum dryers to prevent FFA formation by autocatalytic hydrolysis. Storage is generally in welded steel tanks which contain heating coils to prevent crystallization and subsequent settling out of the solid phase. They may be filled with carbon dioxide or other inert gas above the oil to prevent oxidation.

The sensitivity of palm oil to higher temperatures is well established and the temperature during storage and in transit is controlled between 32 and 40°C with loading and unloading temperatures between 50 and 55°C. Temperatures should be kept as low as possible to minimize deterioration in quality during storage.

Kernel handling

The cake coming from the presses consists of nuts and moist fiber with some residual oil. To extract the kernels it is necessary to separate the nuts from the fiber, crack the nuts, and separate the kernels from the cracked shells.

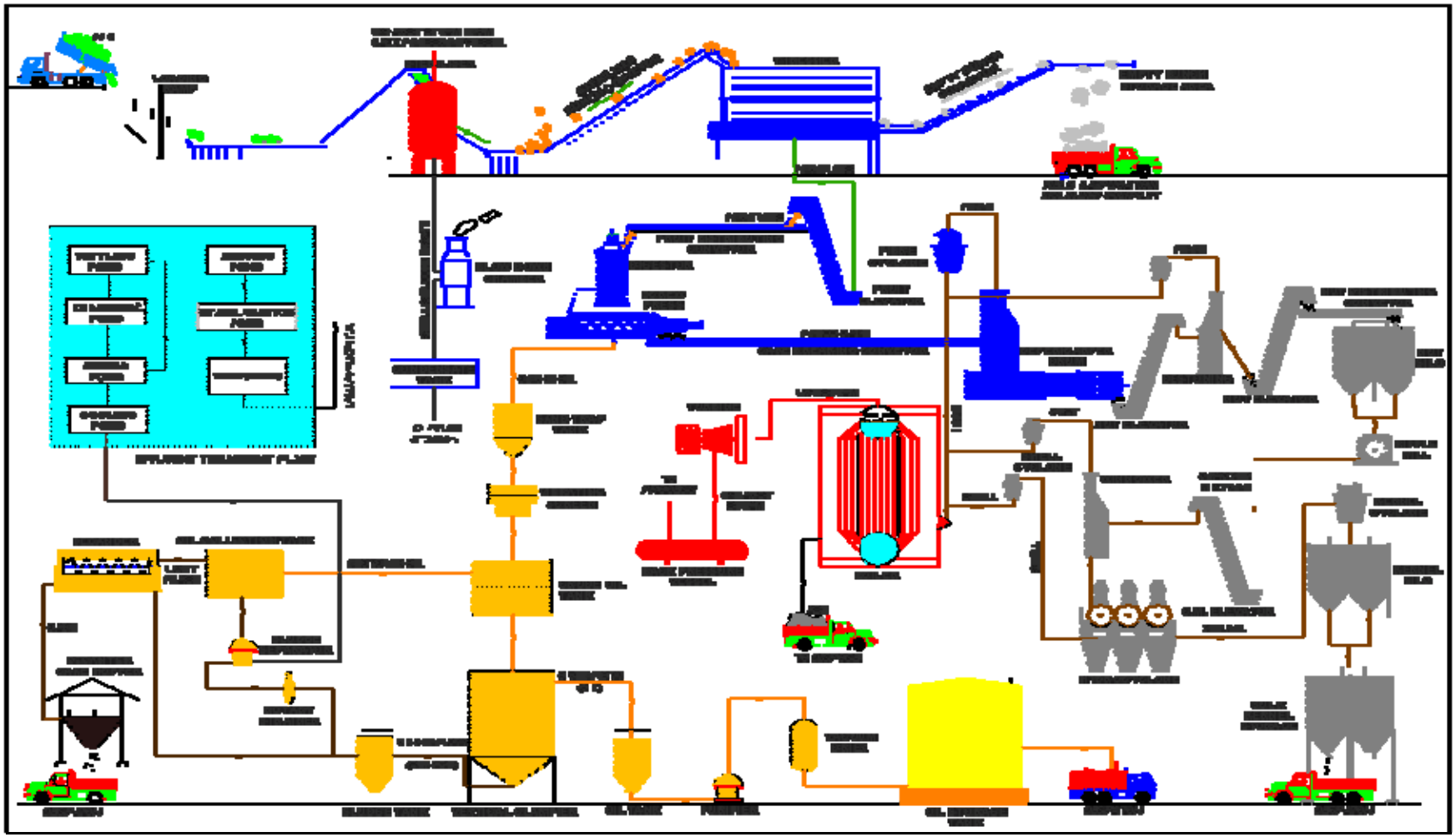
> **Fiber separation**: This may be pneumatic, mechanical or hydraulic, but pneumatic fiber separators have become the standard in modern mills. In the most commonly used type the fiber–nut mixture, partially dried, passes from a 'cake breaker' conveyor into a vertical airstream sufficient to carry the fiber upwards while the nuts fall into a smaller, lower rotating drum, where they are polished by friction. Some air also passes through this drum, carrying any light particles upwards to join the main flow.

Nut screening and cracking: The clean nuts may be dried in a nut silo or if the drying during fiber separation has been sufficient, they may be conveyed straight to screens for grading by size before cracking. In nut-cracking machines of the centrifugal type, the nuts are fed through a central spindle, rotating at 1600–2200 rpm, and flung out against the wall of the cracker. A new development has been the self-sorting nutcracker which incorporates grading slots and pitching blades which grade the nuts and give them the correct speed for cracking; this makes prior nut screening unnecessary. The ripple mill cracker has the advantage that prior nut conditioning is not required and it is now been widely used.

Kernel and shell separation: Modern mills use hydrocyclones for separation. The mixture is fed into a rotating vortex of water and the heavier shell particles settle while the kernels are carried off upwards. The shell is sent to the boiler house for fuel. The kernels should contain no more than 2.75% shell and other foreign matter.

Kernel drying: Fresh kernels have a moisture content of about 20% and cannot be stored without deterioration. Drying is usually done in a silo - the fresh kernels are fed in at the top, warm air is blown upwards from below and dry kernels (7% moisture) are removed at the base. The kernels can also be steam-sterilized for 5–6 min before drying and the FFA of the kernel oil will then remain below 1% after storage for 6 months or more.

Kernel oil extraction: In most mills, palm kernels are the final product and the crushing is done elsewhere, but sometimes kernel oil is extracted in the mill by pressing. This has the advantage of using the same power supply derived from shell and fiber as the rest of the mill.



(Source: MBL)

3.10.5. Production Unit (Mill)

According to Agrinexus, the maximum projected crop/year for this project is approximately 2,168,500 MT in Year 2028. The number of hours calculated during which the mill is able to process fruit is 520 hours i.e. 26 days by 20 hours (i.e. allowance given for breakdowns, absence of fruit, etc,…).

Based on the mill size of 60MT/hr, the calculations are as follows:

- 60 MT/hr X 20 hrs operations per day = 1,200 MT/day
- 1200 X 26 days/month = 31,200 MT/month
- 31,200 X 12 months = 374,400 MT/ year

Therefore, for the total anticipated crop of 2,168,500 MT, the total number of 60 ton mills required will be:

- 2,168,500 / 374,400 = 6 mills
- Hence, the total processing capacity for the 6 units of 60 MT/hr mills will be: 6 x 60MT/hr = 360 MT/hour x 20 hrs/day x 26 days/month x 12 months = 2,246,400 MT of FFB, which is more than sufficient to meet the processing requirements for the project.

Table 3: Mill construction schedule

Mills	Ordering Timeline	Year of Construction	Year of Commission
1	May-Jun 2011	2012	2014
2	Feb-Mar 2014	2015	2017
3	April-May2015	2016	2018
4	Nov-Dec 2016	2017	2019
5	Jul-Aug 2017	2018	2020
6	Jun-Jul 2020	2021	2023

This environmental and social impact assessment will concern only the first mill in the Nguti block not far from the Talangaye nursery and the first plantation.

The first SGSOC Palm Oil Mill will be build by/

MBL – MUAR BAN LEE ENGINEERING S/D
NO. JR52, Lot 1818, Kawasan Perindustrian Bukit Pasir
84300, Muar, Johor, Malaysia
Tel: 606 – 9859998 Fax: 606 – 9858889 http://www.mbl.com E-mail: mbl@mbl.com

It will be a 60 ton/hour Palm Oil Mill.

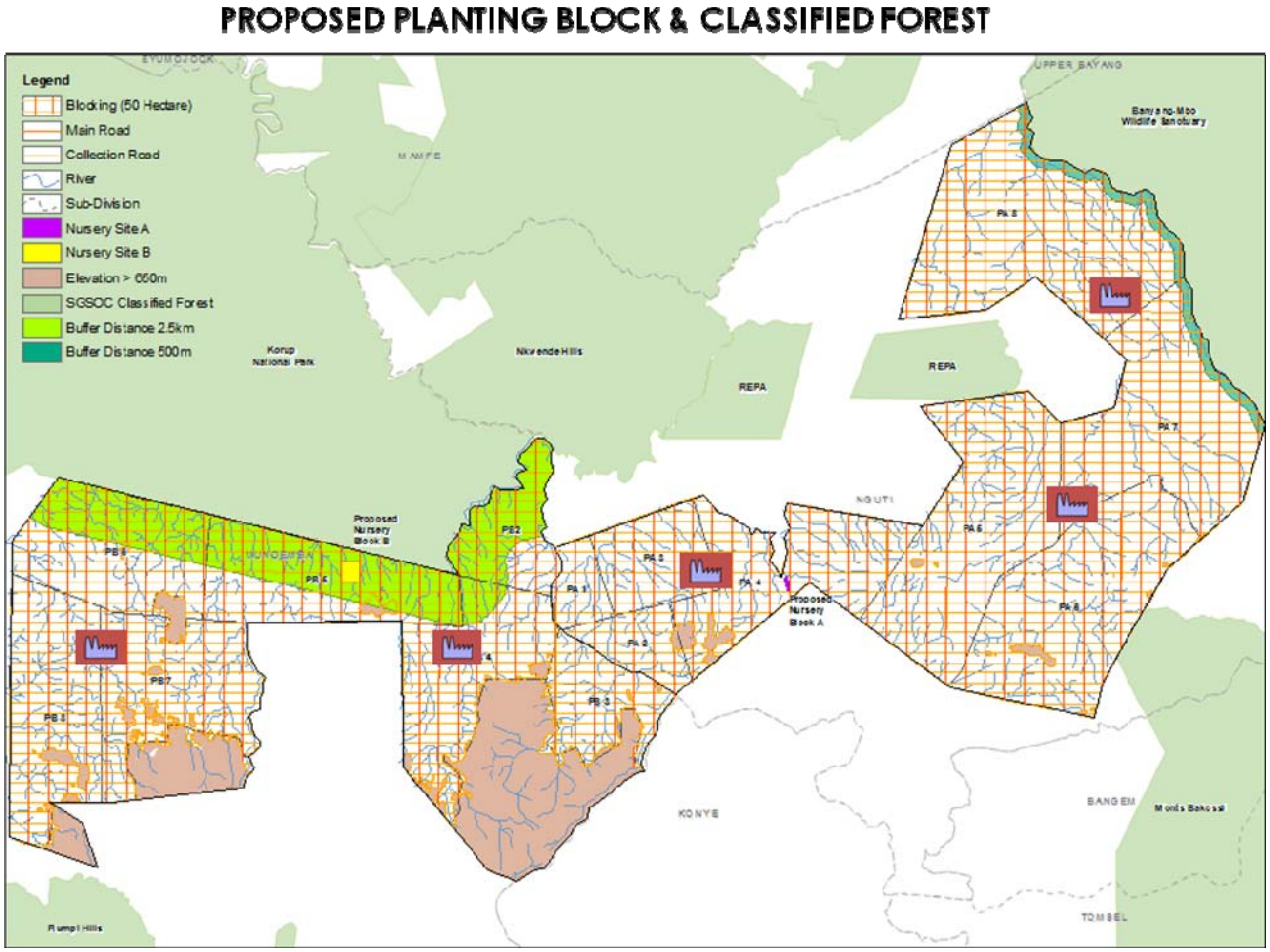


Figure 8: Location of SGSOC mills (5 of the 6 POM)

The mill will include the following equipment provided by MBL:

Specification of Instant-Composting Technology Plant for 60T/HR POM

1. **Moving Floor**

   Moving Floor installed as buffer storage for EFB fiber, before feed into the EFB fiber intake scraper conveyor, it also feeds constantly with variable speed control.

Dimension	:	11,000mm(L) x 4,000mm x 3,500mm(H)
Construction	:	Discharge capacity approx 30cu.m per hour. 1 set of steel plate profiles and cylinder fixing anchors, 1 Equalizing Roller (3,800mm long). 1 control cabit net fir installation.
Drive	:	15hp (with variable speed control)

2. **EFB Fiber Intake Scraper Conveyor**

   Scraper conveyor installation to transfer the EFB to Micro Composter.

Dimension	:	1200mm(W) x 26,000mm(L)
Chain	:	Double conveyot chain 4" x 20,500Lbf.
Brand	:	Tsubaki /OCM (Japan)
Scraper	:	800mm x 75mm x 100mm
Casing	:	3mm&4.5mm thick mild steel plate.
Reinforcement	:	Angle 6mm thk x 65mm x 65mm
Drive	:	Through transmission chain and sprocket, Flender geared motor 20hp x 56r.p.m of equivalent.

3. **Additive Powder Elevator**

   Elevator installed to transfer the additive powder to the Additive Powder Transfer Conveyor.

Dimension	:	775mm(L) x 400mm (W) x 10,000mm (H)
Chain	:	Single conveyor chain 4" x 28,000L.bf.
Brand	:	Tsubaki / OCM (Japan)
Bucket	:	250mm (L) x 175mm (W) x 175mm(D) - 3mm thick mild steel plate. Each bucket installed at every 4th links.
Casing	:	(Both side) 4,5mm thick & (Front &Real) 3mm thick mild steel plate.
Reinforcement	:	Angle 6mm thick x 50mm
Drive	:	Thru, transmission chain and sprocket, Flender geared motor 7,5hp x 56 r.p.m. or equipment.

4. **Additive Powder Transfer Conveyor**

   Conveyor installed to transfer the Additive Powder Distribution Conveyor.

Dimension	:	⌀200mm x 5,800mm(L)
Type	:	Full flight with 4.5mm thick mild steel plate.
Shaft	:	Pipe API sch.40 ⌀50.
Shall Plate	:	4.5mm thick mild steel plate.
Reinforcement	:	Angle 6mm thick x 50mm x 50mm
Drive	:	Sprocket type, Flender geared motor 4.0hp x 56 r.p.m or Equivalent.

5. **Distribution Additive Powder Conveyor**

   Conveyor installed to distribute the additive powder from Additive Powder Transfer Conveyor into the additive Hopper.

Dimension	:	⌀ 200mm x 12,500mm (L)
Type	:	Full flight with 4.5mm thick mild steel plate.

Shaft	:	Pipe API sch. 40 Ø50.
Shall plate	:	4.5mm thick mild steel plate.
Reinforcement	:	Angle 6mm thick x 50mm x 50mm
Drive	:	Sprocket type, Flender geared motor 4.0hp x 56 r.p.m or equivalent.
Control	:	Pneumatic gate for distribution control

6. First Additive Powder Hopper with Feeder

4 units of Additive Powder Hopper (with feeder) installed to feed additive to the Micro Composter.

Dimension	:	1000mm(L) x 1 000mm(H)
Shell Plate	:	3mm S. steel plate of all welded construction and at the top edge stiffed with mild steel angle 6mm thick x 50mm x 50mm.
Reinforcement	:	Mild steel angle 6mm thick x 50mm x 50mm.

7. Micro Composter (SRBC)

4 units of Micro Composter installed to squeeze and shred EFB into short fiber for better enzymatic reaction.

Model	:	SE/SRBC 100
Dimension	:	3100mm(L) x 2200mm (W) x 1300mm (H)
Capacity	:	6Mt/hr (Fresh EFB)
Gear unit	:	SEW or Sumitomo.
Drive	:	125hp

8. Micro Composter Platform

1 (one) lot platform installed for Micro Composter.

Dimension	:	13,000mm(L) x 6,000mm (W) x 2,500mm(H)
Construction	:	the platform will be sitting on steel I-beam. Proper tie and bracing install to ensure structural stability.

9. Fiber Transfer Conveyor

Conveyor installed to transfer the mixture into the Fiber Elevator.

Dimension	:	Ø750mm* 15,600mm (L)
Type	:	Full flight with 6.0mm thick mild steel plate.
Shaft	:	Pipe API sch.40 Ø100.
Shall Plate	:	4.5mm thick mild steel plate.
Reinforcement	:	Angle 6mm thick x 65mm x 65mm
Drive	:	Sprocket type, Flender geared motor 10 hp x 56 r.p.m. or equivalent.

10. Fiber Elevator

Elevator installed to transfer the fiber mixture to FSR-I

Dimension	:	1,075mm x 750mm (W) x 9,400mm (H)
Chain	:	double conveyor chain 4" x 28,000Lbf.
Brand	:	Tsubaki / OCM. (Japan)
Bucket	:	570mm (L) x 150mm (W) x 180mm (D)- 3mm thick mild steel plate. Each bucket installed at every 4th link.
Casing	:	4.5mm mild steel plate (Both side) / 3mm mild steel plate (Front and Real)
Reinforcement	:	Mild steel angle 6mm thick x 50mm x 50mm
Drive	:	Thru' transmission chain and sprocket. Flender geared motor 10hp x 56 r.p.m. or equivalent

11. **Air Lock (OPTIONAL ITEM FOR FSR WITHOUT STEAM JACKET)**

1 (one) unit Air Lock installed from Fiber Elevator to FSR-I and lock the air from FSR-I to Fiber Elevator.

Dimension	:	Ø 900mm
Casing	:	9mm mild steel plate
Reinforcement	:	Mild steel angle 9mm thick x 50mm x 50mm
Drive	:	Thru' transmission chain &sprocket. Flender geared motor 5.5hp x 56 r.p.m or equivalent.

12. Fermentation Sim Reactor-I

FSR-I installed to heat up fiber mixture for fermentation simulation reaction and to dry the reacted fiber using steam jacket installed.

Dimension	:	Ø1200mm x 40,000mm (L)
Frame & Jacket	:	- 6mm thk. Boiler plate reinforce with 8mm x 65mm Mild Steel Angle, 65 x 125 Mild Channel and 9 x 65 Flat Bar as flange. - 6mm thk Boiler Plate Shell Jacket reinforce with 25 x 25 Square Bar & 2'' SCH Pipe c/w 2 nos. of 1'' Dia. Of Outlet Flange. - 2 mm thk. Mild Steel Cover
Ribbon	:	- 4M Length Full Flight with 8mm thk. Mild Steel Plate Welded to 150 mm Dia. SCH 80 Pipe. - Hanger Bearing at every 4M
Insulation	:	Calcium Silicate c/w Aluminium Jacket.
Drive	:	Flender Geared Motor c/w 22kw Motor & 14'' Flexible Coupling.

13. Fermentation Sim Reactor- II

FSR-I installed to heat up fiber mixture for fermentation simulation reaction and to dry the reacted fiber using steam jacket installed.

Dimension	:	Ø1200mm x 40,000mm (L)
Frame & Jacket	:	- 6mm thk. Boiler plate reinforce with 8mm x 65mm Mild Steel Angle, 65 x 125 Mild Channel and 9 x 65 Flat Bar as flange. - 6mm thk Boiler Plate Shell Jacket reinforce with 25 x 25 Square Bar & 2'' SCH Pipe c/w 2 nos. of 1'' Dia. Of Outlet Flange. - 2 mm thk. Mild Steel Cover
Ribbon	:	- 4M Length Full Flight with 8mm thk. Mild Steel Plate Welded to 150 mm Dia. SCH 80 Pipe. - Hanger Bearing at every 4M
Insulation	:	Calcium Silicate c/w Aluminium Jacket.
Drive	:	Flender Geared Motor c/w 22kw Motor & 14'' Flexible Coupling.

14. End Product Air Lock (OPTIONAL ITEM FOR FSR WITHOUT STEAM JACKET)

1 (one) unit Air Lock installed from FSR-2 to End Product Elevator and lock the air from FSR-2 to End Product Elevator.

Dimension	:	Ø900mm
Casing	:	9mm mild steel plate
Reinforcement	:	Mild steel angle 9mm thick x 50mm x 50mm.
Drive	:	Thru' transmission chain & sprocket. Flender geared motor 5.5hp x 56r.p.m or equivalent.

15. End Product Elevator

Elevator installed to transfer the end product to End Product Cross Conveyor.

Dimension	:	775mm (L) x 400mm (W) x 10,000mm (H)
Chain	:	Single converyor chain 4''x 28,000Lbf.
Brand	:	Tsubaki / OCM (Japan)
Bucket	:	250mm(L) x 175mm(W) x 175mm(D) – 3mm thick mild steel plate. Each bucket installed at every 4th links.
Casing	:	(Both side) 4.5mm thick & (Front &Real) 3mm thick mild steel plate.
Reinforcement	:	Angle 6mm thick x 50mm x 50mm
Drive	:	Thru' transmission chain and sprocket, Flender geared motor 10hp x 56 r.p.m. or equipment.

16. End product Cross Conveyor

Conveyor installed to transfer the composted fiber from end product elevator to End Product Conveyor In-Store.

Dimension	:	~~O~~600mm x 6,100mm (L)
Type	:	Full flight with 4.5mm thick mild steel plate.
Shaft	:	Pipe API sch. 40 ~~O~~75.
Shall Plate	:	4.5mm thick mild steel plate.
Reinforcement	:	Angle 6mm thick x 65mmed x 65mm
Drive	:	Sprocket type, Flender gear motor 5.5hp x 56 r.p.m or equivalent.

17. Recycle Tank with Pump

Recycle Tank installed to supply the water to the Micro Composter for better enzymolysis reaction.

Dimension	:	3000mm X 1500mm X 1500mm (H)
Shell Plate	:	6mm thick, mild steel plate of all welded construction and at the top edge stiffened with mild steel angle 6mm thick x 50mm x 50mm
Reinforcement	:	6mm thick x 50mm x 50mm

18. Blower & Cyclone [OPTIONAL ITEM FOR FSR WITHOUT STEAM JACKET OR FOR DRY FIBER PRE – DELIVER TO THE CUTTER MILL (IF ANY)]

Blower & cyclone to be installed are for sucking the steam from chimney from the Palm Oil Mill or to make the fiber dry before sending to cutter mill.

Construction	:	G.i plate & 2.0mm thickness, Maintenance and servicing platform provided. Proper tie and bracing installed to ensure structural stability.
Motor	:	7.5hp

19. POME Buffer Hopper With Feeder

1 (one) lot POME Buffer Hopper With Feeder installed as a storage for POME which to be added during the enzymatic reaction process.

Dimension	:	4,000mm(L) x 1,000mm(W) x 1000mm(H)

20. Magnet Detector

Heavy duty magnetic block installed to attract iron particle to avoid the damage of machine.

Dimension	:	304mm x 177mm
Series SD	:	All stainless steel construction.

21. 2nd Addictive Hopper with Feeder

Additive Hopper with Feeder (4 section) installed for different types of additives.

Dimension : 4000mm (L) x 1000mm (H)

Shell Plate : 3mm SS. Plate of all welded construction and at the top edge stiffened with mild steel angle 6mm thick x 50mm x50mm.

22. Support And Platform

1 (one) lot support platform installed for the item as below

Item no. : 4, 5, 12, 13, 16,17,2

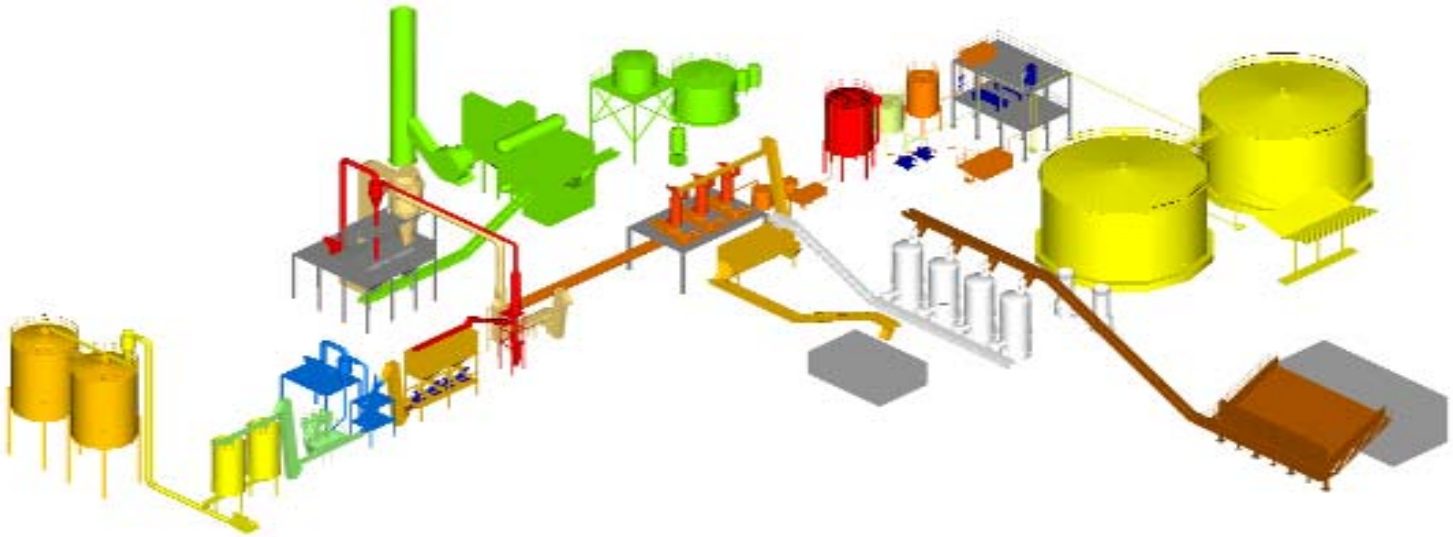
All the support and platform are Inside the ICT plant only.

23. Advance POME Treatment System

To remove approximately 85% suspended solid in the POME. Slurry POME collected is to insert into the ICT System.

The system consisting:

- DAF Dissolved Air Floating System Ø 3200
- Air Dissolved Tank
- Operation Platform and Support 4.5m (W) x 4.5m (L) x 2m (H)
- Handrail
- Pressurized Pump (5hp x 2) (40 MH, including pressure gauge and flow meter)
- Power Dissolver (0.5hp x 6) – Exclusive of polymer tank (1 ton x 6 pieces)
- Submersible Sewage Pump (3hp x 2) x 30 CMH
- Control Panel – outdoor type, steel painted
- Fast Mixing Tank O 1200 x 3050 (H) x SUS 304
- System Piping (SUS 304) Polymer Piping (SUS UPVC SCH80, Including valve)
- Brackets Fixing (SUS304).



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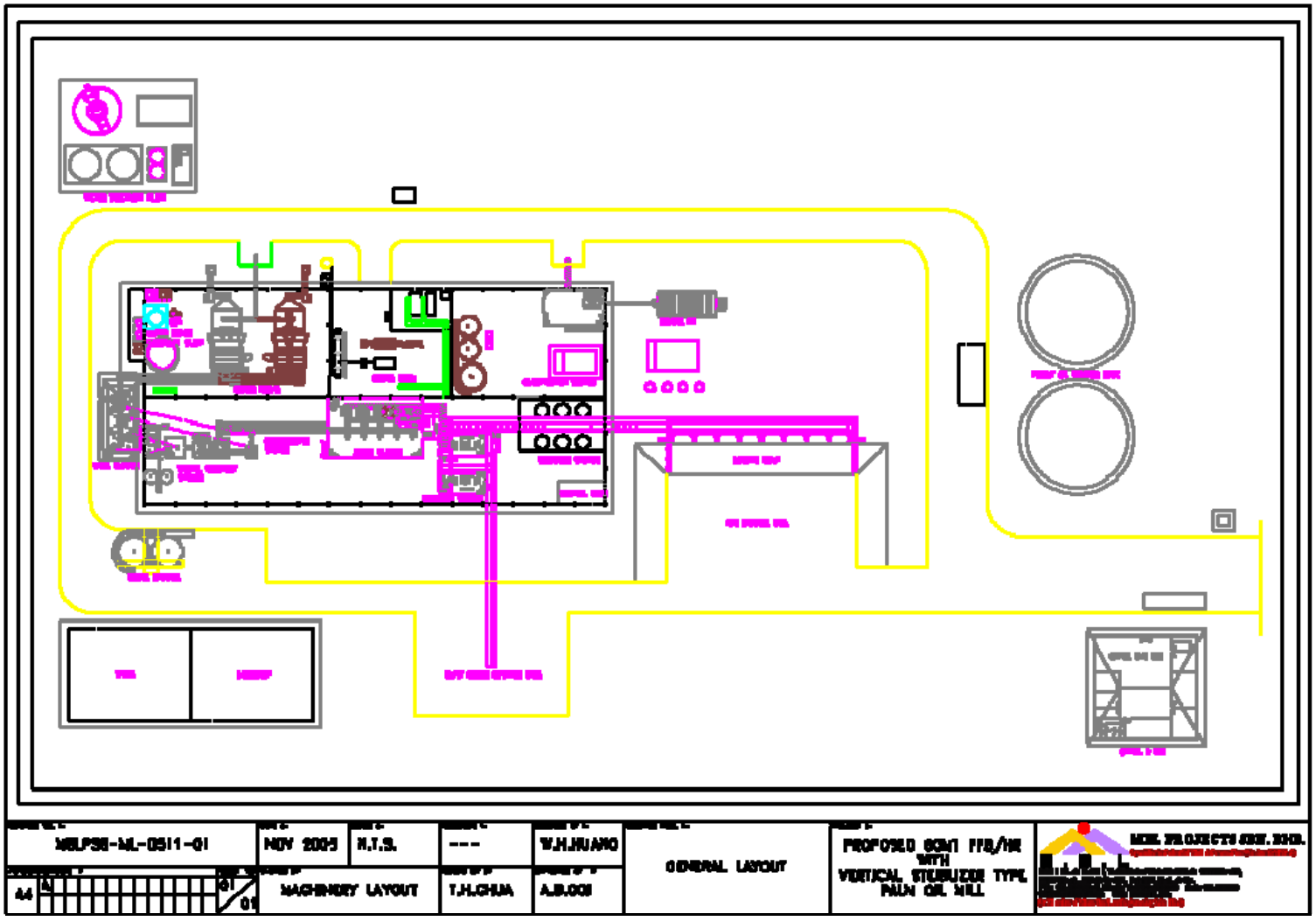
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W.H.HUANG
GENERAL LAYOUT
PROPOSED 60MT FFB/HR
WITH
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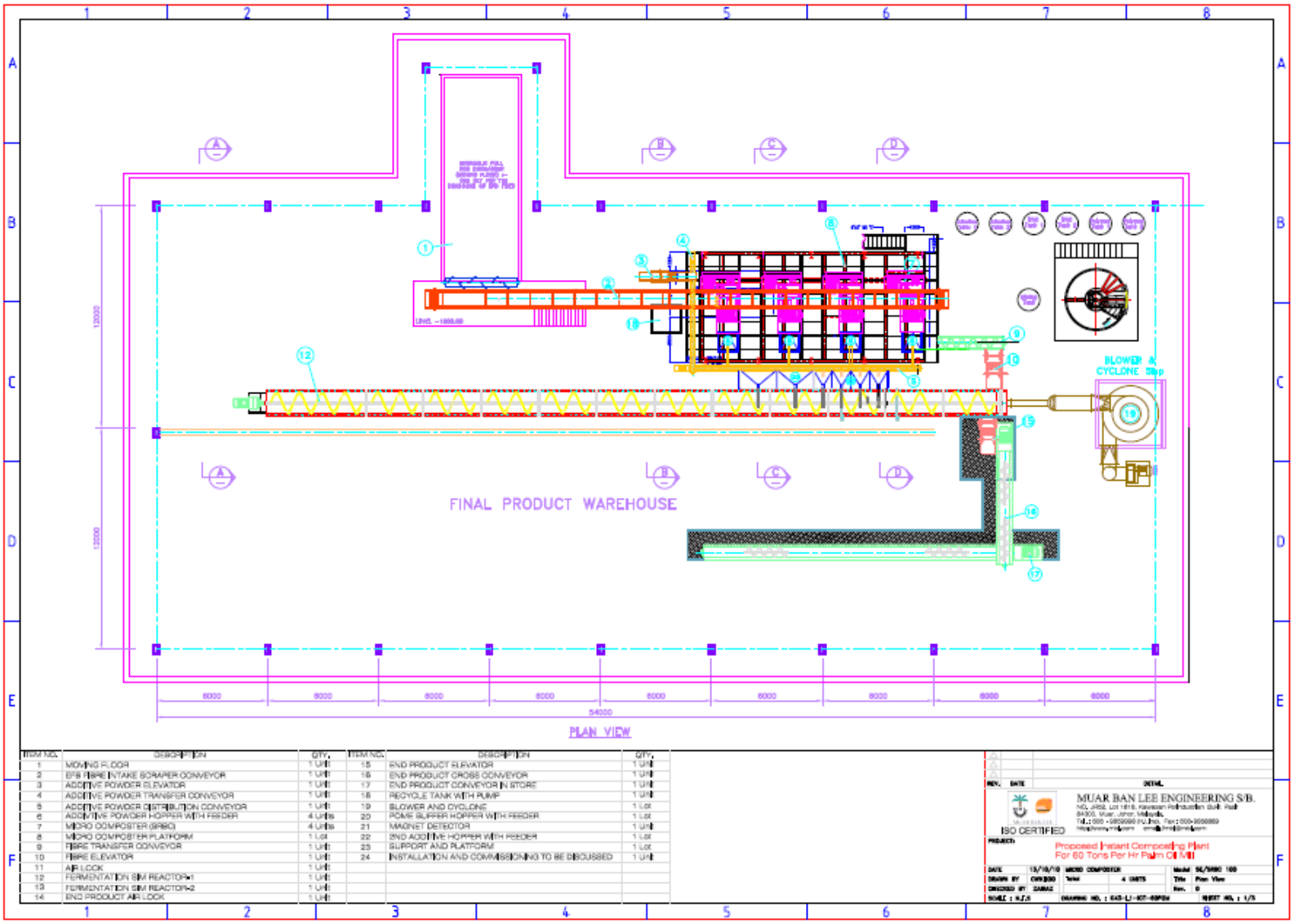
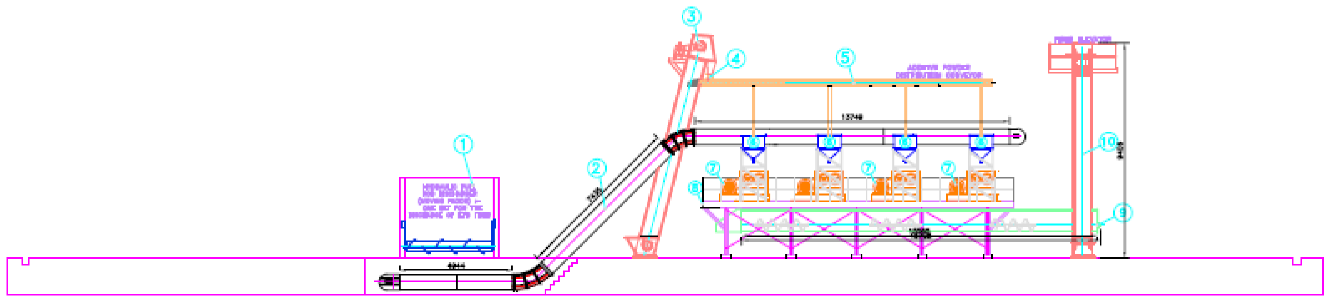
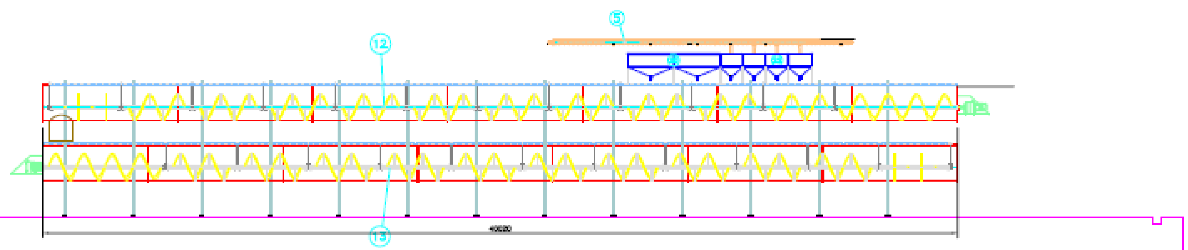
T.H.CHUA
A.B.OOI



ITEM NO.	DESCRIPTION	QTY.	ITEM NO.	DESCRIPTION	QTY.
1	MOVING FLOOR	1 UNIT	15	END PRODUCT ELEVATOR	1 UNIT
2	EFB FIBRE INTAKE SCRAPER CONVEYOR	1 UNIT	16	END PRODUCT CROSS CONVEYOR	1 UNIT
3	ADDITIVE POWDER ELEVATOR	1 UNIT	17	END PRODUCT CONVEYOR IN STORE	1 UNIT
4	ADDITIVE POWDER TRANSFER CONVEYOR	1 UNIT	18	RECYCLE TANK WITH PUMP	1 UNIT
5	ADDITIVE POWDER DISTRIBUTION CONVEYOR	1 UNIT	19	BLOWER AND CYCLONE	1 LOT
6	ADDITIVE POWDER HOPPER WITH FEEDER	4 UNITS	20	POME BUFFER HOPPER WITH FEEDER	1 LOT
7	MICRO COMPOSTER (BRBC)	4 UNITS	21	MAGNET DETECTOR	1 UNIT
8	MICRO COMPOSTER PLATFORM	1 LOT	22	2ND ADDITIVE HOPPER WITH FEEDER	1 LOT
9	FIBRE TRANSFER CONVEYOR	1 UNIT	23	SUPPORT AND PLATFORM	1 LOT
10	FIBRE ELEVATOR	1 UNIT	24	INSTALLATION AND COMMISSIONING TO BE DISCUSSED	1 UNIT
11	AIR LOCK	1 UNIT			
12	FERMENTATION SIM REACTOR-1	1 UNIT			
13	FERMENTATION SIM REACTOR-2	1 UNIT			
14	END PRODUCT AIR LOCK	1 UNIT			



ELEVATION VIEW



ELEVATION VIEW

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6	ADDITIVE POWDER HOPPER WITH FEEDER	4 Units	20	POME BUFFER HOPPER WITH FEEDER	1 Lot
7	MICRO COMPOSTER (SMBC)	4 Units	21	MAGNET DETECTOR	1 Unit
8	MICRO COMPOSTER PLATFORM	1 Lot	22	2ND ADDITIVE HOPPER WITH FEEDER	1 Lot
9	FIBRE TRANSFER CONVEYOR	1 Unit	23	SUPPORT AND PLATFORM	1 Lot
10	FIBRE ELEVATOR	1 Unit	24	INSTALLATION AND COMMISSIONING TO BE DISCUSSED	1 Unit
11	AIR LOCK	1 Unit			
12	FERMENTATION SIM REACTOR-1	1 Unit			
13	FERMENTATION SIM REACTOR-2	1 Unit			
14	END PRODUCT AIR LOCK	1 Unit			

REV.	DATE	DETAIL

MUAR BAN LEE ENGINEERING S/B.

ISO CERTIFIED

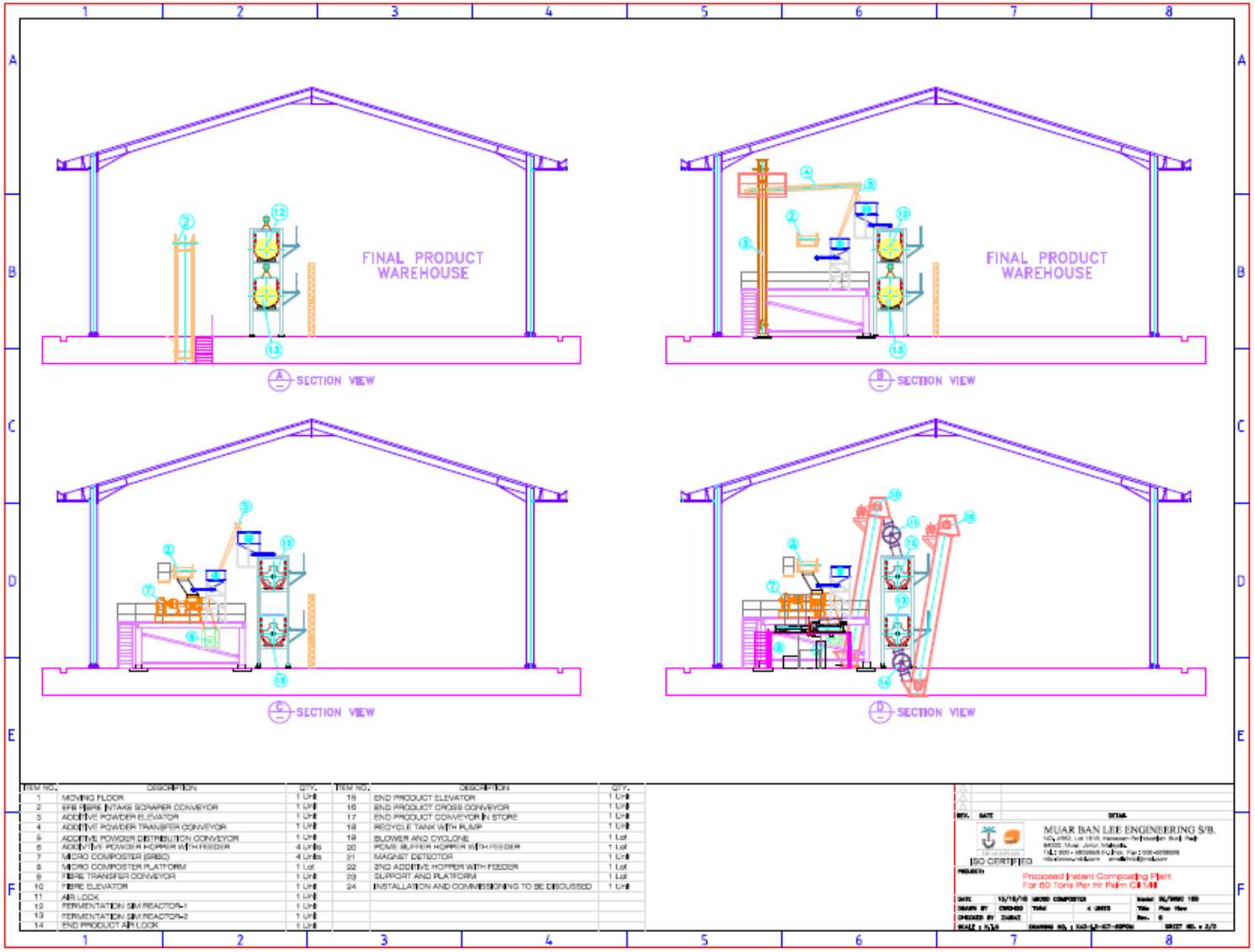
PROJECT: Proposed Instant Composting Plant For 60 Tons Per Hr Palm Oil Mill

MICRO COMPOSTER

Total 4 UNITS

Title: Plan View

SCALE : N.T.S



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14	END PRODUCT AIR LOCK	1 Unit			

MUAR BAN LEE ENGINEERING S/B.

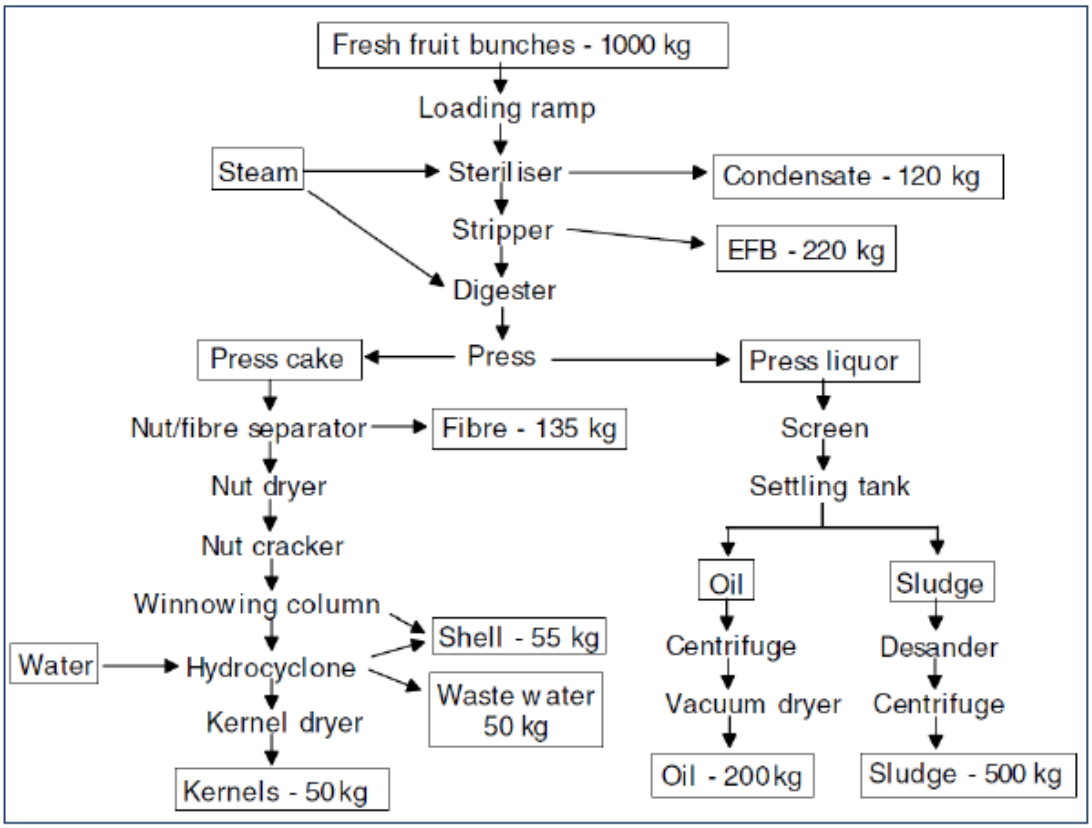
ISO CERTIFIED

Proposed Instant Composting Plant
For 60 Tons Per Hr Palm Oil Mill

According to the mill plan which is still provisional, three drainage systems will be installed, namely:

- A separate drainage system for processing effluents
- A separate drainage system for rainwater
- A separate drainage system for workshops discharging waste into the environment through an oil/water separator system.

Below a schematic flow diagram illustrating the percentage of palm oil, kernel extraction, and waste:



Waste products (Source: AGRINEXUS)

Liquid effluent

There are several sources of liquid effluent from a mill:

- condensate from bunch sterilising (0.6 t/t Palm Oil produced);
- the water phase or sludge from clarification centrifuges (up to 2.5 t/t Palm Oil); and
- water from the hydrocyclone (0.25 t/t Palm Oil).

Palm Oil mill effluent (POME) consists of a mixture of these liquid wastes. It is a thick, brownish, colloidal slurry of water, oil, and cellulosic residues from the bunches and fruit. This material is biodegraded by populations of micro-organisms, in processes that can be anaerobic, aerobic or facultative; often all three are applied sequentially in cleaning up POME. The anaerobic process produces methane, carbon dioxide and traces of hydrogen sulfide, while the aerobic process produces only carbon dioxide. Both also produce residual solid material. The anaerobic stage is a two-stage process, in which the first stage produces organic acids. These must be broken down by the second stage quickly enough to prevent the development of an extremely low pH.

Currently in modern mills, large steel tanks are used as closed digesters in which biogas is collected and once more circulated to ensure good mixing, and these allow the collection and use of the biogas. According to estimates, a 1200 MT/day mill can produce approximately 20,000m^3 bio gas/day with approximately 5 300 kcal/m^3 energy content.

Solid wastes

The solid wastes from a mill may include any of the following:

- *Empty fruit bunches:* Due to clean air regulations and realization of the value of this organic matter as mulch, it is commonly returned to the field;
- *Surplus shell and fibres, not required as fuel*: Where there is a surplus, most mills will use the fiber as fuel, as this is harder to dispose of in other ways;
- *Decanter cake***:** This is most commonly returned to the field to recycle the nutrients that it contains; and
- *Solids from effluent ponds*: With regular desludging of the ponds, the solids are recycled to the field.

3.10.6. Biodiesel production

SGSOC would pursue secondary transformations of crude palm oil (CPO) that are commercially attractive. To achieve this SGSOC would focus on the production of quality biodiesel as a flagship product. This Biodiesel will be for SGSOC own use and not to sell commercially.

SGSOC would aim to establish a biodiesel refinery and an integrated upstream and downstream production facility. As it takes 4 years for palm oil to start yielding fruit, a biodiesel refinery would be

established as soon as practicable after the first large-scale planting provided the economics of biodiesel justify the investment.

SGSOC has closely examined and continues to monitor the business prospects for transforming CPO in to biodiesel and other potential value added products. Compared with other vegetable oils, palm oil is the most suitable to be used as a feedstock for biodiesel production as it has the highest yield (e.g. liter per hectare). This translates to palm oil requiring less land to produce a given amount of biodiesel than other major vegetable oils such as rapeseed and soybean. However, the economics of palm oil have historically favored the food market (e.g. as a cooking oil, baking product, margarine, etc.) as opposed to the fuel market.

SGSOC's strategy would therefore be based on the economic rationale for transforming CPO, while also taking in to account both local and international social & environmental concerns related to biodiesel. SGSOC is acutely sensitive to the issue of food security. Members of the Government of Cameroon have noted that palm oil production should first and foremost be used to satisfy demand for food products. Furthermore, SGSOC is a Member of the Roundtable on Sustainable Palm Oil ("RSPO") which has a mandate to not cultivate palm oil on ecosystems that store significant amounts of carbon.

To refine portions of the CPO, the company would build a refinery and scale-up the facility based on the long-term demand for biodiesel. The Business Plan submitted previously contains capital expenditure projections for the first phase of biodiesel production. The company would plan to initially spend roughly $5 to $7 million on the refinery and related infrastructure. This would enable SGSOC to produce approximately 15,000 tons of biodiesel per year.

Sources and uses of biodiesel

The vegetable based oil crops (e.g., palm oil, jatropha, rapeseed, soybean) are processed into biodiesel by extracting the oils from the fruit/seeds and then undergoing a chemical process called transesterfication where alcohol reacts with triglyceride oil contained in the vegetable oils. The hydrocarbon structures of petroleum, vegetable oils and animal fats are similar, although vegetable oils cannot be utilized directly in most diesel applications because of its higher viscosity. Refining the CPO separates out the glycerin and the resulting product is known as biodiesel.

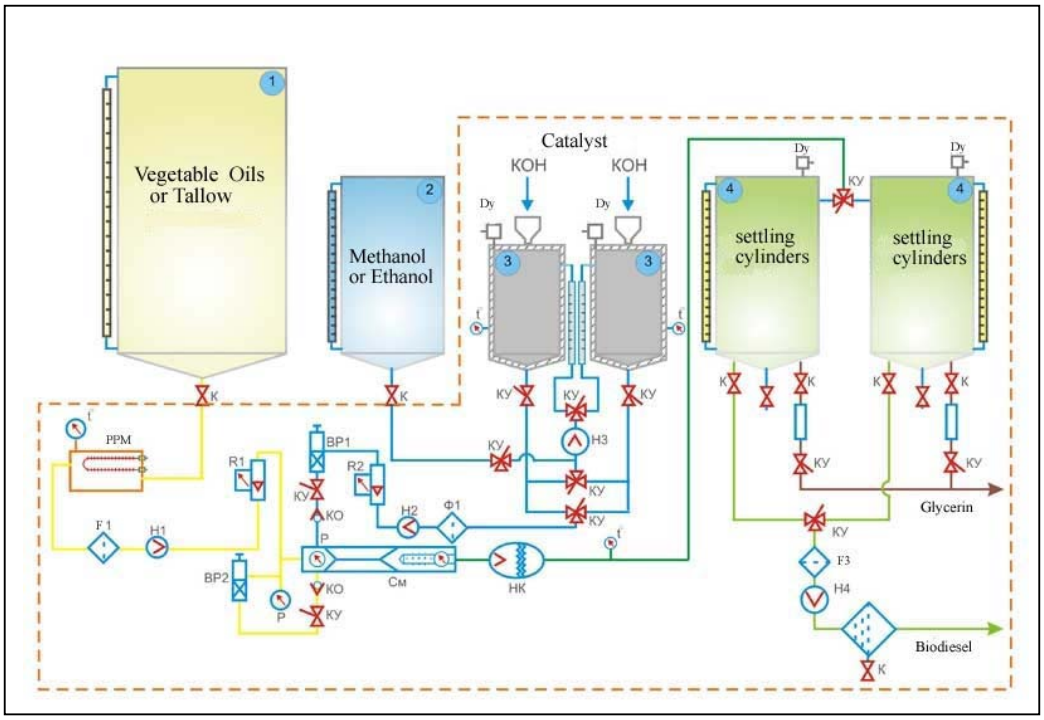
One of the fundamental issues for biodiesel refiners is related to the high cost of the feedstock. The major source of raw materials for biodiesel production is rapeseed (i.e. canola) in Europe and soybean in the US and South America. Palm oil has the highest yield per hectare / acre vis-à-vis other vegetable oils. SGSOC would use CPO from its operations as a feedstock for the biodiesel refinery. The vertical integration of the plantation and the refinery would guarantee access to the palm oil feedstock at predictable costs.

Without further refining, CPO can serve as a direct substitute for heavy fuel oil in several industrial applications, for instance, it can be used in many industrial boilers with minimal mechanical modifications. CPO can also be used in some reciprocating engines with minor modifications to the engine that primarily relate to pre-heating the CPO.

Alternatively, CPO can be further refined in to biodiesel that can be used “neat” (i.e. without blending with petroleum diesel fuel) in certain types of diesel applications from electrical diesel generators and heavy earthmoving equipment to locomotives and marine engines.

Biodiesel can also be blended at any ratio with petroleum diesel and is the only alternative fuel that runs in any conventional, unmodified diesel engine. Biodiesel can be stored exactly like petroleum diesel and shows similar fuel consumption, horsepower, torque, and haulage rates as conventional diesel fuel.

Biodiesel is a more environmentally friendly source of energy than petroleum based fuels due to lower greenhouse emissions. By and large carbon emissions from burning biodiesel are neutralized since palm oil trees consume carbon dioxide during the growing process. Moreover, biodiesel is biodegradable, nontoxic, essentially free of sulfur, and represents a significant reduction in carbon monoxide and soot particles, resulting in a much cleaner burning fuel compared to petroleum based diesel.



General Process Flow of Biodiesel

Biodiesel manufacturing technology

There are a wide range of biodiesel production equipment and technologies available and more are currently in development. As noted earlier, the process of converting vegetable oil (e.g., palm oil) into biodiesel is called transesterification, which requires neutralizing the free fatty acids in oil, removing the glycerol and creating an alcohol ester. This is accomplished by mixing methanol with sodium hydroxide or potassium hydroxide, resulting in sodium (or potassium) methoxide. This liquid is then mixed with the CPO or other vegetable oil. The entire mixture then settles with the heavier glycerol settling on the bottom, and the lighter methyl esters, or biodiesel, settling on top. Finally, the methyl esters are washed, filtered and refined.

An emerging technology that SGSOC is exploring is “hydrodynamic cavitation”, a method that utilizes pressure variations in the feedstock. Biodiesel is obtained using the geometry of the system creating velocity variation to separate out the esters and glycerol. Conventional techniques for biodiesel production utilizes temperatures in the range of 70°C to 200°C, pressures in the range of 6 to 10 atmospheric pressure and reaction times of up to 70 hours for achieving conversions in the range of 90% to 95%, although this is based on the type of raw material used. On the other hand, the use of

hydrodynamic cavitation decreases reaction time and temperature to 70 minutes and 30°C, respectively1. The use of a cavitation reactor for biodiesel production can therefore significantly lower electrical consumption.

The schematic design above illustrates the cavitational process flow utilizing vegetable oils as the feedstock to produce biodiesel. The CPO from the vessel 1 via mesh filter F1, flow heater PPM is fed to the hydrodynamic mixer CGD with H1 pump. Oil flow is controlled with the flowmeter P1. A pre-mixed solution of the catalyzer in methanol is fed from vessel 3 to the vacuum chamber of the hydrodynamic mixer through the BP regulator valve and the flowmeter P2. The solution mixing is performed by the H2 pump. The solution is then taken from vessel. The first stage of the peretherification reaction is performed in the hydrodynamic mixer. The final stage of the reaction is performed in the cavitation pump HK. Intensive cavitation processes in the hydrodynamic mixer and the cavitation pump lead to a breakdown of fatty acid molecules, which significantly increases reaction speed and improves the quality of the fuel. After the cavitation pump, the mixture goes to the settling columns 4, where it separates into biodiesel and a water-glycerin mixture. The fuel is discharged via the FBO moisture separator filter and the pump H3.

Glycerin is another by-product of the technological process discussed above, although it requires further cleaning. Glycerin has many applications such as a processing aid in cosmetics, toiletries, personal care, drugs and food products. Opportunities to upgrade the glycerin to other chemicals (e.g., propylene glycol) will be explored for the medium to long term future. The glycerin from the refinery will be sold into regional markets and the balance exported.

Picture 3: Biodiesel Service Station

3.10.7. Site and Operations Staff

Proposed Organizational Structure (Source: AGRINEXUS)

The Group General Manager will head the overall operation of the various departments and will report to the Executive Management Team – AGRINEXUS International (based in Malaysia).

All heads of departments of the Head Office will be responsible for their respective operations and report to the Group General Manager.

For the Plantation Division – All Regional General Managers will be responsible for their respective estates and report to the Senior General Manager.

Estate Managers will be responsible for their Estates and report to their respective Regional General Manager.

Palm Oil Mill Managers will be responsible for their mills and report to the General Manager of Processing and Engineering Services.

The reporting structure for the other positions is shown in the organizational charts below.

Note: It is recommended that expatriates should be employed during the initial 7 years (critical period) for the positions of Group General Manager, Senior General Manager and General Managers of Plantation Division, Processing and Engineering Services. This will enable them to train the locals to eventually take over the operations.

Location - Head Offices

The Main Head Office should be located centrally at one of the Complexes.

The HQ/liaison Office for the Group General Manager will be at AGRINEXUS International in Malaysia.

A Regional Office in the Northwest Region/West Region which consumes 65% of the CPO and provides 60% of the labor force.

Regional Head Offices will be located in one of the Complexes under the respective Region.

Estate Main Offices will be located at each Complex. Each Complex comprises of 2 Estates of 2,500 ha each.

Employment:

Based on current working practices in Malaysia, the average land:worker ratio is about 12 ha:1 worker. For this project, due to the inexperienced workforce, the estimated number of employees ratio is expected to be 8 ha : 1 worker.

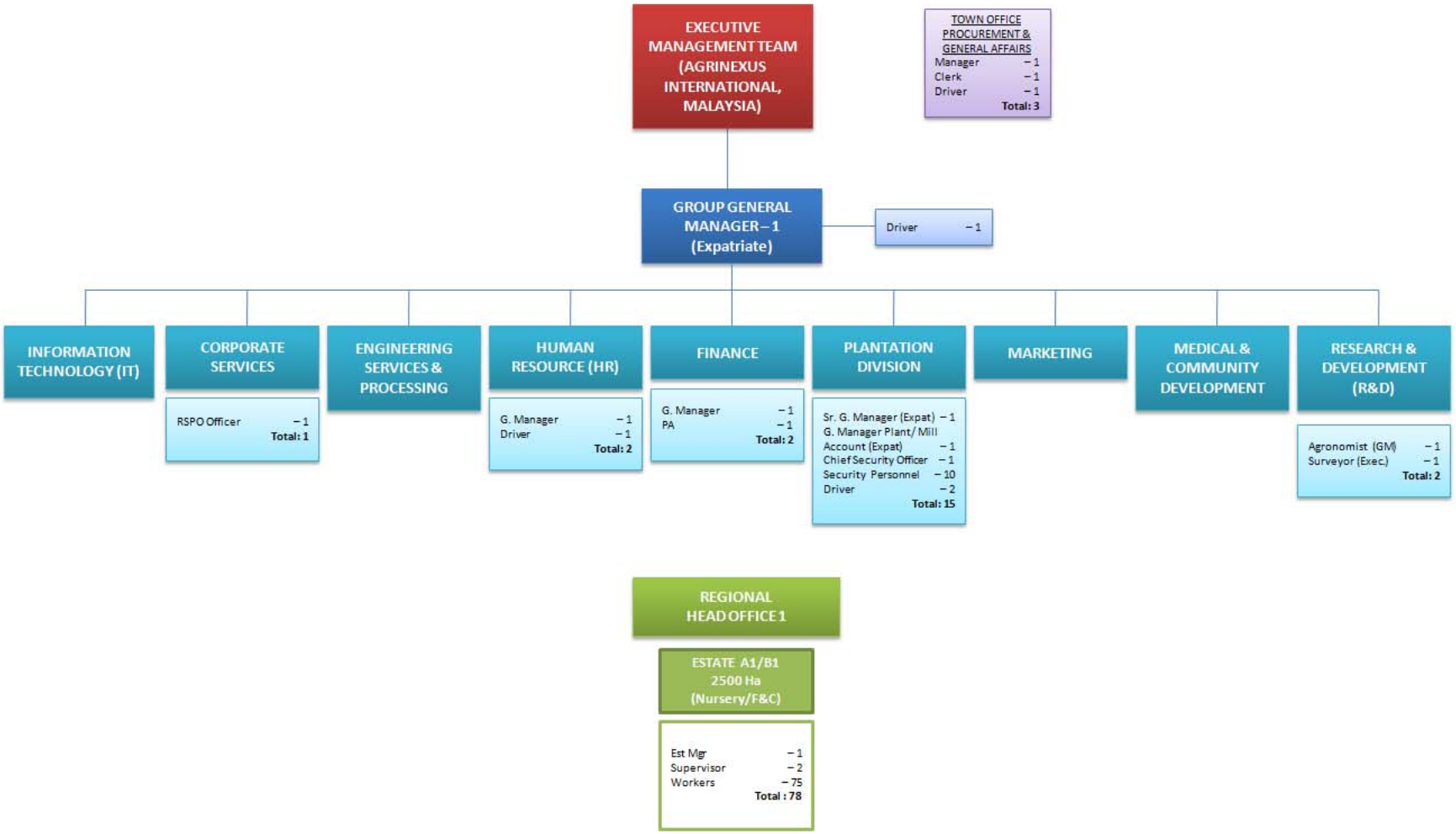
Table 4: Estimated number of employees

Planting Phase	Hectares	No. of Employees
Phase 1	5,000	625
Phase 2	5,000	625
Phase 3	10,000	1,250
Phase 4	12,500	1,563
Phase 5	12,500	1,563
Phase 6	12,500	1,563
Phase 7	12,500	1,563
Total	**70,000**	**8,752**

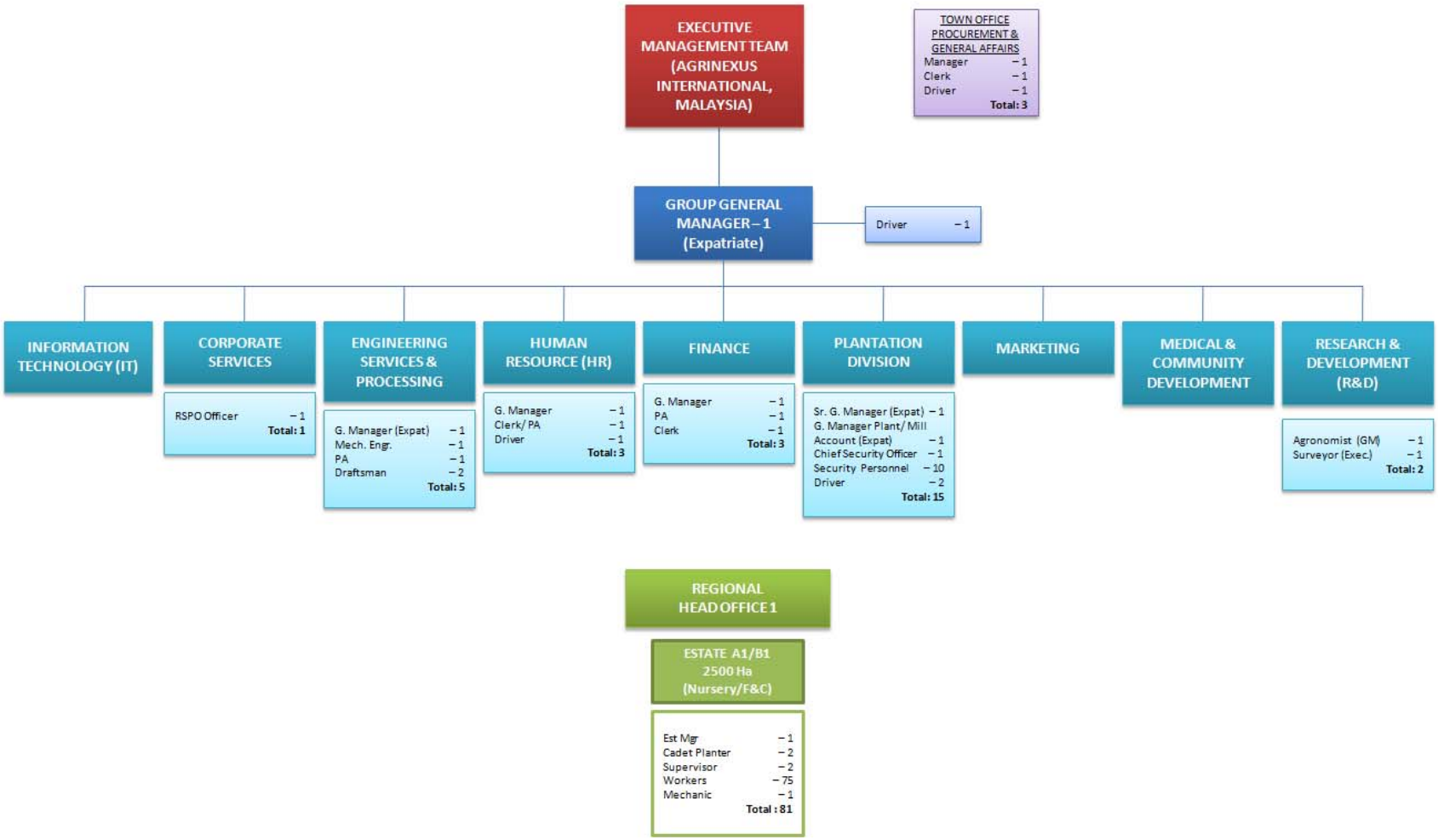
Organization Charts from 2010 to 2017

Please refer to the following pages for the Organizational Charts from 2010 to 2017 (Source: AGRINEXUS).

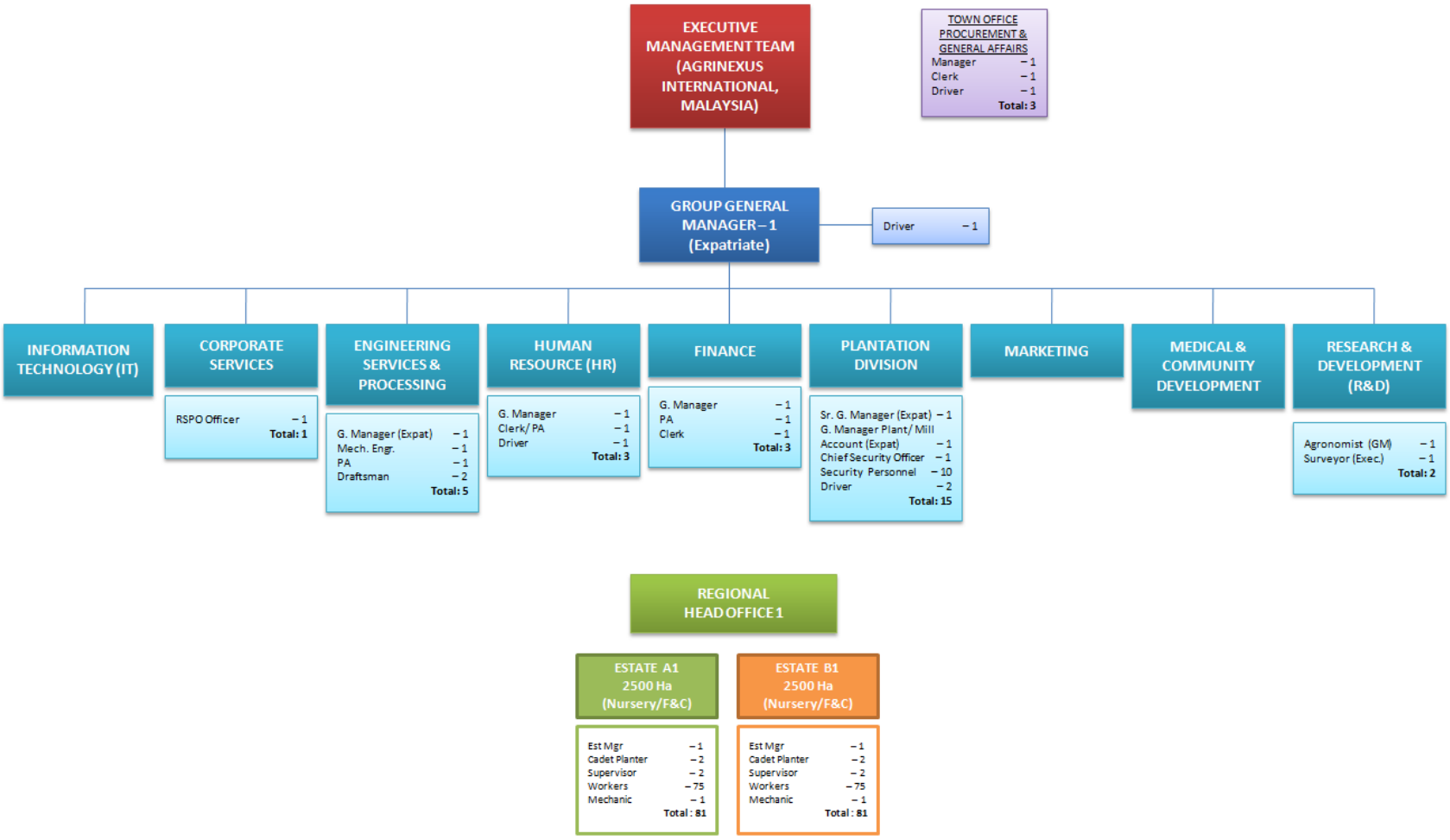
ORGANISATIONAL CHART – OIL PALM YEAR 2010 (AUG to DEC)



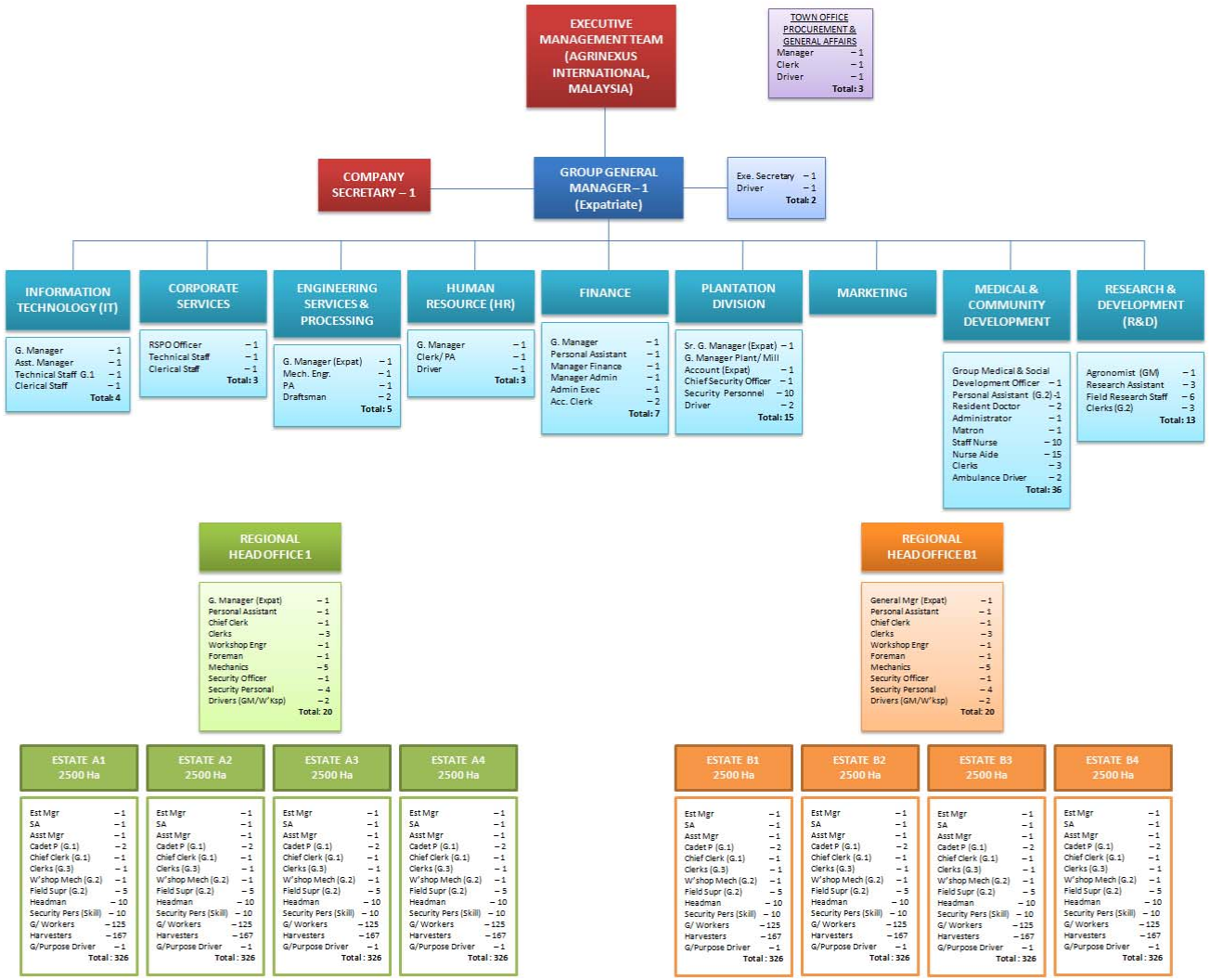
ORGANISATIONAL CHART – OIL PALM YEAR 2011



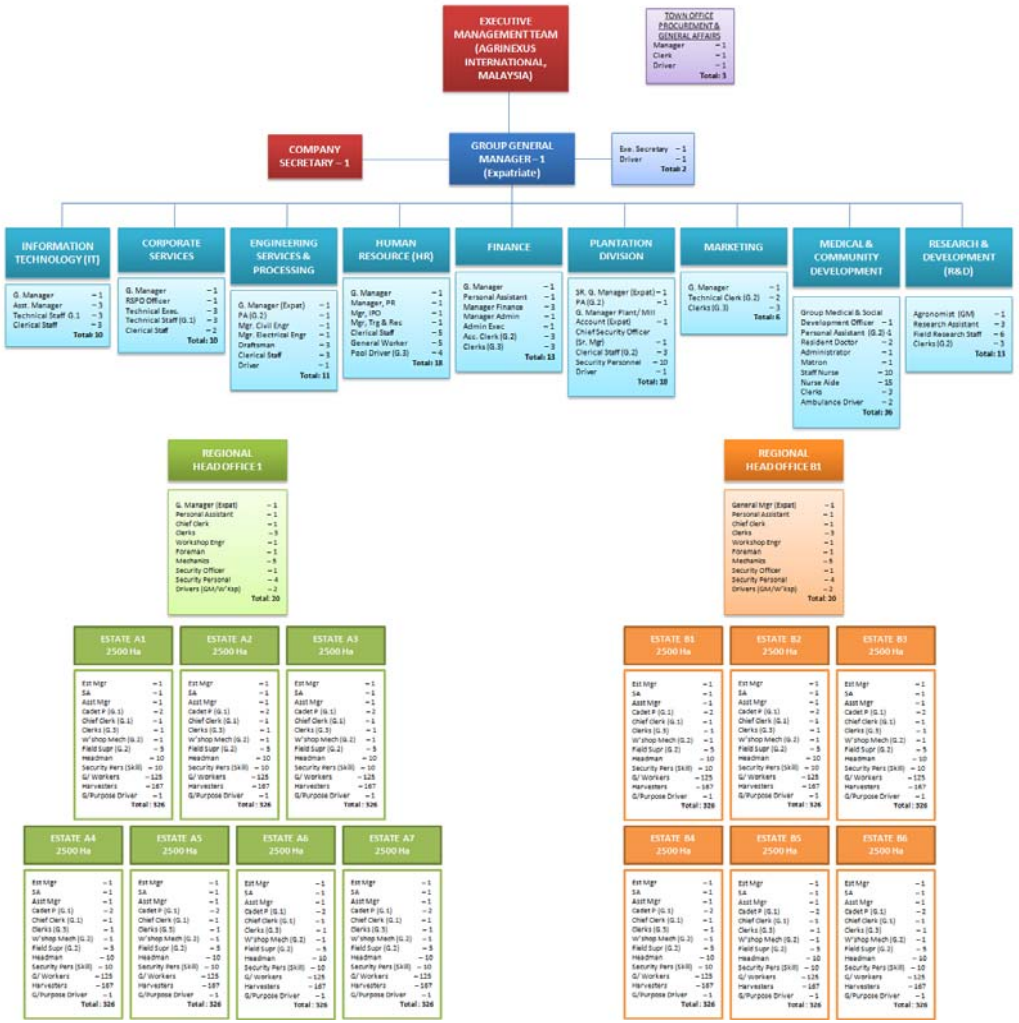
ORGANISATIONAL CHART – OIL PALM YEAR 2012



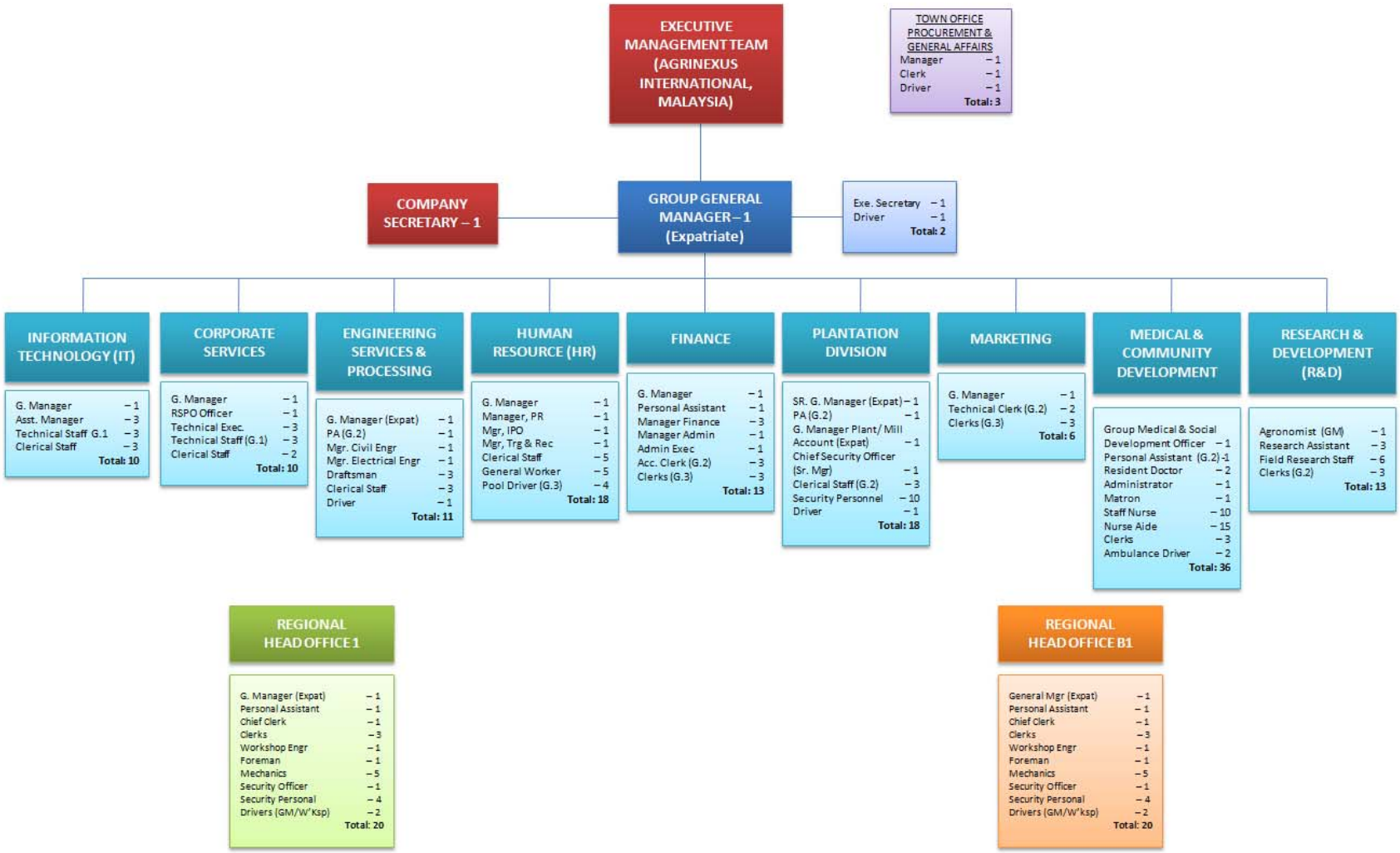
ORGANISATIONAL CHART – OIL PALM YEAR 2013

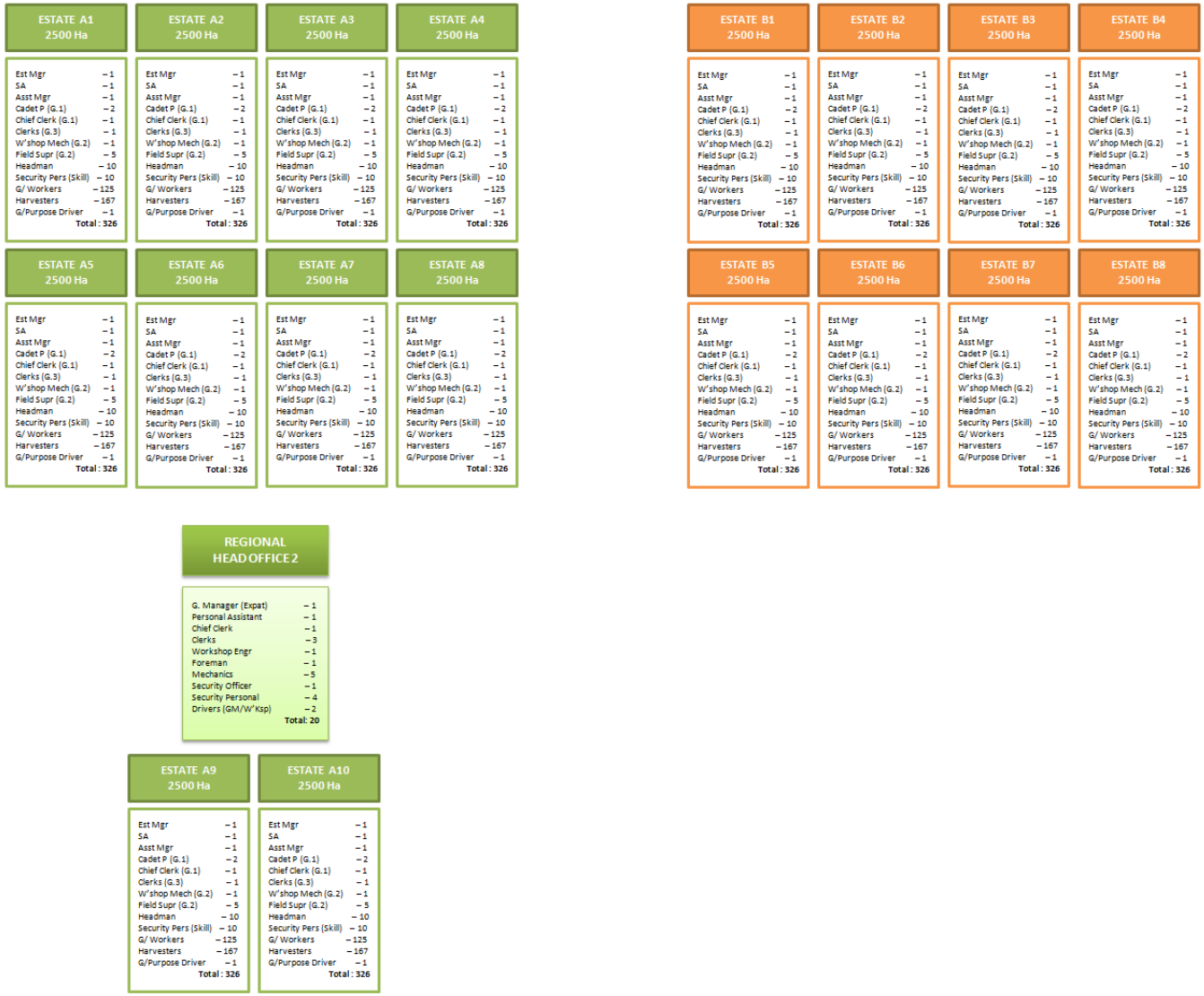


ORGANISATIONAL CHART – OIL PALM YEAR 2014

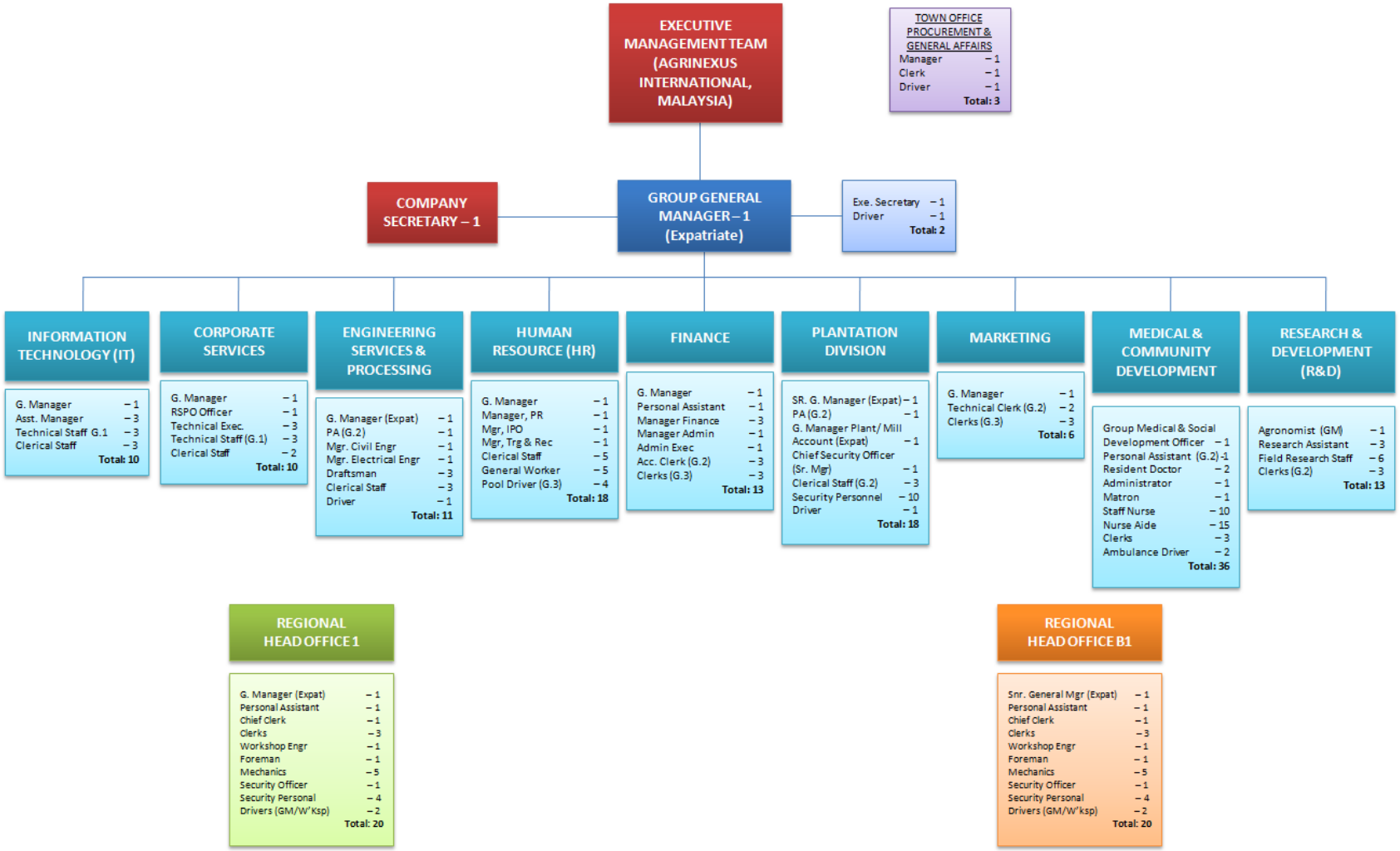


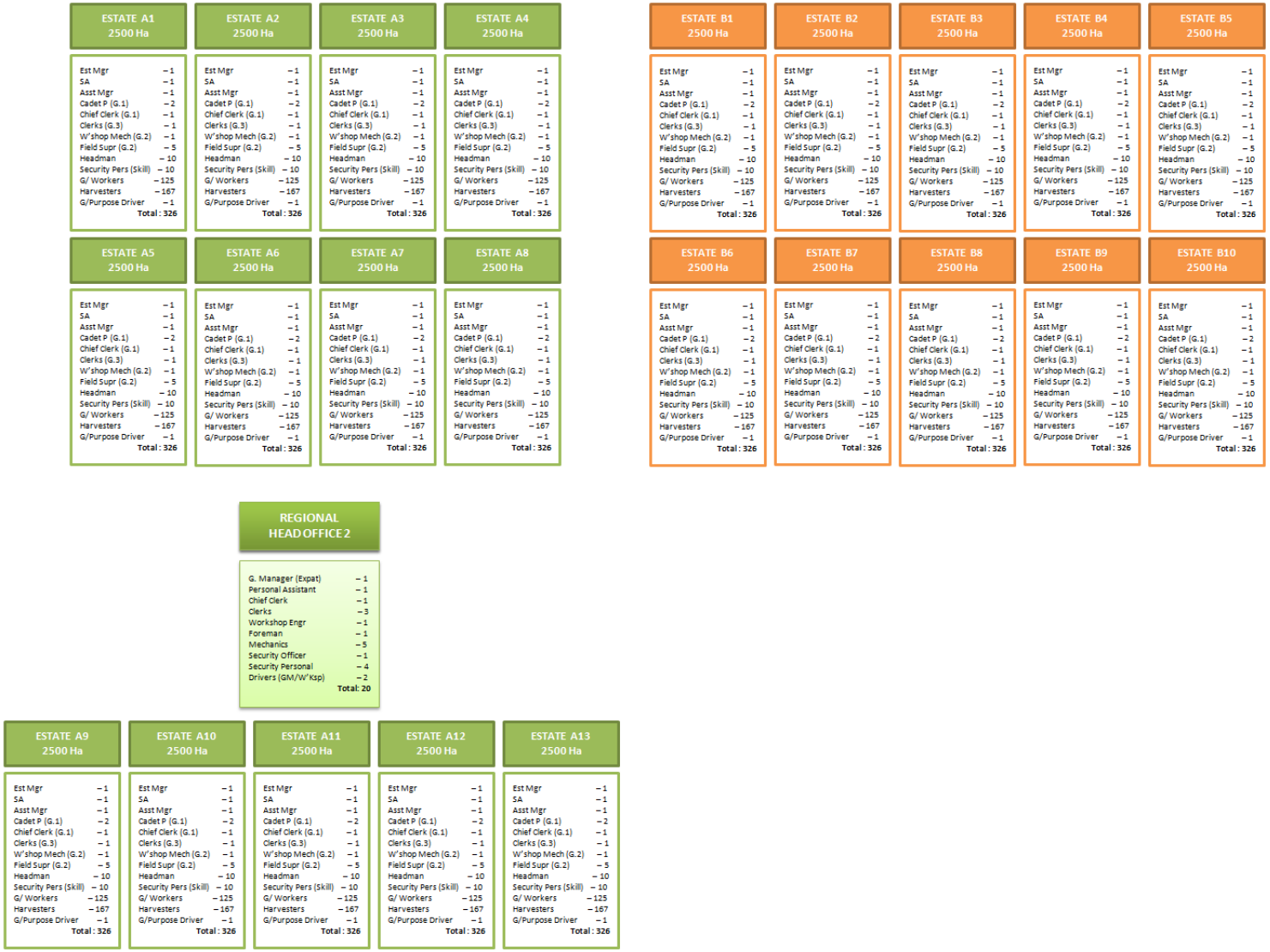
ORGANISATIONAL CHART – OIL PALM YEAR 2015



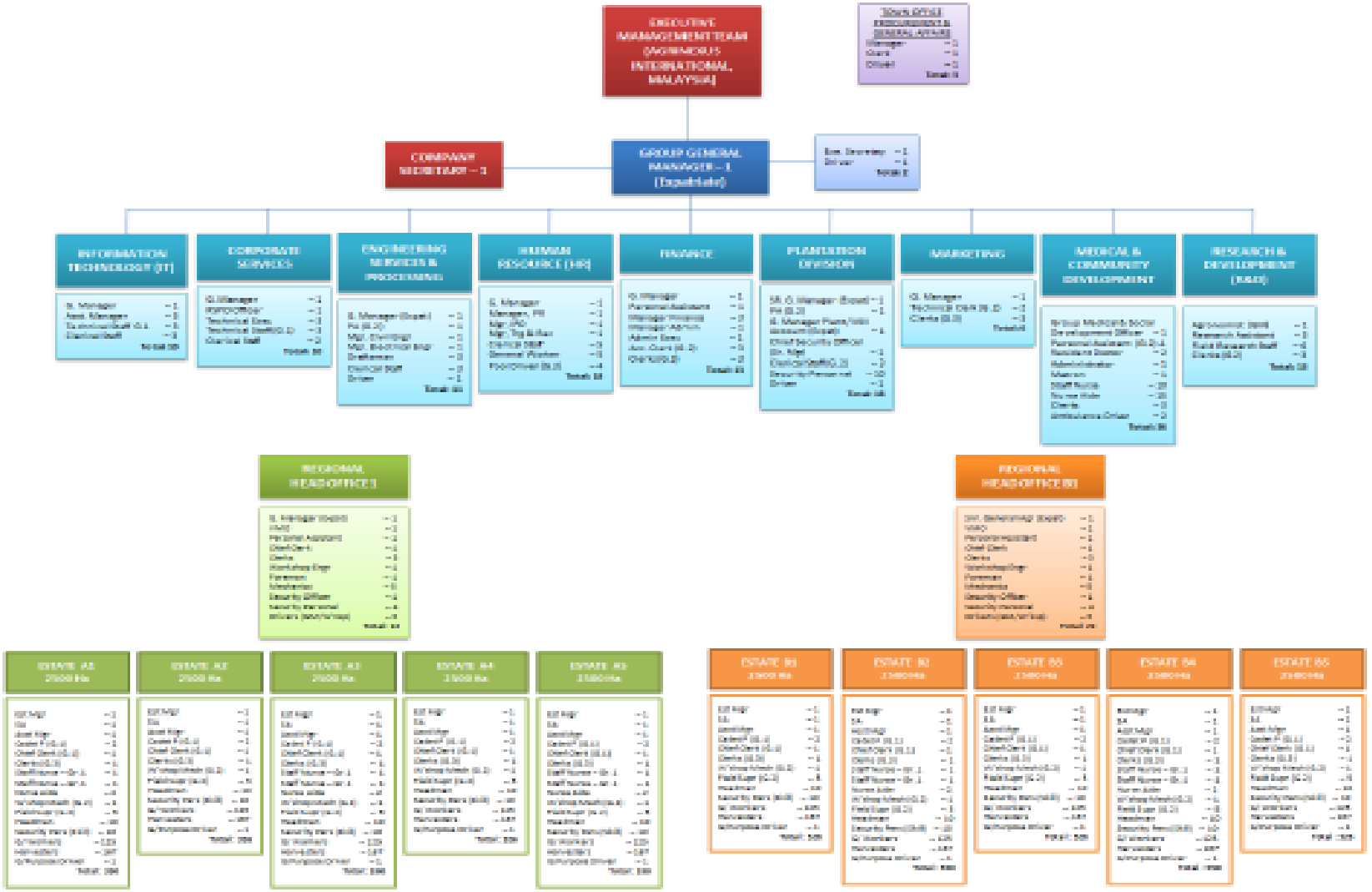

ESTATE A1
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A2
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A3
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A4
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A5
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A6
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A7
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A8
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
REGIONAL
HEAD OFFICE 2
G. Manager (Expat) – 1
Personal Assistant – 1
Chief Clerk – 1
Clerks – 3
Workshop Engr – 1
Foreman – 1
Mechanics – 5
Security Officer – 1
Security Personal – 4
Drivers (GM/W'Ksp) – 2
Total: 20
ESTATE A9
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A10
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B1
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B2
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B3
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B4
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B5
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B6
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B7
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B8
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326

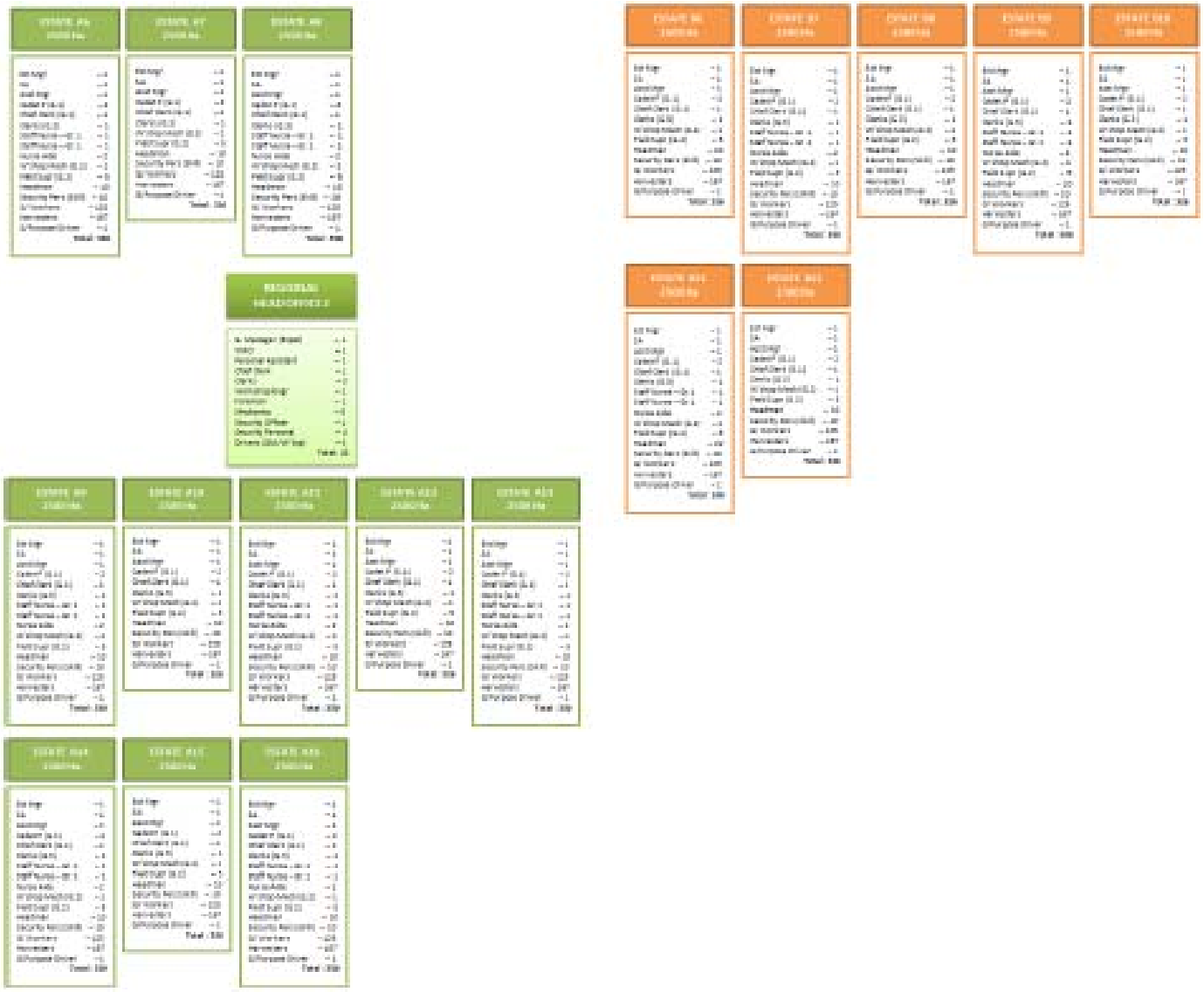
ORGANISATIONAL CHART – OIL PALM YEAR 2016




ESTATE A1
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A2
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A3
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A4
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A5
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A6
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A7
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A8
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B1
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B2
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B3
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B4
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B5
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B6
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B7
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B8
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B9
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE B10
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
REGIONAL
HEAD OFFICE 2
G. Manager (Expat) – 1
Personal Assistant – 1
Chief Clerk – 1
Clerks – 3
Workshop Engr – 1
Foreman – 1
Mechanics – 5
Security Officer – 1
Security Personal – 4
Drivers (GM/W'ksp) – 2
Total: 20
ESTATE A9
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A10
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A11
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A12
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326
ESTATE A13
2500 Ha
Est Mgr – 1
SA – 1
Asst Mgr – 1
Cadet P (G.1) – 2
Chief Clerk (G.1) – 1
Clerks (G.3) – 1
W'shop Mech (G.2) – 1
Field Supr (G.2) – 5
Headman – 10
Security Pers (Skill) – 10
G/ Workers – 125
Harvesters – 167
G/Purpose Driver – 1
Total : 326

ORGANISATIONAL CHART – OIL PALM YEAR 2017

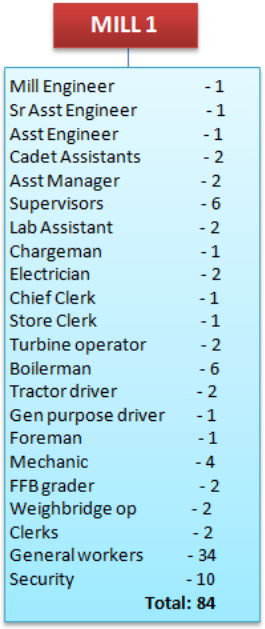




MILL ORGANISATIONAL CHART – OIL PALM YEAR 2012

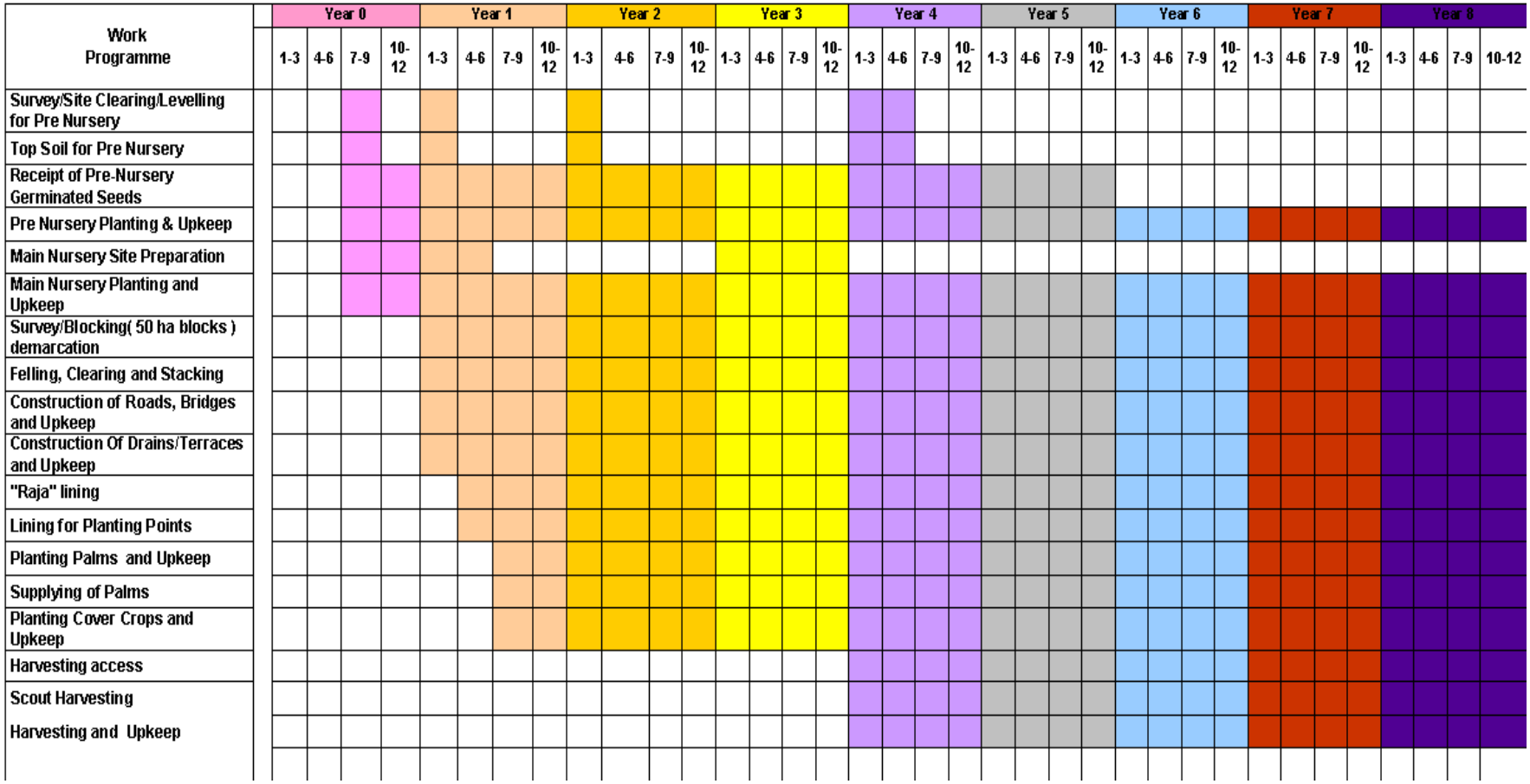
MILL ORGANISATIONAL CHART – OIL PALM YEAR 2013

MILL ORGANISATIONAL CHART – OIL PALM YEAR 2014



Work Program

The diagram below provides a summary of the timing and work program for the Implementation Plan for the project:



(Source: AGRINEXUS)

Building/Housing Implementation Plan

A summary of the entire building/housing implementation plan for the project is presented below:

HECTARES (PER YEAR)		*1,000*	*4,000*	*5,000*	*10,000*	*12,500*	*12,500*	*12,500*	*12,500*		
HECTARES (TODATE)		*1,000*	*5,000*	*10,000*	*20,000*	*32,500*	*45,000*	*57,500*	*70,000*	*70,000*	*70,000*
	NO OF UNITS										
HOUSE/BUILDING TYPE	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
TYPE A				1							
TYPE B				5	25	17	9	18	12	2	1
TYPE C				2	24	17	9	20	14	3	3
TYPE D				3	65	35	23	46	37	9	9
TYPE E				56	684	528	240	693	500	21	21
B.C.	1		1								
B.C. 1	1		1								
B.C. 2	1	4	3								
ENGINE ROOM - GENERATORS	1										
GUARD HOUSE - NURSERY/COMPLEX	1										
CHEMICAL STORES	1										
FERTILISER STORE	1										
NURSERY STORE	1										
PUMP HOUSE - NURSERY/COMPLEX	1										

(Source: AGRINEXUS)

Notes:

- ✓ *Type C, D & E – Room sharing based on 2 persons per unit*
- ✓ *At the time of recruitment, consideration should be given to recruit working family teams to reduce the number of houses*
- ✓ *Calculation for number of workers based on 70% resident and 30% non-resident*
- ✓ *Also includes housing for the 6 mills*

Machinery and Agricultural Equipment Requirements (Source: AGRINEXUS)

NO.	MACHINERY/EQUIPMENT	TOTAL UNITS	YEAR 2010	YEAR 2011	YEAR 2012	YEAR 2013	YEAR 2014	YEAR 2015	YEAR 2016	YEAR 2017	YEAR 2018	YEAR 2019	YEAR 2020	YEAR 2021	YEAR 2022
1	***TRANSPORT***														
	L/CRUISER	**1**	1												
	PRADO	**1**	1												
	4 X 4 TATA JEEP	**47**	6	2	4	10	7	5	5	5	1			1	1
	AMBULANCE	**15**		1	1	3	2	3	2	3					
	MOTOR CYCLE - 125 CC	**56**				16	10	10	10	10					
	MOTOR CYCLE - 80 CC	**140**	2	2	36	25	25	25	25						
	TATA TRUCK - 19 TON TIPPER	**84**	1	1	1	3	6	12	15	15	15	15			
	TATA TRUCK - 12.5 TONS N.TIPPER	**28**	1			1	2	4	5	5	5	5			
	TIPPING TRAILER - 5 TONS	**140**	2	2	1	20	20	30	20	20	25				
	TIPPING TRAILER - 10 TONS	**140**	2	2	1	20	20	30	20	20	25				
	TRAILER -C/W 2000 LITRES WATER TANK	**7**	1	1	1	1	1	1	1						
2	***MACHINERY***														
	MF 4WD 80 HP TRACTOR	**140**	2	3	5	10	20	25	25	25	25				
	D6 BULLDOZER	**3**				1	1	1							
	EXCAVATOR	**14**	1	2	3	3	3	2							
	BACK HOE DIGGER (90HP)	**14**	1	1	2	2	2	2	2	2					
3	***AGRICULTURE IMPLEMENTS***														
	MOTOR ROAD GRADER/RIPPER	**14**	1	1	1	2	3	2	2	2					
	REAR MOUNTED GRADER	**28**	1	1	2	4	5	5	5	5					
	SINGLE DRUM VIBRATORY COMPACTOR(7 TONS)	**14**	1	1	2	2	2	2	2	2					
4	***SUNDRY EQUIPMENT***														
	GENERATOR SET - 200 KVA	**28**	2	2	8	4	4	4	4						
	WATER PUMP	**28**	2	2	8	4	4	4	4						

3.10.8. Fuel consumption

Fuel consumption cannot yet be estimated satisfactorily because a large amount of data is not yet known at this stage of the project such as, the type of mobile or stationary engine, quantity of biodiesel used in the project instead of hydrocarbons to reduce air pollution, the total number of vehicles and equipment, etc. On the other hand, the 60 MT/Hr Palm Oil Mill energy consumption will be 1.2 Megawatts.

3.10.9. Water consumption

Theoretically, all the water needed for processing and consumption needs will be obtained from streams and boreholes. The boreholes will have to meet certain requirements for the process, namely low silicate rate, drinking water should be free of heavy metals as well as bacteriological parameters.

Water consumption in plantations will be reduced as the **SGSOC** concession is located in a high rainfall zone. The estimated water consumption for all purposes, namely processing and consumption during the construction phases, could attain 400 to 500 m^3 per day. During construction this estimate could be reduced by one quarter or one fifth. Furthermore, water consumption during construction will vary significantly as the volume of consumption will depend on work to be done.

The Palm Oil Mill water consumption in m^3 per hour equals 1:1 to Fresh Fruit Bunch (1 T FFB = 1 T H_2O).

3.10.10. Transportation of (imported and local) materials and equipment for the construction of the plant

All steel structures and machinery to be installed will be imported into the country via the port of Douala. These materials and equipment will be transported to the construction site.

The transportation of equipment will have a short-term impact on the environment in the form of air pollution by the exhaust fumes of transportation vehicles, including pollution resulting from the loading and unloading of materials and equipment. This impact (emission of carbon dioxide into air) will be a function of the tonnage, distance, type of truck, road conditions, etc.

3.11. Possible Inconveniences in the Event of Work Stoppage

In line with EIA requirements, a comment should be made concerning any inconveniences that may arise. Although it is difficult to provide a valid answer, the following can be said with regard to this palm oil project:

In principle, a mill will operate for 30 or 40 years before becoming obsolete or unproductive, it will depend on technological improvements and other changes that cannot be considered now.

If the mill needs to be destroyed at the end of its lifespan, an EIA in due form will have to be carried out in accordance with the law. The EIA will stipulate how the factory will be dismantled and destroyed and site changes.

4. SITE DESCRIPTION

4.1. Site description for Mundemba/Toko project area

4.1.1. Location

Mundemba which also happens to be the capital of the Ndian Division is located in the Southwest region of Cameroon. The separate village of Manja is nowadays practically an extension of Mundemba. Mundemba is accessible by car from Kumba via an earth road. The majority of the famous Korup National Park is also situated in Mundemba (Management Plan of Korup National park and its Peripheral Zone 2008-2012).

Korup National park (KNP) in the Ndian division is the only extensive forest of western central Africa that originally spread from the Niger Delta eastwards to Cameroon and south through Equatorial Guinea and Gabon. Located at the centre of the Guinea Congolian forest refugium (Maley, 1996; Maley & Brenac, 1998), KNP is reputed to be the best remaining example of this forest type and richer than any other African forest for which data is available (Richards, 1952). The Geographical coordinates of Mundemda in degrees minutes seconds (WGS84) Latitude: 4 57' 00" Longitude: 8 52' 00" The SGSOC project site is located in a lowland region of the support zone of Korup National Park and the Nguti area in the Southwest region of Cameroon (Figure 1). It falls within Mamfe, Kupe-Manenguba, Bangem and Mundemba Sub- Divisions of Cameroon.

Biogeographically, the project is located in the Guineo-Congolian forest region which is known for its extensive tracts of lowland humid forest. This Congolian Coastal Forest is one of Africa's richest in forest birds, mammals and plants diversity. In fact, these lush forests are home to half of the endemic plants of west tropical Africa, including six whole families of plants that are found only in tropical Africa (WWF, 2003).

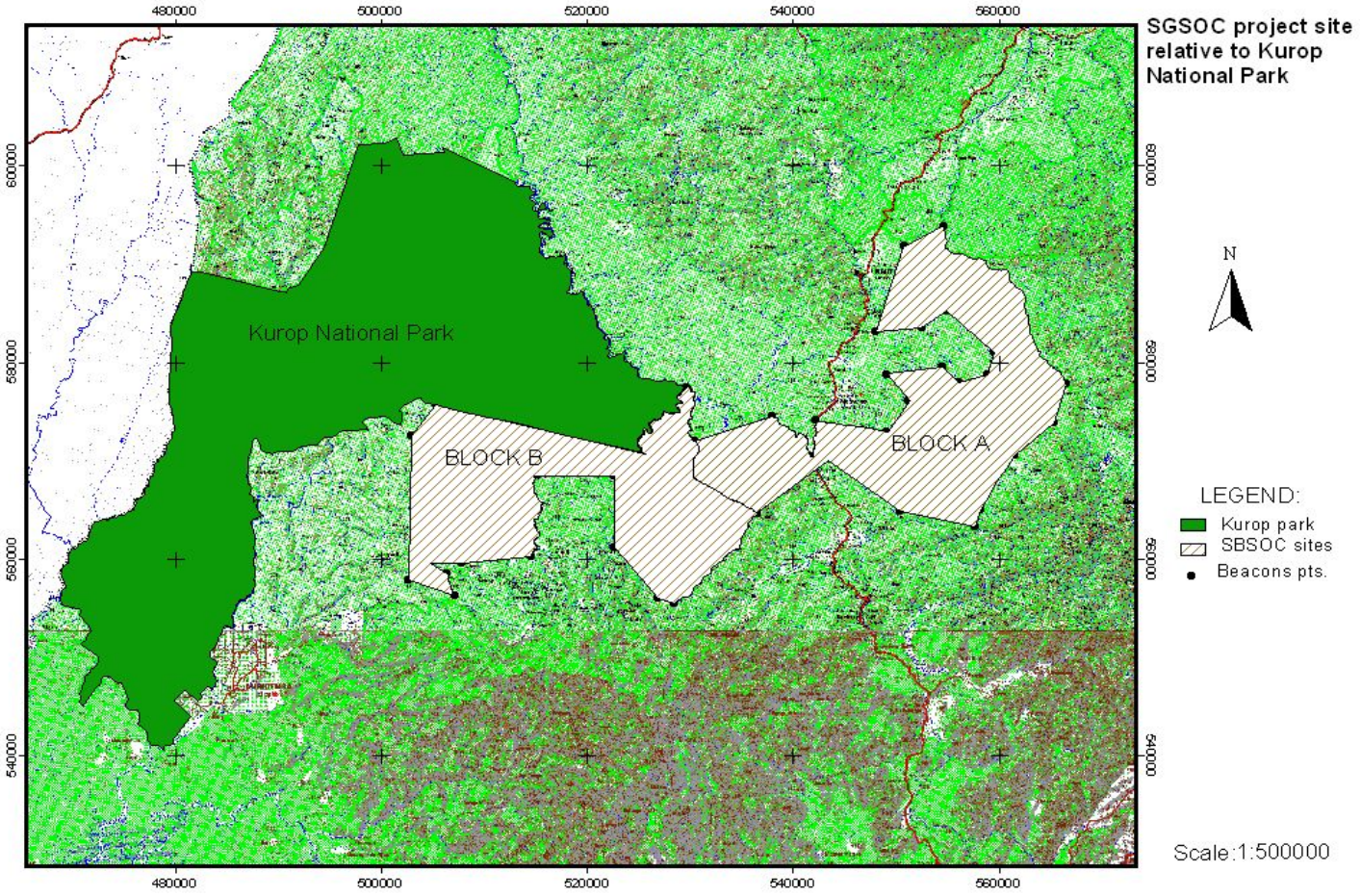


Figure 9: Map of the SGSOC Project site relative to the Kurop National Park

4.1.2. Physical environment

4.1.2.1. Climatology and Rainfall

The Mundemba climate is characterized by two seasons: one dry season from November to mid-March and one wet season from mid-March to October with the wettest months being July, August and September. The total rainfall is estimated at 5,000mm per annum (Zimmermann, 2000).

Extended dry periods have, in recent years, resulted in forest streams drying up, killing epiphytes as well as trees and plants rooted in thin soils.

Rainstorms can be extremely local and rainfall intensity may be very high. High intensity rainfall combined with the presence of steep slopes make it particularly important to protect the soil surface as much as possible from direct exposure to rain (Management Plan of Korup National park and its Peripheral Zone 2008-2012).

Relative humidity: The mean annual relative humidity is 83%, the mean daily maximum is 98% and the minimum is 66%. The mean annual temperature is about 25 °C with August and February being the coldest and hottest months respectively. The mean annual maximum temperature is 30.2 °C. The coolest month typically occurs at the peak of the rainy season in August with monthly mean maximum temperatures of 25˚C, while February is the hottest month with monthly mean maximum temperatures of 33˚C. A mean annual maximum temperature of 30.2˚C and a mean minimum temperature of 23.8˚C have been calculated (all measurements taken at 0700 local time). Mean annual variation in temperature is 6.5°C, mean diurnal temperature range is 6.2°C (Zimmermann, 2000).

The radiation is greatest during the early wet season (March-May), decreasing during the peak rains in July and August and rising again in the late wet season (October to December), (Gartlan, 1985). The northeasterly winds from the Sahara prevail during the dry season while south-westerly winds are prevalent during the wet season. Wind speeds are generally low, less than 5 or 10 km/h (Gartlan, 1985).

Evapotranspiration: Estimated to be not less than 4mm per day, hence months with less than 120mm of rain are considered as dry months (Zimmermann, 2000).

Radiation: Low compared to other wet tropical localities although more uniform throughout the year. It is greatest during the early wet season (March-May), decreasing during the peak rains in July and August and rising again in the late wet season (October to December). During the dry season, radiation values fall slightly due to the seasonal

Harmattan dusts (Newbery et al, 1998). Data from Ndian Division indicate that over a 5 year period there was an average of only 3.5 hours of sunshine per day. It is anticipated that the number of sunshine hours increases northwards as a result of decreasing rainfall (Gartlan, 1985).

Winds: North-easterly winds from the Sahara prevail during the dry season while southwesterly winds are prevalent during the wet season. Wind speeds are generally low, less than 5 or 10 kmh. Convectional thunderstorms, involving high winds and sudden squalls, are common at the beginning and end of the wet season and may cause extensive damage to the forest and its edges. Generally, however, wind is not an important feature of the Park area (Gartlan, 1985).

4.1.2.2. Air quality

Transportation by land and air through this area is very limited coupled with the presence of a few industries like PAMOL in Ekondo Titi, MUNDEMBA PALM OIL (M.U.P.O), the air quality is expected to be good. Measurement of ambient concentrations of various emissions was not the subject of the assignment in question.

4.1.2.3. Climate change

This area appears likely to be prone to climate change effects given that forest (secondary forest) in the project area has been repeatedly logged. Recent findings by the Cameroon ministry of forestry and wildlife confirmed that forest in the project area has gradually been transformed from primary to secondary.

However, there is no information on the effects of climate change on the rivers in the area and potential floods. A majority of the households rely on fuel wood as the main source of energy source for cooking.

4.1.2.4. Noise level

The noise level is limited to the natural fauna in the area and very seldom the passage of a motorcycle and timber trucks. Therefore the noise level is quite low.

4.1.2.5. Geology, Soils – quality and erosion

Six main geological types have been identified from Mundemba and the Support Zone of Korup National Park which includes recent alluvium, Cretaceous sediments, Mio-Pliocene sediments, Pre-Cambrian neiss, Tertiary (older) basalt and Tertiary dolerite (MINPAT, 1989, Gartlan, 1985). The Mosongeseli-Isangele area is dominated by Cretaceous and Mio-Pliocene sediments with recent alluvium in the creeks and marshes. Isolated basaltic plateaus, which rise above the general level of sediments, also occur. The Mundemba-Toko area consists largely of basaltic lava flows produced from volcanoes in the Rumpi Hills.

These flows now form a broadly semicircular, stepped and dissected plateau from Fabe in the west, to Ebemi Bakundu in the east, reaching as far as Masaka Bima and Babiabanga in the north. The vast majority of KNP (113,000ha) consists mainly of precambrian basement rock of two closely related types: ectinites, quartzites and gneisses predominate in the east, with gneisses, embrechites and areas of syntectonic granite in the west.To the east of Korup National Park in the Manyemen-Baro area, there is an area of basalt lava flow, generally at a lower altitude than the Mundemba-Toko area, and emanating from the Nkwende Hills (MINPAT, 1989, Gartlan, 1985).

Soils: The data from a survey originally carried out to assess the suitability of soils in the region for the cultivation of oil palm (IRAD-ONAREST, 1980) identify four main soil types in the Ndian division:

- Older sedimentary soils derived from Cretaceous sandstone and non-volcanic coastal plain soils cover about 6,000ha (4% of the Park) in the southern Park sector.
- Along the north-eastern boundary of the Park is another area of older sedimentary soils covering about 9,000ha (7% of the Park).
- In the extreme north-eastern corner of the Park old volcanic soils cover approximately 7,000ha (5% of the Park).
- The rest of Korup National Park (104,000ha or 84% of the total area) is covered by soils derived from the *insitu* degradation of the Precambrian basement rocks: granites, gneisses,

schists, embrechites and ectinites. Soils derived from these basement rocks are very coarse-grained, gritty, very strongly acidic and possess a low nutrient status.

In 1987 the Land Resources Development Centre surveyed three areas adjacent to KNP (LRDC, 1987). No consistent catenary pattern was found relating soils and their landscape position; the soils information available is necessarily generalized. Differences in soils due to parent material were also found to be slight, except that soils derived from basalt were generally more clayey and less stony than those from other parent materials. It was concluded that farming systems, in which food crops, tree crops and forest trees are closely integrated are generally well suited to the soils in the area. In summary, the soils of Korup tend to be extremely sandy, low in nutrients and possess poor water-retaining qualities. They are generally very acidic and infertile with low levels of soil nutrients and organic matter.

Soil quality: due to low (nearly no) human activity in the area, the soil is expected to be clean. Soils are prone to erosion.

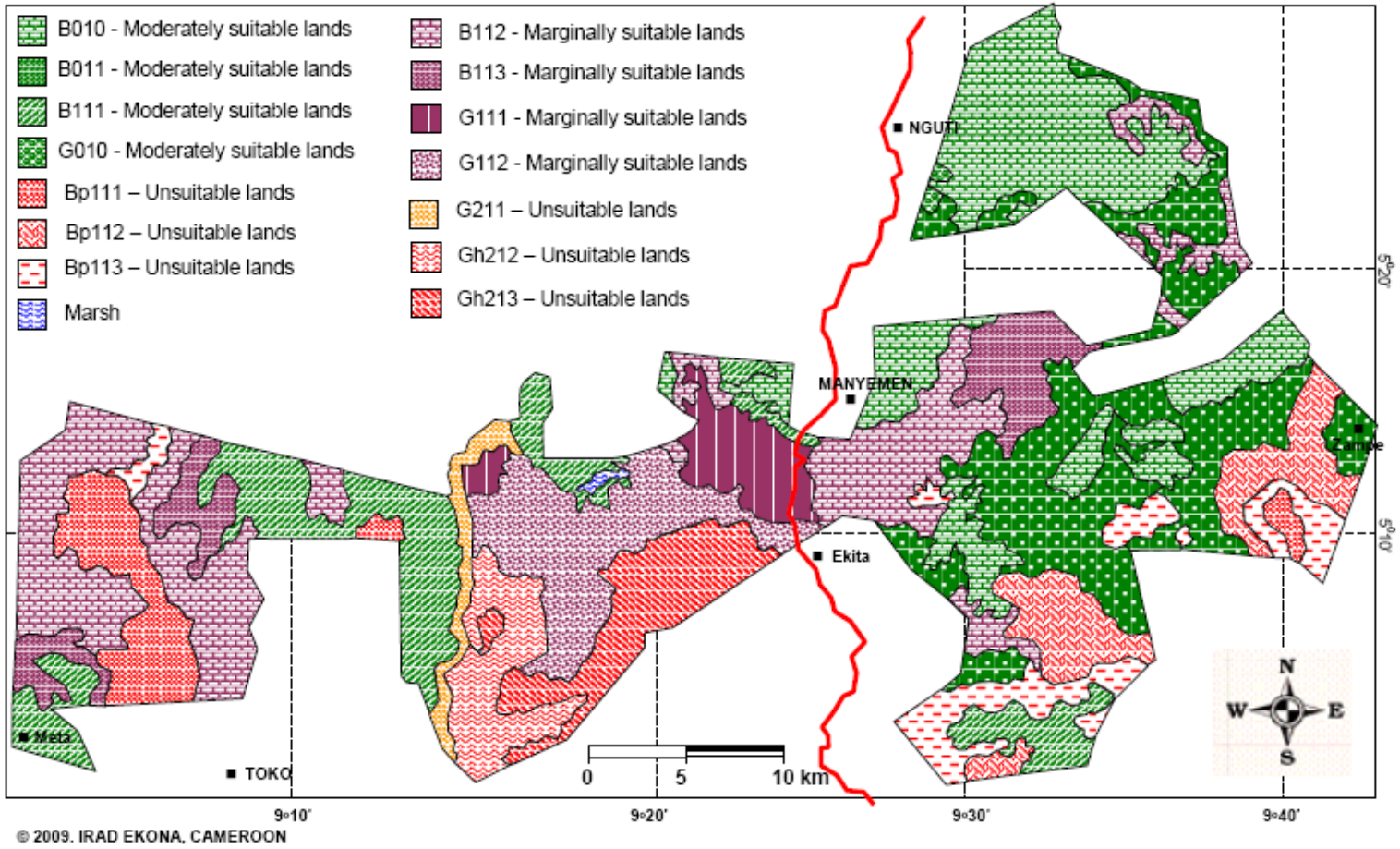


Figure 10: Soil and land suitability map of the Manyemen – Nguti – Toko area for oil palm

4.1.2.6. Hydrology, hydrography (Surface water) and water quality

Major drainage systems within the Ndian Division include:

- **Ndian River System**. Flows in a south-west direction, drains the northern parts of the Rumpi Hills Forest Reserve through its tributaries: Idu, Moliba, Mana, Oweye, Okporo and Nyangoribe.The western and south-western areas of the Park are also drained by the Akpasang and Korup Rivers flowing generally southwards (Management Plan of Korup National park and its Peripheral Zone 2008-2012).

- **Moko River System**. Drains the southern part of the Rumpi Hills Forest Reserve through its tributaries: Dokeri, Massombi, Nyagorobe and Melange.

- **Bake-Munaya River System**. Drains the central and northern parts of the Support Zone of Korup national Park through tributaries such as the: Libangenie, Maili, Marube, Ma, Mameli, Mohib, Bakwe, Bagodo, Bayong Ayib, Bate, Akarem, Akam and also flows north as a tributary of the Cross River (Management Plan of Korup National park and its Peripheral Zone 2008-2012).

Generally hydrological networks are very rich (lots of little and temporary streams). Water is used for fishing, washing; cooking. Little or no information exist on water quality parameters.

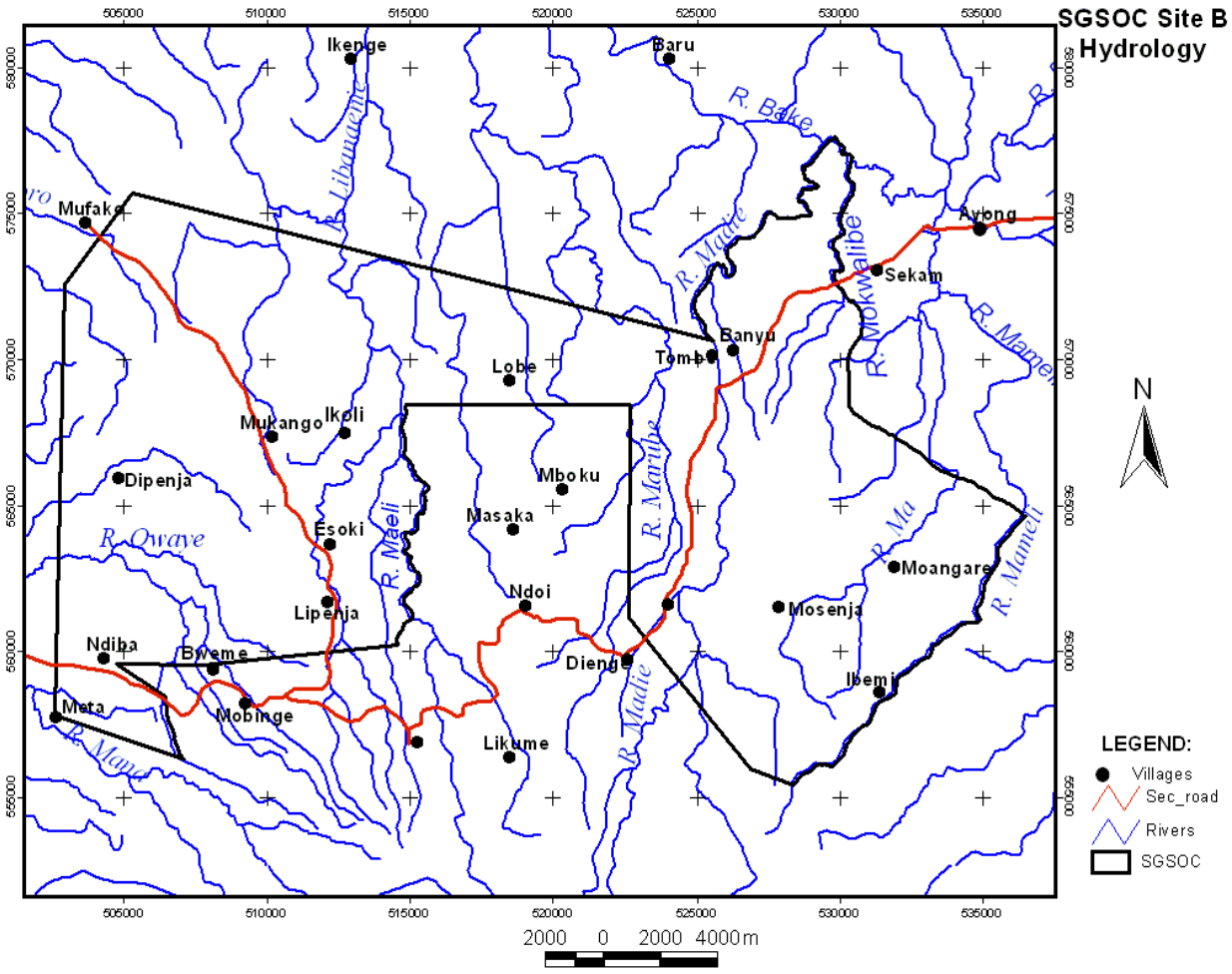


Figure 11: Hydrology map of the SGSOC Project site – Block B: Mundemba/Toko

4.1.2.7. Groundwater

Very little or no information exist on the size, depth, quality and use of ground water.

4.1.2.8. Land use and landscape (geomorphology and topography)

The landscape is characterized by creeks around Mumdemba, hills (rumpi hills around Batanga, Dikome Balue,) and lowlands around the Meme river in Kumba. Various land use patterns include:

Farming: Shifting cultivation forms the basis of the farming system in the Mundemba area. Both food crops (cassava, plantains, bananas, cocoyams) and cash crops (cocoa, coffee, and oil palm) are

produced. Typically, an average household may own 5-10 hectares of land but usually there are only 2 hectares or less under full cultivation at any point in time. In general farming is done using family labour and outside labour (Nigerians and people from the other regions of Cameroon). Coffee (*Coffea robusta)* and cocoa (*Theobroma cacao)*, as well as fruit trees, both planted and wild are continuously being harvested during fallow periods. In general coffee and cocoa production has declined due to problems of accessibility especially for Park and Peripheral Zone villages (Management Plan of Korup National park and its Peripheral Zone 2008-2012).

Livestock: Livestock production is poor in the area and domestic animals are raised more for ceremonial occasions and honoured guests than for home consumption (Devitt, 1988). A small number of dwarf shorthorn Muturu cattle (Trypanosomiasis resistant), occur in the area. In the past these cattle were numerous but their numbers declined largely because they were allowed to roam freely causing damage to crops and were frequently shot by angry farmers as a result (Malleson, 2000). However most households keep a few chickens and some keep a few goats and pigs (Butcher, 1997). Although livestock have been traditionally regarded as a symbol of wealth; studies have shown that livestock are more often regarded as pests of food crops than as an asset to livelihoods.

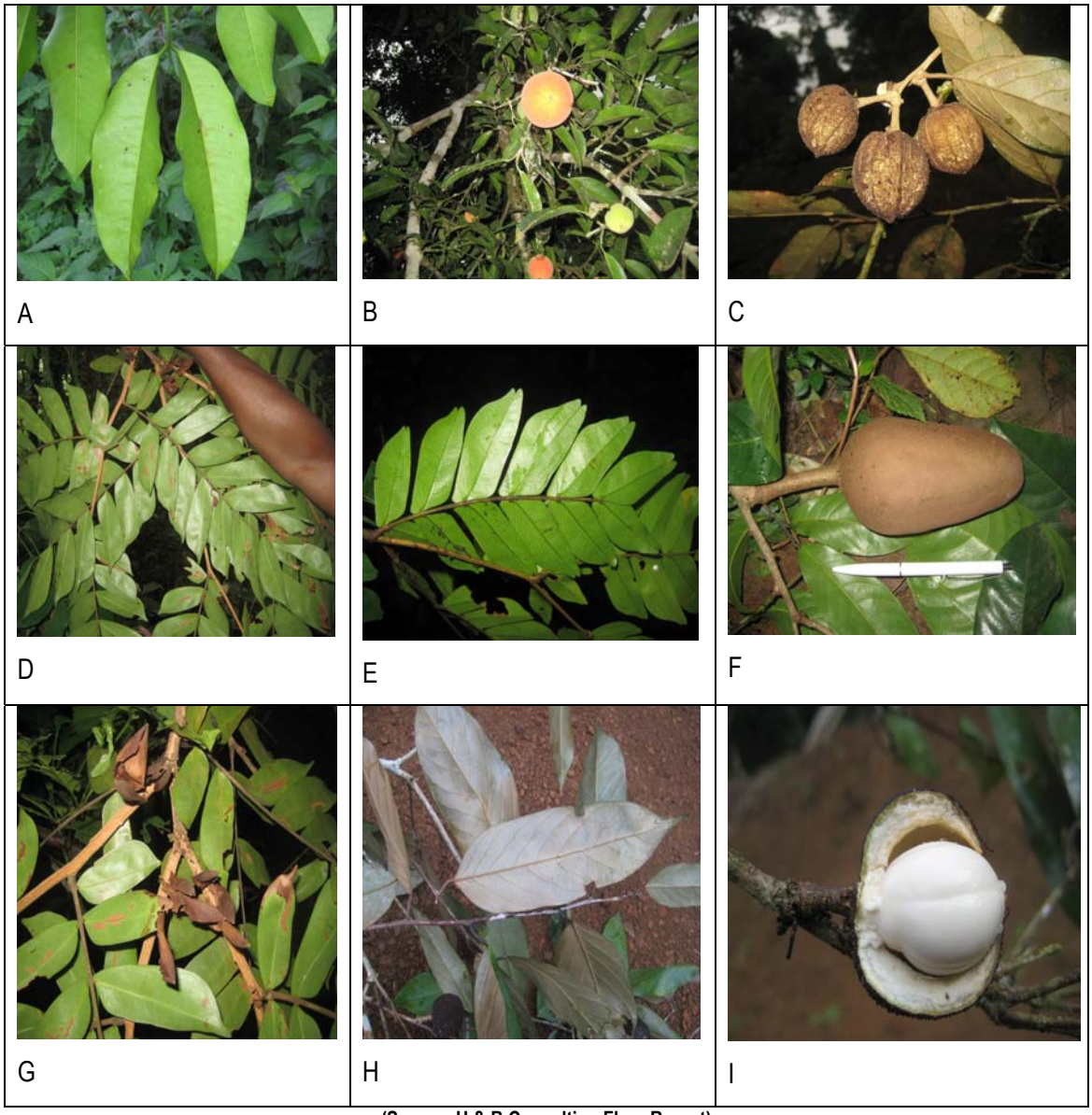
Fishing: Locally caught fish and crustaceans are widely consumed and represent the most significant source of animal protein in local diets particularly for women and children (Malleson, 2000). The relative importance of fishing as a source of income for men has been on the increase (Vabi, 1999). Although surplus fish may be sold locally, fishing is primarily a small scale subsistence activity (Infield, 1988). Fishing is a seasonal occupation for both men and women with least activity during the wet months of July, August, and September. Methods used include hook and line, sleeping hooks, basket traps, and nylon nets of various designs and the poisoning of streams. Poisoning of small brooks and streams with vegetable toxins derived from the macerated fruits of *Strychnos aculeata*, *Blya supida* and *Massularia acuminata* is an ancient traditional practice (Reid, 1989).
Fire arms are the most commonly used tools by poachers. Bush meat represents the most important source of protein in the Ndian Division. Hunting takes place throughout the year but declines in intensity during the peak farming season.

Hunting: The universal hunting weapon in the The Korup area has a locally manufactured 12-bore inglebarrel shot-gun; he use of the original Dane guns has been prohibited although many of them are still in the villages (Infield, 1988). Double-barrel shot-guns and factory-made shot-guns are rarely used. Automatic weapons are occasionally used to hunt elephants although their use is not considered to be

widespread. Most of the shot-guns are manufactured locally. The bulk of hunting is done at night using carbide headlamps for duikers (*Cephalophus spp*). The existence of a huge bushmeat trade ensures regular bushmeat supplies to the markets at Mundemba, Tombe, Mufako Batanga, Abat, Manyemen, Ajayuk Ndip in Cameroon and Ekongnaku in Nigeria (Vabi, 1999). The bulk of the bushmeat from the Korup National Park is sold in Nigeria and other urban centres in Cameroon (Douala, Kumba, Mamfe and Bamenda for example). The species such as the Bay duiker *Cephalophus dorsalis*, Blue duiker *Cephalophus monticola*, and Brush-tailed porcupine *Atherurus africanus*. Red colobus *Piliocolobus preussi*, Drill *Mandrillus leucophaeus*, Leopard *Panthera pardus* and Giant pangolin *Smutsia gigantea* are highly vulnerable to hunting pressure and in some areas are already locally extinct (Infield, 1988).

Fuel wood and wood for other uses: Fuel wood is commonly collected from farmlands and the forests. The species collected vary from tribe to tribe. Collection is usually done by women. In the Oroko tribe, fuel wood is kept in bands inside the kitchens to get dry in preparation for the rainy season. Recently with the use of engine saws much wood is collected in a short time for commercial purposes (Management Plan of Korup National park and its Peripheral Zone 2008-2012). The species preferred are *Staudtia spp, Uapaca spp* and *Homalium spp*. *Diospyros spp* are very straight and used as poles for roof construction and wire snares.

Non-Timber Forest Products (NTFPs): Collecting, processing and marketing of NTFPs traditionally represent a major source of income for women and increasingly for men and youths. These products include kola nuts *Cola* and *Garcinia spp*., country onion *Afrostyrax lepidophyllus*, njabe *Baillonella toxisperma*, bush mango *Irvingia gabonensis*, eru *Gnetum spp.*, shell nut *Poga oleosa*, njansang *Ricinodendron heudelotti*, chewing sticks *Garcinia mannii* and *Massularia acuminata* and numerous medicinal plants. Alcoholic beverage (palm wine) is sapped from Raffia palm *Raphia hookeriana* and oil palm *Elaeis guineensis*. Bush mango, eru and njansang have a predominant economic value. Many of these products are commonly collected from farm, fallow and secondary growth forests. There is growing interest among men and youths in the collection and marketing of NTFPs owing to the drop of wildlife and the risk involved in poaching. In the Southern part of the Park at Erat the exploitation of Hausa stick *Carpolobia spp*. is an important cross-border activity largely controlled by Nigerians (Nkwatoh, 1995).



(Source: H & B Consulting Flora Report)

Pictures Plate 4: Pictures of leaves and fruits of some important species within the project area.

A – Leaves of *Garcinia kola*,
B – Fruits of *Garcinia kola*,
C – Twig of *Afrostyrax lepidobotrys* with fruits,
D - Leaves of *Hymenostegia bakeriana*,
E – Leaves of *Plagiosiphon multijugas*,
F – Fruits of *Monodora myristica*,
G – Leaves of *Hymenostegia bakeriana* showing leathery stipules,
H – Leaves of *Afrostyrax lepidobotrys*,
I – Open fruit of *Afrostyrax lepidobotrys*

Two forest concessions are currently being exploited within the region with a sawmill located at Nguti. Large-scale agro-industrial plantations owned by CDC and PAMOL that grow palm oil, rubber and banana exist near and around the SGSOC concession areas already.

4.1.2.9. Seismicity

The area has the potential of manifesting some seismic activity given its location around the Mt. Cameroon and the Rumpi hills and Lake Barombi. The risk of seismic activity is very low as none has been reported for a very long time in the project area.

4.1.3. Natural environment

4.1.3.1. Natural milieu (zones of ecological interest)

The project is situated around four major zones of ecological interest in the South West Region of Cameroon; Takamanda-More and the Bayang Mbo-Bakossi Gorrilla sanctuaries, the Korup-Ndongere and Mount Cameroon.

4.1.3.2. Natural Habitat

Vegetation type in the area:
The vegetation of the Korup National Park and its support zone where Mundemba is found can be classified according to altitudes. These were originally described by Letouzey (1985) and partially surveyed by Thomas (1995, 1997):

- **Lowland Evergreen Forest (below 400m):** A major part of the support zone is covered with the Atlantic Biafran forest (very rich in Caesalpiniaceae). This forest type is species-rich and contains many unknown, rare and endemic plant species. The Ejagham Forest Reserve (Ejagham FR) is being replaced gradually by the Atlantic forest which is lesser in Caesalpiniaceae;because it is lesser in Caesalpiniaceae it is classified as similar to piedmont forest. (Thomas, 1997).
- **Piedmont Forest (above 500m):** Atlantic forest of the north-west type, not dominated by Caesalpiniaceae species, with semi-deciduous elements. Widespread in Ejagham FR, Rumpi Hills FR and Nta Ali FR. The semi-deciduous elements refer to areas of secondary growth

forest, probably resulting from past agricultural practices. This type is species-rich and contains many unknown, rare and endemic species.

- **Submontane Forest (above 800m):** Found in Rumpi Hills FR with small patches on Nta Ali and Ejagham (Thomas, 1997). Canopy height is 10-15m. Characteristic trees of submontane forest include *Anonidium mannii, Camptostylus sp., Zenkerella citrina, Chionanthus sp., Syzygium staudtii, Anthocleista scandens* and *Garcinia sp*. The Submontane forest is known to be a hotspot of botanical diversity and supports a number of plant species of particular botanical interest due to their narrow or disjoint distributions.
- Korup National park (KNP) in the Ndian division is the only extensive forest of western central Africa that originally spread from the Niger Delta eastwards to Cameroon and south through Equatorial Guinea and Gabon. Located at the centre of the Guinea Congolian forest refugium (Maley, 1996; Maley & Brenac, 1998), KNP is reputed to be the best remaining example of this forest type and richer than any other African forest for which data is available (Richards, 1952). There is no evidence of any major historical influence by man and in the southern Park sector at least the forest is likely to be primary. Despite the stress on the ecosystem, the forest has a biomass and production equivalent to other African forests (Newbery et al, 1997).

Other vegetation types in the Korup National Park include:

- **Atlantic Biafran Forest**: A lowland evergreen association that occurs in wet coastal areas with very protracted wet seasons characterized by the dominance of large, gregarious Caesalpiniaceae species. This forest type covers the majority of Korup National Park, Ejagham Forest Reserve, Nta Ali Forest Reserve and the Peripheral Zone. It is very important for conservation since it is species-rich and contains many poorly known, rare and endemic plant species. It is also important for timber production and non-timber forest products (NTFPs).
- **Swamp Forest**: This forest type occurs on sandy soils with ground water at or near to the surface. Canopy height is 25-30m. Species diversity is poor. Herbs and shrubs are very sparse. Species characteristic of this vegetation type include *Crateranthus talbotti, Mitragyna stipulosa, Protomegabaria stapfiana, Diospyros* preussi, Spondianthus preussi, Symphonia globulifera, Amanoa strobilacea, Raphia sp., Liparis sp., Affrofittonia silvestris and Renealmia spp.

4.1.3.3. Flora (Botanical studies)

118 species belonging to 45 families were recorded during the survey in and around the project areas (see Table 1 and appendix 1 in the Flora Report in the Annexes). The checklist of plant species in the

project area based on the APG III system of classification (APG 2009) is presented in appendix 2 in the Flora Report in the Annexes. Eight of these species were on the IUCN red list with 06 being classified as vulnerable [VU], 01 endangered [EN] and 01 as near threatened [NT] (see appendix 2 in the Flora Report in the Annexes). These are all abundant in the lowland rain forest region of Cameroon, hence the impact will be minor. None was also listed on either appendix II of the International Trade in Endangered Species (CITES) list or the list of protected species under the Cameroon wildlife law (Article 2 of the Order of 14 August 1998).

4.1.3.4. Fauna (Zoological studies)

Large Mammals: The Korup National Park and its Support Zone where Mundemba is included contains a similar range of endangered species including drill *Mandrillus leucophaeus*, red colobus *Piliocolobus preussi*, chimpanzee *Pan troglodytes,* water chevrotain *Hyemoschus aquaticus*, elephant *Loxodonta africana* and buffalo *Syncerus caffer*. However hunting pressure is much higher in the Support Zone compared to Korup National Park and the surrounding Forest Reserves. It is likely that certain species such as leopard, golden cat, yellow-backed duiker and giant pangolin are locally extinct within the Support Zone, whilst others such as red colobus, drill and chimpanzee remain vulnerable to extinction (Usongo, 1995; Infield, 1988; Waltert, 2000; Steiner, 2001). The Rumpi Hills are known to be an important area for diversity and endemism including fish (Schliewen, 1996), butterflies (Larsen, 1997), birds (Usongo, 1995) herpetofauna (Lawson, 1992) and plants (Thomas, 1995).

KNP contains one quarter of all Africa's primate species and represents a particularly important site for primate conservation. It also includes species of a much more restricted distribution including a number of endemic species such as the Giant Otter Shrew *Potamogale velox*, Calabar Angwantibo *Arctocebus calabarensis* etc. Fishermen on the southern Munaya River have reported the presence of the hippopotamus *Hippopotamus amphibius* and claim that Manatee *Trichechus senegalensis* may be found in the deep stretches of the Akwen gorge a little north of the Park boundary (Reid, 1989).

Avifauna: In ornithological terms KNP is reputedly the most diverse lowland site in Africa (Rodewald et al, 1994) with a total of 410 bird species recorded so far in 53 families. Particularly diverse groups are: Flycatchers (Muscicapidae), Old World Warblers (Sylviidae), bulbuls (Pycnotidae), sunbirds (Nectariniidae), and weavers (Ploceidae). According to ICBP/IUCN four species found in the area are considered to be 'rare' including the Green-breasted Bush-Shrike *Malaconotus gladiator*, the Whitethroated Mountain-Babbler *Lioptilis gilberti*, the Red-headed Rockfowl *Picathartes oreas*, and the

Yellowfooted Honeyguide *Melignomon eisentrauti*, four are listed as 'near-threatened' and a minimum of 40 are considered as 'threatened' . The African Grey Parrot *Psittacus erithacus* is heavily hunted for the export trade.

Herpetofauna: Amphibians and reptiles of Korup have been partially surveyed by Sanderson (1936), Perret (1966), Amiet (1978) and Stucki-Stirn (1979). More recent studies by Lawson (1992, 1993) indicate that Korup has the highest herpetofaunal diversity known for a single locality in tropical Africa, comparable to that of the most diverse neotropical sites. Korup contains 82 reptiles and 92 amphibians, a number of them endemic to the area. They include 3 Caecilian species (limbless worm-like Amphibians), 89 species of Frogs and Toads (among them 8 species are not described), 2 tortoises, 2 aquatic turtles, 15 lizards, 5 chameleons, 3 crocodiles and 55 snakes. Amphibians listed as endangered or vulnerable include *Bufo superciliaris* and *Nectophryne afra*. The Nile Crocodile *Crocodylus niloticus* was formerly common in the rivers, creeks and estuaries between Ekondo Titi and Ndian but has become much rarer in recent years due to human predation. The Pygmy African Crocodile, *Osteolaemus tetraspis*, is still fairly common in the region but is also heavily hunted. Likewise two species of Forest Tortoise, *Kinixys erosa* and *K. homeana* are heavily exploited and their status is of particular concern. Adults and tadpoles of the Frogs *Conraua robusta* and *Trichobatrachus robustus* are considered to be a local delicacy, women and children sometimes travel extensive distances in remote areas to harvest them.

Fishes: Peculiar to this zone are colonies of sting-rays, typically marine snappers *Lutjanus spp*. and a jack *Trachynotus goreensis*, all living over 300kms from the sea. About 130 different kinds of fish species are known within Korup region.

Rivers draining the Korup region are not uniform in their taxonomic composition and diversity of fishes. Three distinct zones can be distinguished (Reid, 1989):

- The **Akpa-Yafe** and **Upper Ndian** of southern Korup, only moderately diverse in terms of the range of taxonomic groups present and rather impoverished in terms of numbers of fish species. The zone does not contain any Nilo-Sudanian species and is assumed to have lost much of their original Lower Guinean fish fauna due to a prehistoric catastrophe.
- The **Lower Ndian** of southern Korup differs from both other zones in the predominance of marine fish like the Barracuda Sphyraena spp. and Groupers Serranus spp. The high taxonomic diversity of this zone is noteworthy.
- The **Upper Cross** (including Munaya or Bake River) has by far the greatest overall diversity including a number of endemic species. In addition to characteristic Lower Guinean species, the

zone contains, remarkably, a substantial Nilo-Sudanian component of which the Nile Perch *Lates niloticus* is a typical representative. Peculiar to this zone are colonies of Sting-rays, typically Marine snappers *Lutjanus sp*.

Butterflies: The Korup region is considered to be the most species-rich site for butterflies in Africa (Larsen, 1997). Although only 480 have been recorded to date, it has been estimated that Korup contains at least 950 species, equivalent to more than a quarter of the total number of known afro-tropical species. Many species are effectively endemic to the area between River Cross and River Sanaga including two very rare species, *Euriphene schultzei* and *Thermoniphans bibundana.*

Pictures Plate 5: Poster of IUCN and Ministry of Forestry and Wildlife (MINFOF) Cameroon highly protected fauna species at Kurop National Park office Mundemba, Ndian

4.1.3.5. Biodiversity

The Rumpi Hills are known to be an important area for diversity and endemism including fish (Schliewen, 1996), butterflies (Larsen, 1997), birds (Usongo, 1995) herpetofauna (Lawson, 1992) and plants (Thomas, 1995). KNP contains one quarter of all Africa's primate species and represents a particularly important site for primate conservation. KNP is reputedly the most diverse lowland site in Africa (Rodewald et al, 1994)in terms of birds with a total of 410 bird species recorded so far in 53 families. Korup contains 82 reptiles and 92 amphibians, a number of them endemic to the area. They include 3 Caecilian species (limbless worm-like Amphibians), 89 species of Frogs and Toads (among

them 8 species are not described), 2 tortoises, 2 aquatic turtles, 15 lizards, 5 chameleons, 3 crocodiles and 55 snakes About 130 different kinds of fish species are known within Korup region. It has been estimated that Korup contains at least 950 species of butterflies equivalent to more than a quarter of the total number of known afro-tropical species Some major zones of ecological interest in the project area; Takamanda-More and the Bayang Mbo-Bakossi Gorrilla sanctuaries, the Korup-Ndongere and Mount Cameroon, the Rio del Rey Ramsar Site.
(www.ramsar.org/wn/w.n.cameroon_bird_census.htm,www.ramsar.org/wn/wn.cmeroon_coast_survey.pdf,www.ramsar.org/.../ramsar...cameroonnewsite/.../ramsar/1-26-45-437%5E24629_4000_0__-).

Within the vicinity of the project area are the following associated protected areas; Korup National Park KNP (Ndian Division), Banyang-Mbo Wildlife Sanctuary (Kupe-Manengouba Division), Nta Ali FR and Ejagham FR (Manyu Division) and Rumpi Hills FR (Ndian and Kupe-Manengouba Divisions).

Several community forests have been identified but yet to be formally approved. Of all of these protected areas listed, only KNP and Banyang-Mbo Wildlife Sanctuary have approved management plans with some conservation and enforcement activities.

4.2. Site description for Nguti project area

4.2.1. Location

Nguti is situated in Meme Division, South West region of Cameroon. Its geographical coordinates are 5° 18' 0" North, 9° 26' 0" East. The major access road from Kumba to Mamfe passes through the municipality of Nguti.

4.2.2. Physical environment

4.2.2.1. Climatology and Rainfall

Climate and, winds rainfall: The climate in the Nguti area is influence generally by the presence of the massif Mountains of Cameroon, and specifically by Mt Kupe (Nambu, 2001).The climate is dominated by two prevailing wind systems. These are the Atlantic moist monsoons, which are southwesterly, and the continental, dry northeasterly trade winds (Gartlan, 1985). The climate is hot and humid with two unequal seasons: the wet and dry seasons (Nchanji and Plumptre per.com.). The wet season runs from

mid-March to the end of October (Lawson, 2000; Bechem and Nchangi, 2001). Annual rainfall in Nguti area ranges from 3497 mm to 4739 mm with a mean of 4082 ± 486.6 mm (Nambu, 2001). 10 years data collected from 1993-2002 shows that the heaviest rainfall occurs between Mat and October (Nchanji per. Com) October is the wettest season and has a mean rainfall of 611.6 ± 486.6 mm (Nambu, 2001).

Temperature: The mean annual minimum and maximum temperatures recorded from the Nguti area are 23.7 º C and 30 .2 º C (Nambu, 2001).

4.2.2.2. Air quality

Transportation by land, and air through this area is very limited coupled with the presence of a few agro industries implies, the air quality is expected to be good. Measurement of ambient concentrations of various emissions was not the subject of the assignment in question.

4.2.2.3. Climate change

This area appears likely to be prone to climate change effects given that forest (secondary forest) in the project area has been repeatedly logged. Recent findings by the Cameroon ministry of forestry and wildlife confirmed that forest in the project area has gradually been transformed from primary to secondary. However, there is no information on the effects of climate change on the rivers in the area and potential floods. A majority of the households rely on fuel wood as the main source of energy source for cooking.

4.2.2.4. Noise level

The noise level is limited to the natural one (fauna in the area) and very seldom, the passage of a motorcycle and timber trucks. Therefore the noise level is quite low.

4.2.2.5. Geology, Soils – quality and erosion

Geology: The central and northern regions of the sanctuary are uplifted basalt with some exposed granite outcrops (Powell *et al* 1994). The eastern sections consist of basalt larva flow that originated in the interior of the Rumpi Hills and Mt. Manengouba respectively (Powell *et al* 2002). Lava flow, which

originated in the kwendi Hills, are also present between Manyemen and Baro (Land Resources Development Center, 1987) Most of the rest of the Support Zone, including Ejagham Forest Reserve and the Nkwende Hills are geologically similar to Korup National Park (Powell *et al* 1994).

Soils: No pedological surveys have been conducted in the Nguti area including the Mbayang Mbo forest (Powell *et al* 2002). Sedimentary soils cover the coastal plain about (6,000 ha) in the southern regions of Korup National park (MPRD 1989). The soils are derived from Cretaceous sandstone and tend to be sandy, acidic, and low in nutrients and without structure (MPRD 1989).

4.2.2.6. Hydrology, hydrography (Surface water) and water quality

Hydrography: Rich hydrological networks (lots of little and temporary streams.The hydrographic net of the forest area is composed of the Bake River and its affluents. Bake river originates from Nkwende Hills and flows in a southerly direction to the south of Osirayib village (Powell, 1997). Downstream, Bakebe River joins Bake river near Ayong village, and Bake river continues flowing in a north-westerly direction. Three upper tributaries of the Cross River also drain the BMWS; the Mbu or Mbe, the Mfi-Mie and Bashuwe (Powell, 1997). All of these rivers originate from the Bakossi Mountians and the south of the sanctuary (Powell, 1997) and then empty to the Manyu River. In the Southern part of the forest, there are small water bodies, rocky waterfalls and escarpment all draining into larger water bodies that vary in size with the seasons (Nambu, 2001).Water is used for fishing, washing; cooking. Little or no information exist on water quality parameters.

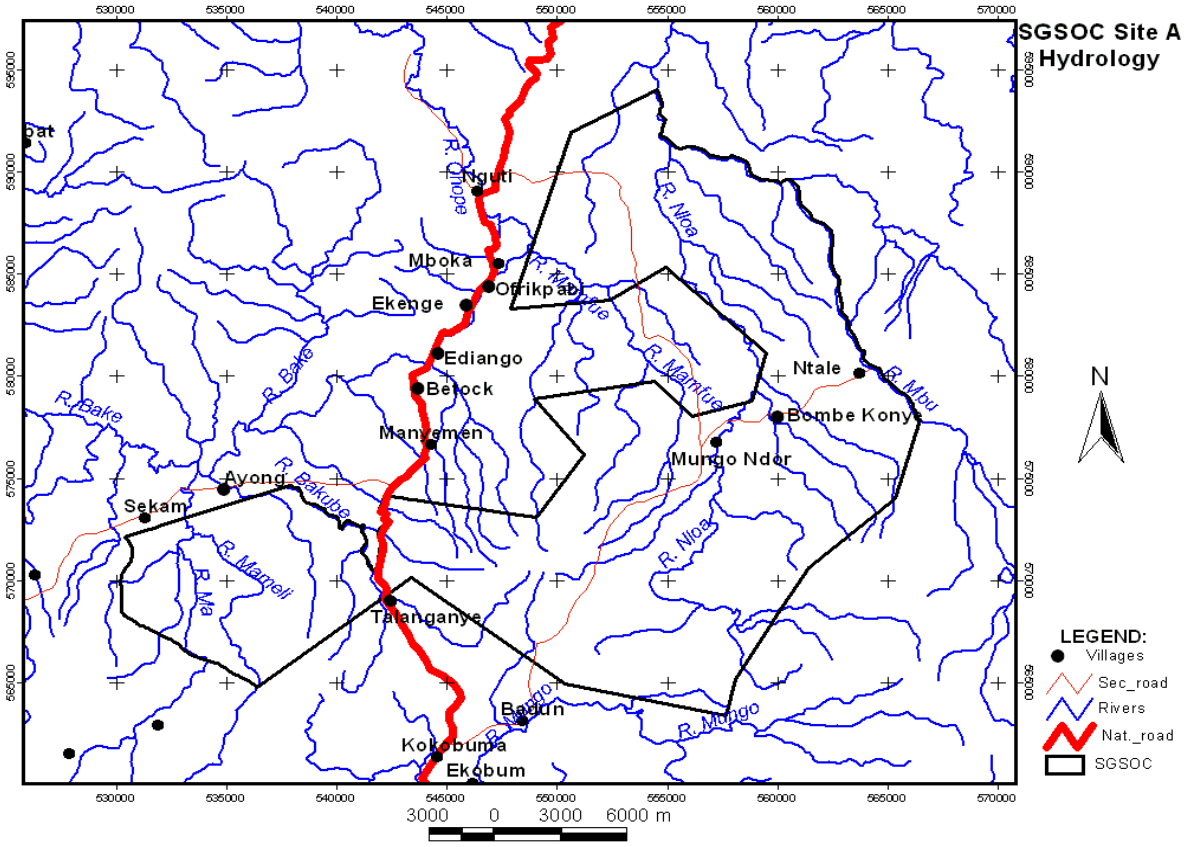


Figure 12: Hydrology map of the SGSOC Project site – Block A: Nguti

4.2.2.7. Groundwater

Very little or no information exist on the size, depth, quality and use of ground water.

4.2.2.8. Land use and landscape (geomorphology and topography)

The topography of the Nguti area is in its whole extension made of flat to undulating terrain. Altitudes within the Banyang-Mbo Wildlife Life Sanctuary (BMWS) vary from 120 to 1760 asl (Nambu, 2001; Lincoln et al 2002). The southern part represents a small northern extension of the Bakossi hills and rises to over 1700 m (Lincoln et al 2002). The highest point is an un-named peak in the extreme south east, which rises to 1751 m (Powell, 1997).

Land use:

Hunting: through the use of fire arms and traps (of various types) is a tradition and general practiced by the men. Common species hunted include duikers and deers (*Cephalophus spp),*porcupines (*Atherurus spp*) and Pangolins *(Phataginus spp*).

Fishing: mainly for subsistence is practiced by the males in all villages using nets mostly in the main rivers and big streams, particularly in Bake river (Nguti Council Forest 2007).The harvesting and sale of **Non Timber Forest Products (NTFPs)** from the wild is also a common occupation of the inhabitants. NTFPs commonly harvested for sale include bush mango (*Irvingia spp*), eru (*Gnetum spp*), njangsang (*Ricinodendron heudelottii*) and Ngabe oil (*Baillonella toxisperma*) (Nguti Council Forest (2007).

Farming: Shifting cultivation forms the basis of the farming system in the Mundemba area. Both food crops (cassava, plantains, bananas, cocoyams) and cash crops (cocoa, coffee, and oil palm) are produced.

4.2.2.9. Seismicity

The eastern sections consist of basalt larva flow that originated in the interior of the Rumpi Hills and Mt Manengouba respectively (Powell *et al* 2002). Lava flow, which originated in the Nkwendi Hills. The area does not represent any serious risk due to seismic activity.

4.2.3. Natural environment

4.2.3.1. Natural milieu (zones of ecological interest)

Takamanda-More and the Bayang Mbo-Bakossi Gorrilla sanctuaries.

4.2.3.2. Natural Habitat

Vegetation: The forest in the Nguti area is part of the Atlantic Biafran Forest as described by (Letouzey, R. 1985) and as such moist lowland evergreen forest, rich in Cesalpinaceae. It is typically a tropical lowland rainforest. Lejoly (1996) proposes to nominate the zone “atlantic lower-Guinean domain” to stress the influence of the Atlantic Ocean. Small swampy areas can be found on the banks of the river Bake Frequently occurring species in the forest include; Azobe *(Lophira alata*), Ekop Naga (Brachystegia spp.), Tali (*Erythrophleum ivorensis)*, Okan (*Cyclodiscus gabonensis*),Framire (*Terminalia ivorensis*), Dabema (*Pipadeniastrum africanum*). Other occurring species are Bilinga (*Nauclea*

diderrichii), Ilomba (*Pycnanthus angolensis*), Niove (*Staudtia stipitata*), Padouk (*Pterocarpus soyauxii*), Moabi (*Baillonella toxisperma*),Movingui (*Distemonanthus benthamianus*), Doussie (*Afzelia ssp*), Aiele (*Canarium schweinfurthii*) (Lejoly 1996).

4.2.3.3. Flora (Botanical studies) (see Flora study for details)

118 species belonging to 45 families were recorded during the survey in and around the project areas (see Table 1 and appendix 1 in the Flora Report in the Annexes). The checklist of plant species in the project area based on the APG III system of classification (APG 2009) is presented in appendix 2 in the Flora Report in the Annexes. Eight of these species were on the IUCN red list with 06 being classified as vulnerable [VU], 01 endangered [EN] and 01 as near threatened [NT] (see appendix 2 in the Flora Report in the Annexes). These are all abundant in the lowland rain forest region of Cameroon, hence the impact will be minor. None was also listed on either appendix II of the International Trade in Endangered Species (CITES) list or the list of protected species under the Cameroon wildlife law (Article 2 of the Order of 14 August 1998).

4.2.3.4. Fauna (Zoological studies)

Fauna: The fauna in the Nguti area is mostly recorded from the Banyang Mbo Wildlife Sanctuary. The sanctuary was created for the protection of certain mammal species like the drill *Mandrillus leucophaeus*, elephant *Loxodonta Africana*, buffalo *Syncerus caffer* and crocodiles (BirdLife International 2009). The wildlife santuary is under pressure from logging, hunting and agricultural encroachment. The populations of some large mammal species have been seriously affected by unsustainable hunting .Common species hunted include duikers and deers (*Cephalophus spp),*porcupines (*Atherurus spp*) and Pangolins *(Phataginus spp*).

Avifauna: The avifauna in the Nguti area including the Mbanyang Mbo Sanctuary includes 322 recorded species. *Telophorus kupeensis*, was recently found to occur, along with many species of the Guinea-Congo Forests biome. One species of the Sudan-Guinea Savanna biome (A04) also was also found in this area (BirdLife International 2009).

4.2.3.5. Biodiversity Hot Spot

The Bayang Mbo Wildlife Sanctuary:

Bayang Mbo Wildlife Sanctuary lies between the towns of Nguti and Bangem, to the east of the Nguti-Mamfe road. It also shares a common boundary with SGSOC project site in the Nguti region. Situated between Korup National Park to the west and Santchou to the east, Bayang Mbo falls naturally into two sections, a northern block of about 34,000 ha, lying between 200 m and 500 m, where the terrain is generally flat, and a mountainous southern part (which represents a small northern extension of the Bakossi mountains), where the land rises to over 1,700 m. The vegetation in the northern block is coastal evergreen rainforest while, in the south, it is a mix of mid-altitude and montane forest. The two sectors are separated by a transition zone of inselbergs supporting low-canopy forest. There extensive patches of secondary forest where logging has occurred. Average annual rainfall is mm (BirdLife International 2009).

Bayang Mbo Wildlife Sanctuary was gazetted in 1996 when the pre-existing Bayang Mbo Forest Reserve was extended to include the mountains. The sanctuary was created for the protection of certain mammal species and crocodiles. It is under pressure from logging, hunting and encroachment—there are a number of villages within the sanctuary boundaries (indeed, this is by law). The populations of some large mammal species have been seriously affected by the community-based conservation project is working in the region (BirdLife International 2009).

The state of the roads in the rainy season

Picture 6: The state of the roads during the rainy season

4.3. The project area

"SGSOC permanent palm oil plantation 38,000-ha concession at Mundemba and 40,000-ha concession at Nguti," is the main terrestrial impact site required for the palm nurseries and plantations. Surveys were conducted in the two blocks to also provide a basic understanding of the magnitude and type of biodiversity impacts to be expected during clearing and planting phases.Two protected areas exist in the vicinity of the concession, Korup National Park (category II) and Bayang Mbo Wildlife Sanctuary (Category VI), listed by the World Database on Protected Areas (WDPA 2006 version see figure 8). (See annex 2 for definitions of the IUCN Protected Area Management Categories). The concession areas do not overlap with any of the protected areas in conformity with IFC PS1 guidelines. A 3 km buffer zone will be demarcated to avoid any potential secondary and cumulative impacts.

The Korup Project area is composed of:

- KORUP National Park (1256 km²),
- Support Zone includes a peripheral zone (3820 km²),
- Three Forest reserves are situated in the support zone: Ejagham (783 km²), Nta-Ali (313 km²), Rumpi Hills (438 km²),
- human population of about 50 000 people lives in 187 villages, 5 of them in the park and 27 very close to the park (3km zone) (Korup National Park Management Plan 2008-2012).

The Oil palm nursery at Talangaye,Ngutti

Picture 7: SGSOC Nursery in Talangaye, Nguti

4.4. Socio – Economic Environment of the Project area

A socio-economic and needs assessment study was conducted in the project area during the month of December 2010 and January 2011.

The specific objectives of the socio-economic and needs assessment study were to enable a sound understanding of the potential impact of the project in question and other project components on the socio-economy and ecology of the concerned communities or villages, and also to assess current and potential needs of the impacted communities and households so as to better understand the strategies of addressing them as the project is gradually being implemented.

The study area included 36 villages in the Nguti, Mundemba and Toko Sub-divisions, however, only 32 were assessed due to the non-existence of 4. The main findings were gotten through quantitative and qualitative data and participatory maps.

Discussions of findings are centered on:

- Major production systems,
- Nature of the biotic communities,
- Household composition,
- Household access to resources,
- Household production systems,
- Farm economy and division of labor and land,
- Tenure and land use,
- Household expenditure,
- Potential conflicting issues,
- Summary of priority needs per village,
- Environmental and socio-economic impacts and mitigation measures.

Please see detailed Socio-Economic and Needs Assessment Report in Annexes.

Table 5: Households and Population Distribution of the Study Area

Division	Sub division	Village name	No of household	Pop size 0f villages	Native pop	Migrant pop
KUPE M.	**Nguti**	Talangaye	**54**	**600**	**555**	**45**
		Sikam	**18**	**70**	**25**	**35**
		Osirayib	**15**	**65**	**59**	**6**
		Ofrikpabi	**15**	**150**	**149**	**1**
		Ntale	**Did not participate**			
		Nguti	**Did not participate**			
		New konye	**23**	**150**	**144**	**6**
		Mungo ndor	**Did not participate**			
		Mboka	**Did not participate**			
		Manyemen	**500**	**6000**	**-**	**-**
		Ekita	**25**	**300**	**280**	**20**
		Ekenge	**30**	**500**	**495**	**5**
		Ediengo	**23**	**123**	**118**	**5**
		Ebanga	**Partial survey**			
		Bombe konye	**Did not participate**			
		Betock	**50**	**500**	**435**	**15**
		Baro	**65**	**450**	**435**	**15**
		Badum	**100**	**400**	**350**	**50**
		Babensi 11	**32**	**600**	**570**	**30**
		Babensi 1	**50**	**750**	**720**	**30**
		Ayong	**80**	**650**	**97**	**553**
NDIAN	**TOKO**	Babiabanga Batanga	**15**	**110**	**96**	**14**
		Banyo Batanga	**12**	**141**	**13**	**8**
		Bareka Batanga	**20**	**560**	**558**	**2**
		Dipundu Batanga	**Ghost Village**	**/**	**/**	**/**
		Ikoli Batanga	**Ghost Village**	**/**	**/**	**/**
		Ikoli 2 Batanga	**Ghost Village**	**/**	**/**	**/**
		Loe Batanga	**Ghost Village**			
		Mayenke Batanga	**2**	**2**	**2**	**0**
		Lipenja 1	**60**	**801**	**793**	**8**
		Lobe Batanga	**4**	**11**	**11**	**0**
		Manya Batanga	**4**	**20**	**12**	**8**
		Tombe Batanga	**9**	**92**	**61**	**31**
NDIAN	**MUNDEMBA**	Kuma batanga	**05**	**37**	**37**	**0**
		Esoki Bima	**35**	**140**	**137**	**3**
		Lipenja 2	**Not part of survey**			
		Masaka Bima	**9**	**165**	**163**	**2**
		Meta Ngolo	**8**	**33**	**33**	**0**
		Mokanga Bima	**24**	**370**	**370**	**0**
		Ndiba	**12**	**110**	**110**	**0**
		Fabe	**36**	**200**	**200**	**-**
		Meagwe	**100**	**500**	**499**	**1**

(Source: H & B Consulting Field Survey 2010)

5. IDENTIFICATION AND DESCRIPTION OF POSSIBLE ENVIRONMENTAL IMPACTS RESULTING FROM THE PROJECT (PLANTATION and the PALM OIL MILL)

5.1. Introduction

This chapter discusses the environmental and social impacts, positive and negative, that may result from the proposed development Project. Potential negative impacts are identified and described.

An impact is any change to a resource or receptor brought about by the presence of a Project component or by the execution of a Project related activity.

Potential impacts on environmental and social resources arising from the proposed development include direct and indirect (both permanent and temporary) impacts within the development area and its surroundings. There is also potential for some of these impacts to be cumulative.

5.2. Methodology

The methodology used to conduct the Environmental and Social Impact Assessment is described in Chapter 1 of this Report.

The terms of reference for the Environmental and Social Impact Assessment, which were determined during the scoping study, established the environmental impacts considered to be potentially significant and therefore requiring detailed assessment. Some specific field surveys, such as the wildlife/fauna - flora surveys and the socio economic study, have been done.

5.3. Positive Impacts of the Project

A number of positive benefits are predicted to be associated with the Project. The first main benefit is that Cameroon will be able to satisfy its demand in Crude Palm Oil. According to the Post (online newspaper), *"the Association of Palm Oil Refineries of Cameroon has registered a deficit of 100,000 tons of palm oil this year. The Secretary General of the association, Jacques Kemleu Tchabgou, said production from agro-industries like SOCAPALM, SAFACAM, PAMOL and CDC stand at 145,000 tons for the total transformation needs of about 280,000 tons."*

Another benefit of this project will be the improvement of the socioeconomy as it will create permanent jobs to the local population. It is expected that up to 9,000 direct jobs will have been created upon completion of the Project. These will include labor, engineers, clerical workers, drivers, supervisors, maintenance workers, security guards, senior management staff, and other permanent positions.

Other benefits of this project include, but are not limited to:

- rural development;
- training for employees and out growers;
- education programs;
- housing;
- access to electricity and clean water;
- healthcare;
- commercial opportunities for small-and-medium sized enterprises (SMEs);
- tax revenue for the Government; and,
- scholarships for local universities.

SG Sustainable Oil Cameroon (SGSOC) is committed to developing and maintaining sustainable oil palm projects which will have wide reaching benefits for many aspects of the Cameroon economy and the local communities.

5.4. Potential negative Impacts of the Project

5.4.1. Environmental and Social Impacts of the Project: The Nursery Establishment

The nursery site has been prepared with labor for underbrushing, cutting of very large trees with chainsaws, and mechanical preparation of site with bulldozers. After tree and shrub removals, the dozer stocked pile top soil for bag-filling. Afterwards, the grader leveled the site and removed trees were placed in the windrows with no burning.

Normally there is a single stage nursery process, but conditions may impose a second stage. During the second stage, polybags measuring 10cmx20cm are manually filled with top soil and placed in lines. The germinated seeds are planted into the bags (one per bag) and kept in these bags for 3-4 months after which they are removed and transplanted into larger bags 40cmx45cmx150 microns. The seedlings

remain in the large bags for 8-14 months before they are field planted. Once ready for transferring or field planting, the polybag is torn to release and permanently plant the seedling.

During the dry season, if it does not rain, watering will be done every other day. Water will be pumped from a stream into a tank that is tractor driven or fixed and plants are watered when necessary using a water hose. In addition, fertilizers mainly N, P, K, and Mg are used, but doses depend on the health of the plants. Fungicide/nematicide may also be used to control blast disease and herbicides will be used sparingly.

Agrinexus Implementation Plan gives us the nurseries planting schedule, see below:

Year 2010 – Nursery Block A No. 1 (NA1):

15ha for the first Nursery will be established at Block A for Phase 1 for 1,000ha field planting

Year 2011 – Nursery Block A No. 1 (NA1):

The initial 15ha Nursery will be expanded to 60ha to supply seedlings for Phase 2 for 4,000ha of field planting for both Blocks A and B

Year 2012 – Nursery Block A No. 1 (NA1):

The 60ha Nursery at Block A will then be expanded to 75ha to supply seedlings for Phase 3 for 5,000 ha of field planting for both Blocks A and B

Year 2013 – Nursery Block A No. 1 (NA1):

– Nursery Block B No. 1 (NB1):

The 75ha Nursery at Block A will be used to supply seedlings for Phase 4 in Block A and a new 75ha Nursery will be established at Block B to supply seedlings for Phase 4 in Block B.

Year 2014 – Nursery Block A No. 1 (NA1):

– Nursery Block B No. 1 (NB1):

The 75ha Nursery at Block A will then be expanded to 115ha for field planting for its Phase 5 (7500ha in Block A), and the 75ha Nursery in Block B will supply seedlings for its own field planting for Phase 5 (5000ha in Block B)

Year 2015, 2016, 2017 – Nursery Block A No. 1 (NA1):

– Nursery Block B No. 1 (NB1):

The Nurseries in Blocks A and Block B will supply seedlings for its own field planting for Phases 6, Phase 7 and Phase 8 respectively.

There is a scheduled ordering program of the seeds from IRAD La Dibamba; see below:

Table 6: Planting Material Requirement and Delivery Schedule for Blocks A & B

Year	Planting Hecterage (Ha)	Nursery Size	Germinated Seeds Requirement @ 180/ha	Germinated Seeds Delivery Schedule	Remarks
2010 (Phase 1)	1,000	15 ha	180,000	Aug 180,000	All seeds to be checked and verified by SGSOC experts prior to delivery
2011 (Phase 2)	4,000	60 ha	720,000	Apr 240,000 May 240,000 Jun 240,000	All seeds to be checked and verified by SGSOC experts prior to delivery
2012 (Phase 3)	5,000	75 ha	900,000	Apr 300,000 May 300,000 Jun 300,000	All seeds to be checked and verified by SGSOC experts prior to delivery
2013 (Phase 4)	10,000	150 ha	1,800,000	Apr 450,000 May 450,000 Jun 450,000 Jul 450,000	All seeds to be checked and verified by SGSOC experts prior to delivery
2014 (Phase 5)	12,500	190 ha	2,250,000	Apr 562,500 May 562,500 Jun 562,500 Jul 562,500	All seeds to be checked and verified by SGSOC experts prior to delivery
2015 (Phase 6)	12,500	190 ha	2,250,000	Apr 562,500 May 562,500 Jun 562,500 Jul 562,500	All seeds to be checked and verified by SGSOC experts prior to delivery
2016 (Phase 7)	12,500	190 ha	2,250,000	Apr 562,500 May 562,500 Jun 562,500 Jul 562,500	All seeds to be checked and verified by SGSOC experts prior to delivery
2017 (Phase 8)	12,500	190 ha	2,250,000	Apr 562,500 May 562,500 Jun 562,500 Jul 562,500	All seeds to be checked and verified by SGSOC experts prior to delivery
Total	70,000		12,600,000	-	-

(Source: Agrinexus Implementation Plan for SGSOC)

5.4.1.1. Description of the different stages in developing a nursery

A typical palm oil plantation development involves several stages. In this study, we will only discuss the 15 hectares nursery that will be established in Talangaye. During this stage the seedlings will be prepared for field planting.

The Nursery and related infrastructure establishment has several stages:

Creation of access roads to the actual nursery site

For the Nguti site, the access road is available from Douala to Nguti (Douala to Kumba is tarred, Kumba to Nguti is mostly a dirt road with some tarred areas.)

A site chosen for the nursery is in the village of Talangaye which is 30 minutes drive south of the city of Nguti. It is accessible by road and the site is 250 meters from the road.

Picture 8: The tarred road from the Talangaye Nursery site

Picture 9: Talangaye nursery site

Clearing of the sites

The site in Talangaye is secondary forest and will be cleared using both mechanical and manual methods.

Picture 10: Vegetation of the Talangaye nursery site

Removal and management of biomass after clearing

After clearing the site, the felled trees and underbushing are removed to clear the nursery area to naturally decompose and to be later used as compost.

Ordering the seed bags

The nursery in Talangaye will have two stages, that is, the seeds will be planted in the small polybags for 4 months and then transferred to the larger polybags for 8 months before being transferred into the field. This allows for a smaller site during the 1st four months.

Picture 11: Small polybags filled with topsoil – Talangaye Nursery site

The polybags have been procured from a local producer in Douala: NDS PLASTICS SARL. The plastic used by this company to produce those bags are made of polyethylene (PET).

Bagging of the site's top soil

The top soil from the cleared area will be used to fill the polybags where the seeds will be planted.

Creating walkways within the nursery

Foot paths will be established enabling the workers to freely move tools and other required equipment throughout the nursery.

Irrigation

If required, irrigation will be mechanically pumped from a nearby river. The pump will be either floating or fixed in placed next to the river. It is envisaged that there will be very little need of water from the river because the site is located in a heavily rainy region.

Ordering the Planting Material

One hundred eighty thousand (180.000) seeds have been ordered for the nursery from IRAD (Institute of Agricultural Research for Development) La Dibamba, Douala.

Planting inside the polybags

The seeds will be planted manually in polybags filled with top soil from the site.

Fertilizers and agro-chemicals application

The seedlings will be maintained by the application of different fertilizers and agro-chemicals including:

- Herbicides
- Nematicide and Insecticide combined 5 grams/plant/month for 03 months in a year.
- Fertilizers N/P/K/Mg

Pre-Nursery

Weeks after planting in polybag	Type of Fertiliser	Application - Dissolve 7 gms of fertiliser in 4.5 litres of water and foliar sprayed on every 100 seedlings
1 – 4	No fertiliser	
5	NPKMg yellow (15 : 15 : 6 : 4)	
6	NPKMg yellow (15 : 15 : 6 : 4)	
7	NPKMg yellow (15 : 15 : 6 : 4)	
8	NPKMg yellow (15 : 15 : 6 : 4)	

(Source: plantation assessment audit on 3715 ha in the Volta region, Republic of Ghana For SG Sustainable Oils Ghana ltd)

Main Nursery

MONTHS AFTER PLANTING	FERTILISER & RATE (g/seedling)	
	NPKMg Yellow (15 : 15 : 6 : 4)	NPKMgBlue (12 : 12 : 17 : 2+TE)
0	-	-
1	7	-
2	14	-
3	14	-
4	14	-
5	14	-
6	-	21
7	-	21
8	-	21
9	-	21
TOTAL	**63**	**84**

(Source: plantation assessment audit on 3715 ha in the Volta region, Republic of Ghana For SG Sustainable Oils Ghana ltd)

For weed control (Source: Agrinexus):

Pre Nursery

- Before arranging the polybags, area should be clean of weeds
- Any regeneration of weeds in the paths and polybags to be hand-weeded
- No spraying of chemicals to be done

Main Nursery

- Weeds inside the polybags to be manually removed
- To avoid use of hormonal herbicides e.g. 2,4-D amine, triclopyr, etc
- To avoid spray drift by using a spray shield (cone)
- For general weed control, to spray Glufosinate-Ammonium at 3.3 liters per hectare or 132 ml per 18 liters of water
- Chemical requirements:
    - Based on 135 ha Nursery (largest nursery area during project life cycle)
      = 3.3 liters x 135 ha x 3 rounds p/year
      = 1,337 liters of Glufosinate-Ammonium p/year

Base camp construction

For the management of the nursery, it is estimated that the site will employed the following:

- 02 supervisors
- 02 overseers
- 02 head men
- 20 nursery workers

Houses for the workers and a storage facility will be constructed with non permanent material.

Water and electricity for the camp

Water

Water supply for the nursery and domestic use will be pumped from Bakube River**.**

Electricity

Generators will be purchased and installed for:

- the water pump,
- nursery, and
- domestic use.

5.4.1.2. Environmental Impacts of the Nursery Establishment

Loss of habitats of diverse species of flora and fauna – Ecological Impacts

The nursery site is not sensitive since the site does not shelter any IUCN endangered species and the areas to be cleared is minimal (15 hectares).

Since the areas are secondary forests and they have already been heavily exploited, the clearing will not result in destroying any flora species included in the IUCN Red Book.

Soil erosion – resulting from the clearing of the area and water runs

The removal of the protective vegetation cover and disturbance of soil surface will bring soil erosion with the rainfalls.

Air pollution – open burning of the biomass

Site clearing will generate biomass which is traditionally burned causing air pollution.

Water pollution – use of agro-chemicals and sewage generated from workers

Water pollution can occurred due to the use of agro-chemicals such as fertilizers and pest control substances.

The fertilizers are composed of:

- Nitrogen (N),
- Potassium (K),
- Phosphorus (P) and
- Magnesium (Mg).

The fertilizers will find their way into the natural water sources. Nitrate compounds will promote the growth of aquatic flora in the rivers and streams. Phosphate has the same effects, causing growth of algae.

Use of pest control substances is very minimal (see above).

Improper treatment of sewage from the workers will result in elevated chemical oxygen demand (COD), biochemical oxygen demand (BOD), and microbiological contents in the water around the nursery area.

Pest infestation – presence of the biomass in stage of degradation

Presence of a large quantity of biomass will provide shelter for certain pests such as rodents. Pest infestation could also occur during the nursery development.

Traffic

Traffic due to the nursery activities will result in dust and noise pollution.

Hazardous substances

The nursery will use fuel and lubricants for the generators. The use of hazardous materials such as hydrocarbons substances and agro-chemicals can bring potential pollution to the environment (soil and water pollutions).

Analysis of Environmental Parameters

Some water, soil, and noise samples were taken to represent the initial state of the environment around the nursery site.

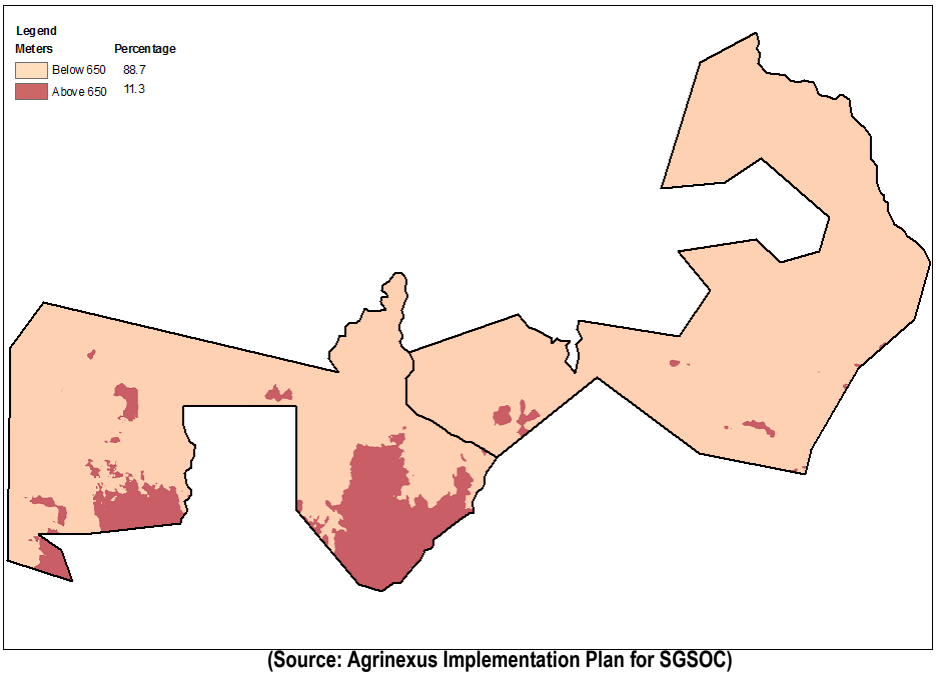
See the results of these analyses in **Annex I**.

5.4.2. Environmental and Social Impacts of the Project: The Plantation Development

The concession of SG Sustainable Oils Cameroon LTD is 80,506 hectares divided into two blocks:

- Block A (Nguti Subdivision) 42,486 ha
- Block B (Toko and Mundemba Subdivisions) 38,020 ha

Agrinexus in their Implementation Plan have taken an elevation of threshold of 650 meters and below for the planting program. The total area below 650 meters is about 88.7% of the concession, which is approximatively 70,000 ha to be cultivated with palm oil.



(Source: Agrinexus Implementation Plan for SGSOC)

Figure 13: Elevation with 650m threshold for both Blocks A and B using GIS

The Implementation Plan for the 70,000 ha will be executed in eight (08) phases over a period of eight (08) years; see below:

Table 7: Implementation Plan for Blocks A and B

PHASE	Year 1 (2011)	Year 2 (2012)	Year 3 (2013)	Year 4 (2014)	Year 5 (2015)	Year 6 (2016)	Year 7 (2017)	Year 8 (2018)	Total (Hectares)	
Planting Phases									Per Year	To-Date
1	1,000								1,000	1,000
2		4,000							4,000	5,000
3			5,000						5,000	10,000
4				10,000					10,000	20,000
5					12,500				12,500	32,500
6						12,500			12,500	45,000
7							12,500		12,500	57,500
8								12,500	12,500	70,000
TOTAL HECTARAGE TO BE DEVELOPED									70,000	70,000

(Source: Agrinexus Implementation Plan for SGSOC)

The first field planting of palms for 1,000 ha (i.e. seeds procured in Year 2010) will commence in May - July 2011 after 9-12 months in the nursery. These palms are expected to mature and start producing FFB 24 months later i.e. by the end of 2013.

The detailed planting phases and hectarage distribution between Blocks A and B is given below:

Table 8: Distribution of development program between Blocks A and B

Year	Planting Phases	Block A (ha) between 550 - 650 m	Block A (ha) Below 550 m	Total A (ha)	Block B (ha) between 550 - 650 m	Block B (ha) Below 550 m	Total B (ha)	Grand Total
2011	Phase 1		1,000	**1,000**				**1,000**
2012	Phase 2		1,500	**1,500**		2,500	**2,500**	**4,000**
2013	Phase 3		2,500	**2,500**		2,500	**2,500**	**5,000**
2014	Phase 4		5,000	**5,000**		5,000	**5,000**	**10,000**
2015	Phase 5		7,500	**7,500**		5,000	**5,000**	**12,500**
2016	Phase 6		7,500	**7,500**		5,000	**5,000**	**12,500**
2017	Phase 7		7,500	**7,500**	3,150	1,850	**5,000**	**12,500**
2018	Phase 8	900	6,600	**7,500**	5,000		**5,000**	**12,500**
Total		**900**	**39,100**	**40,000**	**8,150**	**21,850**	**30,000**	**70,000**

(Source: Agrinexus Implementation Plan for SGSOC)

We have to note that not all of the 70,000 ha will be used for oil palm plantation because space will be left out for:

- Villages,
- Villager's farmland,
- Buffer zones for the Korup National Park and the Bayang Mbo Wildlife Sanctuary,
- SGSOC Base Camps,
- SGSOC Office Buildings,
- SGSOC Palm Oil Mills,
- Etc….

5.4.2.1. Description of the different stages in developing a plantation

The development of an oil palm plantation has several phases after the nursery establishment:

Preparation of the site

The preparation of the site includes:

- Clearing of the site (earthworks, drainage, etc…) will be done by contract specialists
- Opening access road will be done by contract road engineers

  There will be a network of roads to transport FFB from plantations to the palm oil mill. Such roads are usually 3 meters wide for infield transportation and 5 meters for roads to the mill. Road surfaces are made with laterite, bridges/culverts with stones, cement, iron rods, concrete and sand. Roads are created with bulldozers, leveled with graders, and compacted with compactors. Labor for bridges and culverts, and for road machinery is required including:
- Establishing a base camp
- Managing the biomass
- Equipment provision (Tractors, trucks, dozers, graders, compactor, and pickup trucks)

Field establishment

- Field lining and holing
- Transplanting of the seedlings

  The seedlings will be transported by road with tippers or tractors. Seedlings are curled and fronds tied together with twines. The seedlings are lifted into the truck or tractor and transported by road to the planting site where each seedling is placed in a planting hole.

  Planting is at 9m triangular (density of 143 plants/ha) and it is manually done by digging a hole with a planting spade.

Maintenance

- Application of fertilizers
- Control usage of agro-chemicals
- Field upkeep

Harvesting

- Harvesting

Ripe bunches are harvested with a Malayan knife and loaded into a truck or tractor and then transported to the palm oil mill. Loose fruit are picked into baskets and loaded into transport vehicles using bags. Cut bunches are evacuated from the field using mini tractors or wheel barrows to the road sides.

- Transporting the Fresh Fruit Bunch to the Palm Oil Mill

Replanting or abandonment

Replanting

- Establishment of a new nursery
- Removal of the old palm trees
- Biomass management
- Field lining and holing
- Transplanting the seedlings
- Maintenance
- Harvesting
- Transport of the FFB to the Palm Oil Mill

Abandonment

- Removal of equipments and structures
- Site restoration / rehabilitation

5.4.2.2. Environmental Impacts of the Plantation

Ecological Impacts

Site preparation contributes to the ecological impacts of an oil palm plantation development. If the plantation is located in an ecologically sensitive area, it may result in clearing and subsequently removal and extinction of ecologically important habitats and species. Site clearing, access road, nursery establishment, and plantation development can damage the habitats of terrestrial flora and fauna species.

Loss of habitats

Establishment of an oil palm plantation leads to the clearing of the site. The site clearing will cause the loss of natural terrestrial habitat, thus causing an ecological imbalance. It will also cause unfavorable conditions for the survival of the wildlife.

Loss of species

Establishment of an oil palm plantation might result in the loss of economic, commercial, and/or medicinal species or endangered species included in the IUCN Red Book. The presence of endemic species should be highlighted.

The conversion of forests, even secondary, to oil palm plantations reduces biodiversity with species reductions occurring for insects, birds, reptiles, and soil microorganisms.

SGSOC being a member of the RSPO – Roundtable on Sustainable Palm Oil cannot cut down "Primary Forests" to plant oil palm trees or any areas containing one or more High Conservation Values.

The concept of High Conservation Value Forests (HCVFs) was developed to provide a framework for identifying forest areas with special attributes that make them particularly valuable for biodiversity and / or local people.

There are six categories of HCVs covering both ecological and social values:

- **HCV1** Globally, regionally or nationally significant concentrations of biodiversity values.
- **HCV2** Globally, regionally or nationally significant large landscape-level forests.
- **HCV3** Forest areas that are in or contain rare, threatened or endangered ecosystems.
- **HCV4** Forest areas that provide basic services of nature in critical situations.
- **HCV5** Forest areas fundamental to meeting the basic needs of local communities.
- **HCV6** Forest areas critical to local communities' traditional cultural identity.

To assess the SGSOC Concession site, the following two studies were conducted:

Study 1: *"Flora Survey in the Mundemda, Toko and Nguti SGSOC Project Area Report"* by H & B Consulting (See in the Annexes).

The terms of reference of the flora survey were:

- To describe the present status of plants species through desktop review and fieldwork (those listed by the International Union for Conservation of Nature (IUCN Red Data species 2010), as critically endangered, endangered, vulnerable, and lower risk, and species listed on appendix II International Trade in Endangered Species (CITES) list inside the project's zone and protected areas within the sphere of influence.

- To compare the list of species recorded with the list of protected species under the Cameroon wildlife law (Article 2 of the Order of 14 August 1998).
- To take pictures and GPS points for protected species seen in the project zone.
- To identify and describe any forest reserves, Council and Community Forests occurring inside the project zone.
- To identify potential impacts, environmental management measures, and mitigation measures if necessary.

The findings of this vegetation assessment showed that the project area is moist evergreen to moist semi-deciduous forests which has been logged over the years. The vertical profile includes trees of 10 to 20 entangled by woody lianas and other climbers. The woody under storey is fairly dense particularly in areas of evidence of logging. Forest fragmentation is high as most of the settlements are far apart.

In addition, 118 species belonging to 45 families were recorded during the survey in and around the project areas. The checklist of plant species in the project area based on the APG III system of classification (APG 2009) is presented in the appendix 2 of report (See Annex). Eight of these species were on the IUCN red list with 06 being classified as vulnerable [VU], 01 endangered [EN] and 01 as near threatened [NT] (see appendix 2 in the Annex). These are all abundant in the lowland rain forest region of Cameroon; hence the impact will be minor. None was also listed on either appendix II of the International Trade in Endangered Species (CITES) list or the list of protected species under the Cameroon wildlife law (Article 2 of the Order of 14 August 1998).

To reinforce our findings:

1. The Institute of Agricultural Research for Development (IRAD) belonging to the Ministry of Scientific Research and Innovation (MINRESI) did a Soil Study of the area and they concluded that the survey area was covered by secondary forests (See IRAD letter in the Annexes).
2. During the month of September 2010, the Ministry of Forestry and Wildlife (MINFOF) sent a team out to assess the flora of the SGSOC concession area. On October 6, 2010, the Minister of Forestry and Wildlife sent SGSOC an Attestation of Confirmation of Forest Map certifying that, *"the entire concession granted to SG SUSTAINABLE OILS CAMEROON LTD for agricultural development including oil palms at Nguti, Mundemba and Toko Subdivisions have been logged and farmed repeatedly over the years and the area is classify as secondary forests. The concession areas applied for are not virgin or primary forests."*

3. In December 2010, a High Conservation Value Forest Assessment on the 80,506 ha SGSOC Concession was conducted by Augustus Asamoah, RSPO Approved Assessor from the Ghana Wildlife Society. The study found that the concession area is therefore largely an agro-ecological landscape devoid of any primary forest. There are however several small isolated patches of forest fragments dotted throughout the concession especially in the inaccessible areas, some of which are in relatively good condition. The current state of the concession area as a whole does not constitute a High Conservation Value Forest.

The potential environmental and social impacts revealed by the Flora Survey Report are the loss of the villagers' farmland and Non-Timber Forest Products (NTFPs) as the main livelihood of the population of the area. The common NTFP species of the concession area include: Country onion, Bush pepper, bush mango, bitter kola, red Cola, monkey cola, Njabe, and many other spice species. Villagers also depend on phytomedicine for health care. Setting up new camps will entail an influx of migrant population which will exert more pressure on the existing limited natural resources.

Study 2: A **wildlife study** of the area was also done in *"Impact assessment of Fauna and Flora in the Support zones of Kurop National Park and the Nguti area of Cameroon: EIA report for SG sustainable Oils Cameroon LTD" Report* by H & B Consulting (see Annexes).

The objectives of the study were:

1. To describe the present status of plant and animal species with attention to species that may be listed in the International Union for Conservation of Nature (IUCN) Red Data Book 2007), as critically endangered, vulnerable, and lower risk, and species listed on appendix II of the International Trade in Endangered Species (CITES) list, present inside the project's zone and protected areas within its sphere of influence.
2. To determine whether the area overlaps any protected areas, and has critical and/or unique ecosystems essential for survival of species in the area,
3. To ascertain as far as possible from the available biodiversity data, whether any critical habitat (as defined by IFC's Performance Standard 6 – Biodiversity Conservation and Sustainable Natural Resource Management) is present in the two concession areas.
4. Lastly to ascertain if they exist any RSPO high Conservation value (HCV) criteria in the concession areas.

The project location was mapped in relation to known regions and areas recognized as global conservation priorities (protected areas, EBAs, IUCN, etc.) and the occurrence of major habitats and key species of conservation concern within the project area.

The findings from the desktop studies showed that several IUCN-listed species are found in the protected areas like Korup National Park and Bayang Mbo Wildlife Sanctuary and not within the SGSOC concession:

"Habitat required for the survival of IUCN species": Literature review confirmed the following key fauna IUCN-listed species within the Korup National Park and Bayang Mbo Wildlife Sanctuary: Elephant *Loxodonta Africana (*Near threatened*)* Preuss's red colobus *Procolobus badius preussi* (Endangered), Preuss's guenon *Cercopithecus preussi* (Vulnerable), russet-eared guenon (*Cercopithecus erythrotis*), Leopard *Panthera pardus* (Near threatened), Allen's Bushbaby *Galago alleni (*Near threatened), Collared Mangabey *Cercocebus torquatus (*Near threatened), Yellow-backed Duiker *Cephalophus silvicultor (*Near threatened), Bay Duiker *Cephalophus dorsalis (*Near threatened). Species listed by the Convention on International Trade of Endangered Species (CITES) have also been recorded in the Park. African Manatee *Trichechus senegalensis* has been reported to exist locally by the inhabitants in the deep stretches of the Akwen gorge a little north of the Korup National Park, but has not been reported to be within the concession areas.

"Sites holding special significance for endemic and restricted range species": The Protected areas hold species endemic to Cameroon like the Mount Kupe Bush-shrike *Telophorus kupeensis*, and "restricted range" species: Forest Swallow (*Hirundo fuliginosa*) Grey-necked Picathartes (*Picathartes oreas*). These protected species have not been recorded within the concession areas.

"Sites critical to the survival of migratory species". Such sites have not been recorded or were not seen in the SGSOC concession.

"Areas supporting globally significant concentrations of congregatory species". Such areas of concentrations did not exist in the project concession.

"Areas with species associated with key evolutionary processes and ecosystem services". The concession did not qualify under this criterion.

Apart from common species of bird recorded within the concession, all the endangered bird species are recorded in the protected areas of Korup National Park and Bayang Mbo Sanctuary which are important bird areas in Cameroon.

The potential environmental and social impacts revealed by the Wildlife Study Report are:

1. The few elephants feeding sites that occur at the boundary of Bayang Mbo Wildlife Sanctuary with the concession but majority of the elephant population are confined in the protected areas. Some elephants have been seen in the SGSOC concession near the city of Nguti therefore, the impact here will be a human – elephant conflict with destruction of the plantations.
2. The connectivity and biodiversity corridors will be impacted because the SGSOC project Blocks (A&B) are delimited pieces of secondary forest within a continuous degraded band of forest between Korup National Park and Bayang Mbo Wildlife Sanctuary. Biodiversity survives best in larger forest fragments.
3. Reduction of the biodiversity in the plantation.
4. Increase in poaching by the population.

Impacts on air due to the open burning of the biomass

During the plantation development, the site clearing, the construction of roads, and the establishment of the base camp will generate a large amount of biomass which is traditionally burned. The burning of this biomass will cause a massive atmospheric pollution with elevated ambient total suspended particulates.

For each plantation development phase, a survey will be done to ascertain the amount of biomass to be generated and to be disposed of.

In addition to air pollution, burning of biomass releases CO_2 into the atmosphere and thus contributing to climate change.

Impacts on Hydrological and drainage system

Leaching of agrochemicals, runoff, pollution by effluent discharge (POME), sewage, and hydrocarbon contamination all affect water and can be significant impacts of oil palm cultivation.

The Project is situated in the rainforest; in the Southwest region of Cameroon which has the highest rainfall level in the country. The SGSOC concession is drained by a dense network of rivers and streams (see figures below).

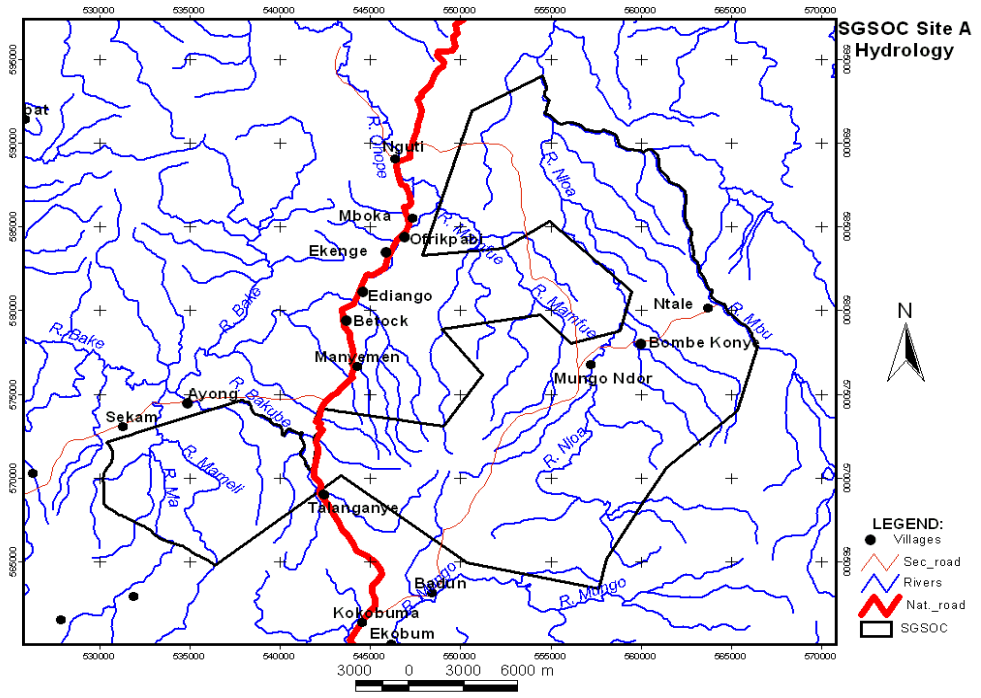


Figure 14: Hydrology map of the SGSOC Project site – Block A: Nguti

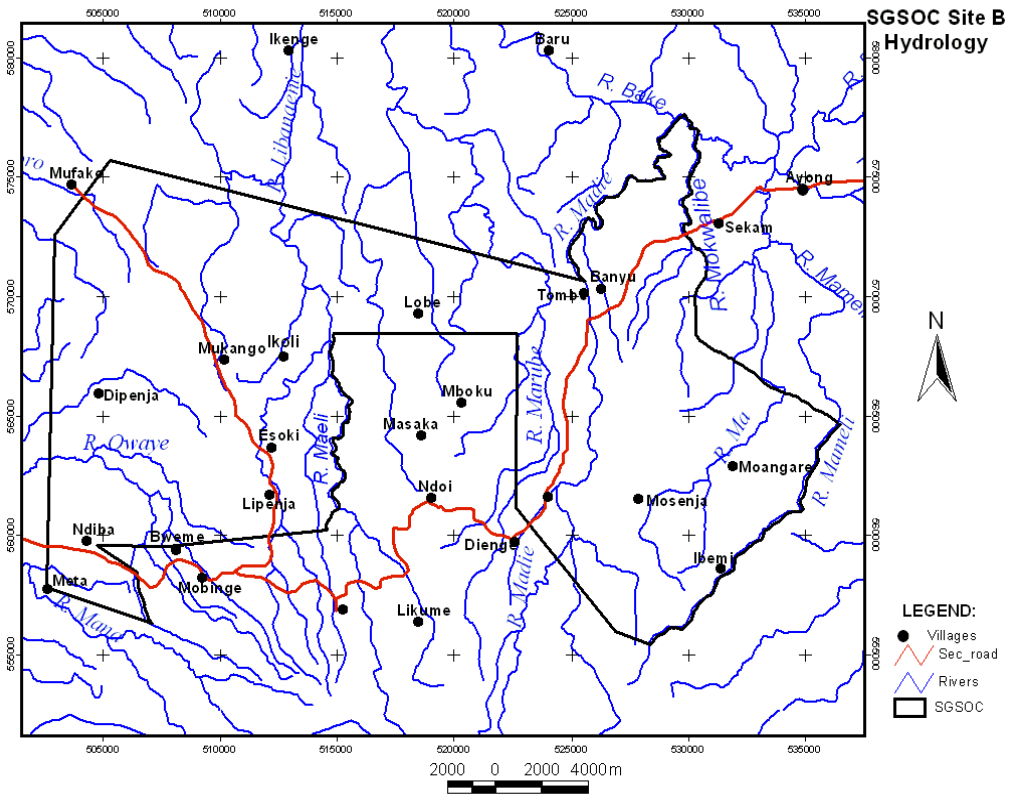


Figure 15: Hydrology map of the SGSOC Project site – Block B: Mundemba/Toko

When vegetation is removed, the hydrological cycle is altered as water that would normally have been returned to the atmosphere by means of plant transpiration processes (evapotranspiration), now remains within the soil layer. Absence of vegetation also allows a greater proportion of direct rainfall to reach the forest floor. This causes an increase in surface runoff due to the reduction of infiltration and soil erosion from cleared areas. It can also cause sedimentation of the waterways and flood.

Water pollution due to agro-chemical usage

Usage and application of agro-chemicals (fertilizers, pesticides, fungicides, insecticides, etc…) during the plantation development can pollute the soil and the water in the area.

The use of artificial fertilizers (Nitrogen – N, Potassium – K, Phosphorus – P, and Magnesium – Mg) can pollute the water and have an impact on the water quality. The effect will be the "euthrophication" in the surface water causing growth of vegetation and affecting aquatic life.

High levels of chemicals (pesticides, insecticides, fungicides, etc…) in the waterways can affect the aquatic life and even the supply of freshwater.

Weed Control (source: Agrinexus):

Immature Plantings (Year 1 – 3)

- Palm circles to be kept weed free – done manually
- Chemical weeding should commence not later than 6 months after field planting
- To avoid use of hormonal herbicides e.g. 2,4-D amine, triclopyr, etc
- To avoid excessive spray drift and scorching on lower fronds when spraying
- For circle spraying, to spray Glufosinate-Ammonium at 3.3 liters per hectare or 132 ml per 18 liters of water
- Subject to the weeds regeneration, spraying can vary from 7-9 rounds p/year
- Ensure all noxious and undesirables weeds are eradicated
- Chemical requirements:
    - Based on 15,000 ha (largest immature area during project life cycle)
      = 3.3 liters x 15,000 ha x 7 rounds p/year
      = 346,500 liters of Glufosinate-Ammonium p/year

Mature Plantings (Year 4 onwards)

- Circle Spraying & Path Spraying

  The general policy is as follows:

	No of rounds per year		
Years of Maturity	1 year	2-5 years	> 6 years
Circle spraying	6	4	3*
Path spraying	6	4	3*

** Average for the Estate*

For general weeds, the recommended herbicides and dosage for circle and selective/path spraying is as follows:

Weed	Herbicide	Rate (amount/ha)	Dilution Rate (amount/18 litre)
General Weed	Glyphosate + Metsulfuron-methyl	1.5 litre + 75 g	60 ml + 3 g

Hence, the chemical requirements are as follows:

(i) Glyphosate

- Based on 45,000 ha (60K ha – 15K ha)

  = 1.5 liters x 45,000 ha x average 5 rounds p/year

  = 337,500 liters of Glyphosate p/year

(ii) Metsulfuron-methyl

- Based on 45,000 ha (60K ha – 15K ha)

  = 75 g x 45,000 ha x average 5 rounds p/year

  = 16,875,000 g = 16,875 kg of Metsulfuron-methyl p/year

Fertilizers application (Source: Agrinexus):

FERTILIZER APPLICATION FOR IMMATURE FIELD PLANTED PALMS

The following fertilizer schedule is recommended for the first three years of field planting:

Year	Month After Planting	Fertilizer	Rate (kg/Palm)
1	1	NPK 15:15:6:4	0.50
	4	NPK 12:12:17:2 + TE	0.50
	7	Kieserite	0.50
	7	NPK 15:15:6:4	1.00
	9	MOP	0.75
	11	NPK 12:12:17:2 + TE	1.00
		Total	4.25
2	14	NPK 12:12:17:2	1.25
	17	NPK 12:12:17:2	1.25
	19	Muriate of Potash	1.00
	20	NPK 12:12:17:2	1.25
	23	NPK 12:12:17:2	1.25
		Total	6.00
3	24	NPK	1.50
	25	Kieserite	0.75
	28	NPK	1.50
	30	MOP	1.50
	33	NPK	1.50
		Total	6.75

Note: For the highest fertilizer requirement during the immature period, we will use the amounts stated for Year 3.

The calculations are as follows:

- Total NPK requirements:

  15,000 ha x 143 stand/ha x 1.50 kg/palm = 3,217,500 kg x 3 = 9,652,500 kg
- Kieserite : 15,000 ha x 143 stand/ha x 0.75 kg/palm = 1,608,750 kg
- MOP : 15,000 ha x 143 stand/ha x 1.50 kg/palm = 3,217,500 kg

FERTILIZER APPLICATION FOR MATURE FIELD PLANTED PALMS

The following fertilizer schedule is recommended for the mature palms:

PALM AGE (YR)	FERTILIZER		APPLICATION	TOTAL REQUIREMENT PER YEAR
	NPKMg 12:6:22:3	MOP	ROUNDS PER YR	
	Kg/P	Kg/P		
1				
2				
3				
4	6	2	6	**8**
5	8	2	7	**10**
6	8	2	7	**10**
7	8	2	7	**10**
8	8	2	7	**10**
9	8	2	7	**10**
10	8	2	7	**10**
11	8	2	7	**10**
12	8	2	7	**10**
13	8	2	7	**10**
14	8	2	7	**10**
15	8	2	7	**10**
16	8	2	7	**10**
17	8	2	7	**10**
18	8	2	7	**10**
19	8	2	7	**10**
20	6	1	6	**7**
21	6	1	6	**7**
22	6	1	6	**7**
23	6	1	6	**7**
24	**No fertilizer application as assumed to be replanted after 25 years.**			
25	**No fertilizer application as assumed to be replanted after 25 years.**			

Based on the above, the highest requirement is 10kg/palm/year. Hence, the highest fertilizer requirements are as follows:

(i) NPKMg - 8 kg x 45,000 ha x 143 stand/ha = 51,480,000 kg

(ii) MOP - 2 kg x 45,000 ha x 143 stand/ha = 12,870,000 kg

Summary of the chemical and fertilizer requirements:

1. Total Chemical requirements

Chemical (active ingredient)	Trade Name	Amount
Glufosinate-Ammonium	Basta	347,837 liters/year
Glyphosate	Round Up/Supresate/Ken-Up/Ecomax	337,500 liters/year
Metsulfuron-methyl	Ally	16,875 kg/year

2. Total Fertilizer requirements

- NPK : 9,652,500 kg
- Kieserite: 1,608,750 kg
- MOP : 16,087,500 kg
- NPKMg : 51,480,000 kg

Water and soil pollution due to hydrocarbons

The use of generators in the plantation for the water pump or the camp can also cause soil and water pollution by hydrocarbons if safety measures are not taken into consideration by the workers to prevent spills.

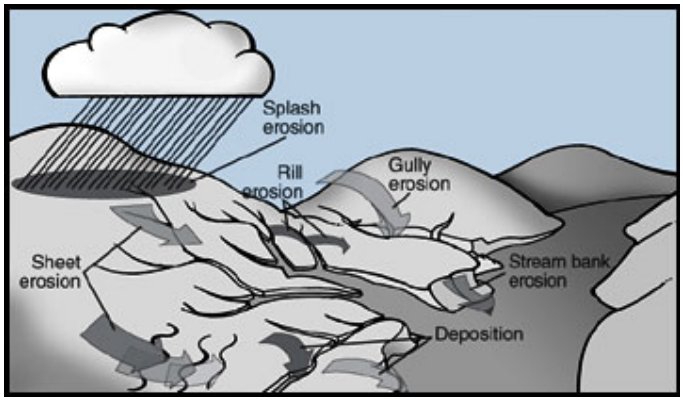
Water pollution due to sewage from base camps

The Project will bring a large amount of people. The sewage generated by this population has to be well managed, if not, it will cause an increase in the level of COD, BOD, and microbiological contents in the water system. It will lead to a bad odor and breeding of mosquitoes and flies.

Impacts on soil – Soil Erosion

Soil erosion is a major soil degradation process affecting the soil quality not only by directly reducing nutrients and organic matter levels, but also by affecting soil properties such as infiltration rates.

Erosion occurs mainly during forest clearing and plantation establishment when the soil is left uncovered, establishment of the base camps, construction of access roads, and drainage works. The top layer of soil is the most vulnerable and unfortunately tends to be the most fertile soil.



(Source: Broz et. al. 2003, University of Missouri, USA)

Figure 16: Types of erosion

According to Broz et. Al. (2003), the most obvious type of soil erosion (see figure above) is on steep slopes.

Soil suspended as solids in the water column can physically enter waterways and obstruct them. Soil erosion can also transport agrochemicals such as fertilizers and pesticides which adhere to the suspended solids.

Pest Infestation

According to Agrinexus' Implementation Plan for SGSOC Plantation, the pests present in an oil palm plantation are:

- Leaf-Eating Caterpillars – Nettle Caterpillars and Bagworms;
- Mammalian Pests – Rats are the most common vertebrate pest ;
- Insect Pests – the Rhinoceros Beetle is a major pest in new plantings.

Biomass will provide shelter for certain pests such as rodents.

There are also other types of infestations such as elephants, monkeys, birds, and the like that are present in the area.

Transportation (FFB and Oil Palm) and Traffic

Transportation of the Fresh Fruit Bunch to the palm oil mills and of the oil palm to the port respectively by tractor and lorries and the workers' transportation vehicles, will impact the traffic activities by generating dust and noise pollution.

Pollution from hazardous substances – Waste Management

A lot of hazardous substances will be used during the plantation development:

- The agrochemicals:
    - Fertilizers
    - Pesticides
    - Insecticides
    - Fungicides
    - Etc…
- The hydrocarbon products for the generators, cars, tractors and lorries, etc., such as diesel fuel, oil and grease, lubricants, etc…

Spillage has to be prevented to avoid soil and/or water pollution. Proper storage and disposal of empty containers will also help prevent pollution.

Social, economic and cultural impacts on population within limited radius of the proposed project of the plantations

The impacts on the human population living in the Project area are mostly positives, but we also have negative impacts such as:

- Loss of land and NTFP (such as "bush meat", medicinal plants, and wood for cooking);
- Destruction of community-based economy;
- Exposure to Health Risks (Malaria, HIV AIDS, STD, etc…);
- Food security;
- Insecurity;
- Destruction of indigenous cultural values;
- The Project employment opportunities are not attractive to the local communities;
- The quality of life and working conditions of workers and laborers in plantations and mill factories:
- The issues on the workers and laborers wages,
- Etc…

These are some of the negative impacts the Project on the human population. Chapter 7 on Public Consultations summarized all the concerns of the population in the SGSOC concession area.

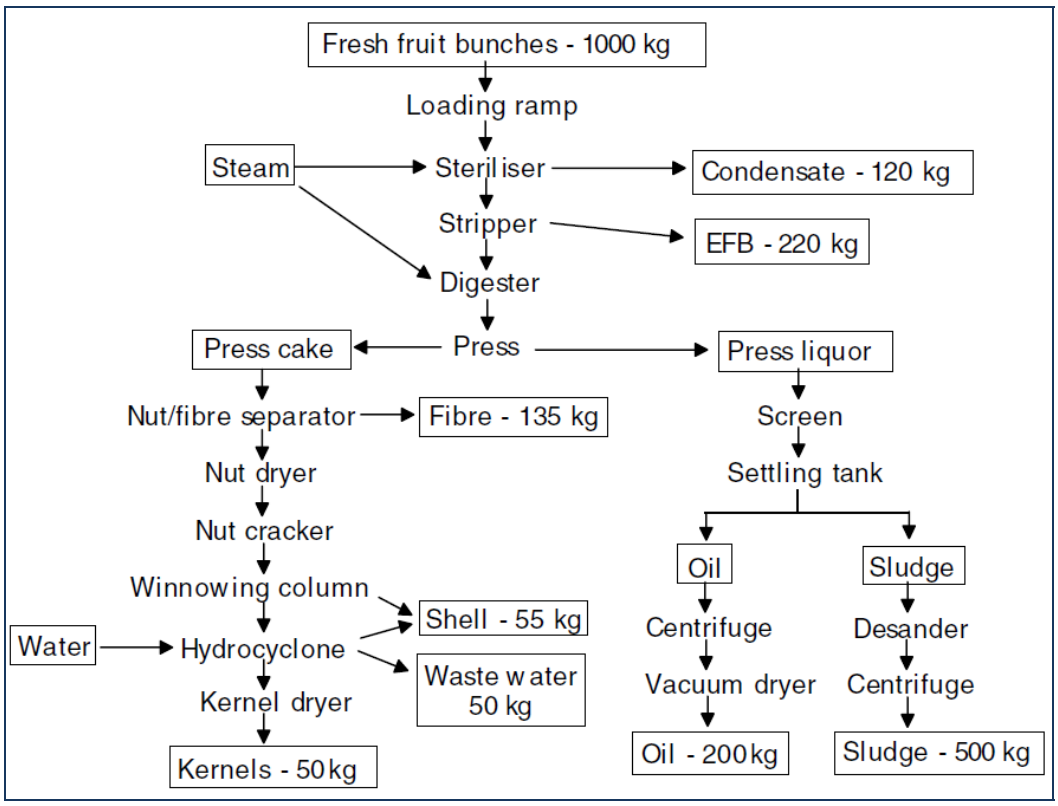
5.4.3. Environmental and Social Impacts of the Project: the Palm Oil Mill

5.4.3.1. Introduction

The stages in the extraction process are (Source: Agrinexus Implementation Plan for SGSOC):

1. **Bunch sterilization with high pressure steam - this loosens the fruit from the bunch, and inactivates the endogenous lipase and any micro-organisms, so that Free Fatty Acid (FFA) build-up does not occur;**
2. **Bunch stripping - to separate the fruit from the bunch stalk and spikelets;**
3. **Fruit digestion to pulverize and disrupt the mesocarp, with heating to aid oil extraction;**
4. **Pressing or other treatment of the digested fruit to extract the oil;**
5. **Separating, clarifying and drying the oil;**
6. **Separating the nuts from the fiber;**
7. **Nut drying, grading and cracking;**
8. **Separating the kernels from the shell; and**
9. **Kernel drying and packing.**

Below, a schematic flow diagram for palm oil and kernel extraction. The approximate mass of outputs shown is from 1MT of FFB, assuming 20% OER and 5% KER:



(Source: Agrinexus Implementation Plan for SGSOC)

An Oil Extraction Plant or a Palm Oil Mill (POM) impacts can be summarized as follows:

- The air and atmosphere as a result of various exhaust gases that are produced in generating the energy required for the extraction process and in transportation. In the higher atmosphere, the ozone protective layer can be affected through the use of substances that destroy this protective layer.
- The surface water courses through the discharge of untreated process effluent and other contaminated effluents. The possible contamination or depletion of underground water sources.
- Soil through hydrocarbon (and other hazardous substances) spilled and through bad "Housekeeping" practices. This could lead to secondary undesirable effects affecting underground water sources and human health.
- Flora and Fauna (See sub chapter 5.4.2. *"Environmental and Social Impacts of the Project: The Plantation Development"*).
- Pollution of immediate environment through the generation of solid waste, waste which requires to be correctly treated in order not to impact the immediate environment.
- Human Population with its cultural and economic structure within the limits of the existing plantation.

5.4.3.2. Impacts on air and atmosphere

The considered impacts

The potential impacts within the boundary of the Palm Oil Mill will be the following:

- Exhaust emission of CO, SO_2, NO, NO_2 and Particulate Matter of less than PM_{10} which result from the combustion of the palm oil fiber and nut shell obtained from the process and used to fuel furnaces in order to supply electric energy for the Palm Oil Mill.
- Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the combustion of the stand-by fossil fuel generators. The use of this source of power will be sporadic.
- Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the transportation of FFB or Fresh Fruit Bunches to the Palm Oil Mill for processing from the plantation by trucks.
- Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the transportation of Crude Palm Oil (CPO) for export or to the port by third party trucks.

- Emission into the air of Methane CH_4 (chiefly but also some Carbon Dioxide CO_2) from the shallow ponds as a result of digestion by anaerobic and some aerobic bacteria of the Palm Oil Mill Effluent (POME).
- Possible use of Ozone Depleting Substances (ODS).

Emission of pollutants which result from combustion of fiber and palm nut shell

The earth's atmosphere consists of 78% Nitrogen, 20% Oxygen, and 2% of other gases (in small or minute quantities) such as Carbon Dioxide, Methane, Carbon Monoxide, various Oxides of Nitrogen, Sulfur Oxides, small quantities of volatile Hydrocarbons, Ozone, etc.

Some of those gases that are found in small or minute quantities, as just mentioned, however, can exert a considerable influence on the characteristics of the atmosphere. Consequently, the introduction of these gases into the atmosphere or emitting them into the air through the process of combustion or through other human activities can have an adverse effect on the quality of the air we breathe (consequently our health) and/or on the climate. The introduction of these gases into the air is termed air pollution.

The emission of exhaust gases from the combustion of fiber that surrounds the nut of the palm oil and the empty shell of the palm oil left after the extraction of the kernel (both of which are considered as waste products or agro – waste) can pollute the atmosphere.

Typical content of the exhaust gases and the approximate quantities of emission per cubic meter of its constituents from combustion of the agro – waste mentioned above, expressed in mg/m^3 are given:

- **CO** **No Trace**
- **CO_2** **52,728 mg/m^3**
- **NO_4** **2,900 mg/m^3**
- **SO_2** **200 mg/m^3**
- **PM_{10}** **0.01 mg/m^3** **= 10 $\mu g/m^3$ (micrograms/cubic meter)**
- **Dust Concentration** **50 mg/m^3**

The preoccupying issue here are the emission of **CO_2** and **NO_4** (for control and attenuation see Chapter 6).

Carbon dioxide is colorless. At low concentrations, the gas is odorless. At higher concentrations it has a sharp, acidic odor and it can cause asphyxiation and irritation. However, the emission of this gas as a Greenhouse Gas from the combustion of palm oil agro – waste is not additive to the atmosphere in the same way as burning fossil fuel is where the carbon is resurrected from under the ground which has been stored for millions of years and added to the atmosphere during the combustion process. In the case of burning the agro – waste, it becomes part of the recycling process of the Atmospheric Carbon (part of the Carbon Cycle) for the following reasons: the palm oil tree has first of all absorbed the Carbon Dioxide from the atmosphere and through the process of photosynthesis and the plant chemistry converted it into palm nut and fiber. In the process of combustion for energy extraction, the carbon content within the palm nut shell and the fiber is returned back into the atmosphere in form of Carbon Dioxide. The issue of Global Warming as a result of combustion of palm oil agro – waste is therefore, a non – issue.

Attenuation measures are discussed in Chapter 6.

Emission of pollutants which result from combustion of fossil fuel in stand – by generators

The Palm Oil Mill is designed to operate with power supplied by its own turbine generating system which uses energy from combustion of agro-waste (see above). As a stand - by power supply, there are two (02) diesel generators (150 kW and 400 kW) that can be used in case of breakdowns or in other emergency situations. These generators are designed to run on ordinary fossil diesel and their use will be sporadic.

Modern stationary (non – road) diesel generators with advanced engine design are limited with reference to exhaust gases (the standards quoted here are from the *Environmental Protection Agency of the United States, Emission Standards for non – road diesel engines*.)

All modern generators are designed to respect these emission standards by the manufacturers.

Table 9: EPA Tier 1-3 Nonroad Diesel Engine Emission Standards, g/kWh (g/bhp·hr)							
Engine Power	**Tier**	**Year**	**CO**	**HC**	**NMHC+NOx**	**NOx**	**PM**
kW < 8 (hp < 11)	Tier 1	2000	8.0 (6.0)	-	10.5 (7.8)	-	1.0 (0.75)
	Tier 2	2005	8.0 (6.0)	-	7.5 (5.6)	-	0.8 (0.6)
8 ≤ kW < 19 (11 ≤ hp < 25)	Tier 1	2000	6.6 (4.9)	-	9.5 (7.1)	-	0.8 (0.6)
	Tier 2	2005	6.6 (4.9)	-	7.5 (5.6)	-	0.8 (0.6)
19≤ kW < 37 (25 ≤ hp < 50)	Tier 1	1999	5.5 (4.1)	-	9.5 (7.1)	-	0.8 (0.6)
	Tier 2	2004	5.5 (4.1)	-	7.5 (5.6)	-	0.6 (0.45)
37 ≤ kW < 75 (50 ≤ hp < 100)	Tier 1	1998	-	-	-	9.2 (6.9)	-
	Tier 2	2004	5.0 (3.7)	-	7.5 (5.6)	-	0.4 (0.3)
	Tier 3	2008	5.0 (3.7)	-	4.7 (3.5)	-	-†
75 ≤ kW < 130 (100 ≤ hp < 175)	Tier 1	1997	-	-	-	9.2 (6.9)	-
	Tier 2	2003	5.0 (3.7)	-	6.6 (4.9)	-	0.3 (0.22)
	Tier 3	2007	5.0 (3.7)	-	4.0 (3.0)	-	-†
130 ≤ kW < 225 (175 ≤ hp < 300)	**Tier 1**	**1996**	**11.4 (8.5)**	**1.3 (1.0)**	**-**	**9.2 (6.9)**	**0.54 (0.4)**
	Tier 2	**2003**	**3.5 (2.6)**	**-**	**6.6 (4.9)**	**-**	**0.2 (0.15)**
	Tier 3	**2006**	**3.5 (2.6)**	**-**	**4.0 (3.0)**	**-**	**-†**
225 ≤ kW < 450 (300 ≤ hp < 600)	**Tier 1**	**1996**	**11.4 (8.5)**	**1.3 (1.0)**	**-**	**9.2 (6.9)**	**0.54 (0.4)**
	Tier 2	**2001**	**3.5 (2.6)**	**-**	**6.4 (4.8)**	**-**	**0.2 (0.15)**
	Tier 3	**2006**	**3.5 (2.6)**	**-**	**4.0 (3.0)**	**-**	**-†**
450 ≤ kW < 560 (600 ≤ hp < 750)	Tier 1	1996	11.4 (8.5)	1.3 (1.0)	-	9.2 (6.9)	0.54 (0.4)
	Tier 2	2002	3.5 (2.6)	-	6.4 (4.8)	-	0.2 (0.15)
	Tier 3	2006	3.5 (2.6)	-	4.0 (3.0)	-	-†
kW ≥ 560 (hp ≥ 750)	Tier 1	2000	11.4 (8.5)	1.3 (1.0)	-	9.2 (6.9)	0.54 (0.4)
	Tier 2	2006	3.5 (2.6)	-	6.4 (4.8)	-	0.2 (0.15)
† Not adopted, engines must meet Tier 2 PM standard.							

(Source: www.dieselnet.com/standards/us/nonroad.php)

For an engine power between 225 ≤ kW < 450 - (300 ≤ hp < 600), the standards are:

CO	3.5 gm/kW h or 2.6 gm/bhp h.
HC + NO_x	4.0 gm/kW h or 3.0 gm/bhp h.
SO_2	Regulated through fuel standards. Levels of sulfur not greater than 0.2% by weight (2 000 ppm) apply up to the year 2011 after which the 7 - 15 ppm only will be tolerated.
PM_{10}	0.2 gm/kW h or 0.15 gm/bhp h.

(Note: the mass emission in stationary diesel engines and the heavy transport diesel engines is measured in gm./bhp.hr or gm./kW.hr; the conversion factor being 1 bhp = 0.74570 kW).

The generators will probably be from an European or Asian manufacturer hence similar standards will apply.

The emissions of the Diesel Generators that will be installed are:

Ambient temperature 25°C

Ambient humidity 50%

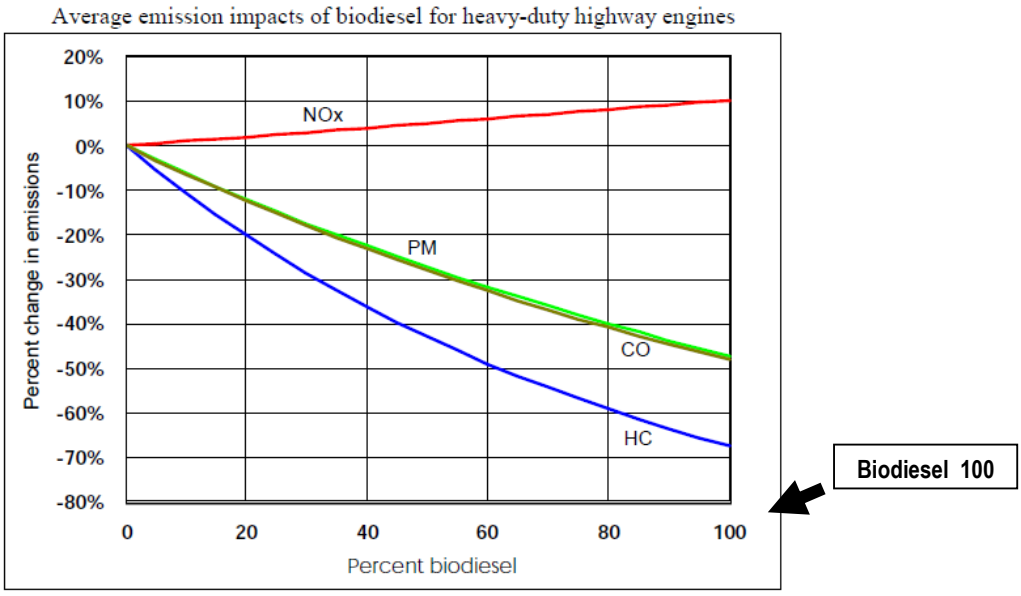
Concentrations	
Units	**g/Nm^3**
NO_x	3.41
CO	0.08
HC (as CH_4)	0.22
SO_x	1.56
O_2	196
CO_2	108
H_2O	0
Particles	-

* Fuel oil sulphur: 2.25%

The number of hours these generators will be in use is not known and cannot be satisfactorily estimated therefore, the impact due to the emission of exhaust gases cannot be effectively calculated.

SGSOC is planning on producing biodiesel from the crude palm oil extracted for its own use. If SGSOC intends to operate the stand-by generators using this locally produced biodiesel, the emissions will be different.

Below is a figure extracted from *"A Comparative Analysis of Biodiesel Impacts on Exhaust Emissions"*, a technical report produced by the Environmental Protection Agency of the United States.



(Source: http://www.epa.gov/oms/models/analysis/biodsl/p02001.pdf)

Graph 8: Average emission of biodiesel for engines

As can be seen all the pollutants with exception of NO_x are dramatically reduced through the use of biodiesel.

It should also be noted that the CO_2 Carbon Dioxide here is not taken into consideration. This gas is not regulated or legislated neither in stationary generators nor in transport, neither in the United States nor the European Community. The European Community sets overall limits of emission of Carbon Dioxide (Greenhouse Gases) through the National Allocation Plans in Phase I of compliance (Phase I: year 2008 - year 2012 in conformity with the UNFCC Kyoto Protocol) but there are no specific limits set for individual equipment including vehicles (which unfortunately accounted for about 28% of the world emissions of CO_2 in 2004).

Setting emission limits for Carbon Dioxide (Greenhouse Gases) in transportation (terrestrial and air), which is presently voluntary is now under consideration by the European Community for Phase II (period after year 2012) of the Kyoto compliance.

If biodiesel is used in the stand-by generators, no measures are required with reference to the attenuation of exhaust gases with the exception of NO_x.

The attenuation measures with reference to NO_x are discussed in Chapter 6.

Emission of pollutants which result from transportation of FFB to the palm oil mill and CPO to the port

This is an extremely complex issue on the fact that transportation of the Fresh Fruit Bunches (FFB) from the plantation to the Palm Oil Mill as well as the transportation of Crude Palm Oil (CPO) to the port is not strictly speaking part of the project that the Promoter is putting in place. It is an incidental issue to the project but an extremely important incidental issue from the environmental point of view.

It is further complicated by the fact that the transportation is not in the hands of the Promoter, but is mainly subcontracted to various Transport Contractors as yet unknown. Transport Contractors that operate a multitude of different non standard vehicles some of which are considerably aged, not well maintained or in bad state of repairs, sometimes on fuels of unknown origin, and on standards that have found their way into Cameroon.

The proposed plant has a capacity to process 60 T of FFB per hour, the annual requirement of FFB could, therefore, be in the region of some 374,400 T (Agrinexus Implementation Plan for SGSOC) at full capacity. This tonnage would require to be transported an average distance from various plantation collection points to the Palm Oil Mill. If we suppose that each truck carries about 5T of FFB at a time, the number of trips require to be made would be in the region of 74,880 and if the emission of the vehicles is say 250 gm of carbon dioxide per km (this is an estimated assumption which can vary considerably depending on the type, age, fuel used, condition and the design technology of the engine of the vehicle). If we had the distance traveled, we could estimate the amount of carbon dioxide gas that might be dumped into the atmosphere per annum from the vehicles supplying the Palm Oil Mill with FFB.

Similar calculation can be done for the transportation of the CPO to the port.

As already mentioned above, this emission is not regulated and consequently cannot be considered as illegal though it affects the environment (chief contributor to global warming) and is not desirable.

These vehicles in addition to the emission of carbon dioxide would emit gases that are regulated or legislated (legislated in other parts of the world but not directly in Cameroon; in Cameroon, they could be interpreted as being applicable, indirectly, by virtue of the Article 9 (f) of the Framework of Environmental Law 96/12 of 5/8/1996). These gases are nitrogen oxides, carbon monoxide, sulfur dioxide and HC hydrocarbons as well as particulate matter PM.

The European Union set Emission Standards for Diesel Engines of lorries and buses, applicable as from October 2008 or *"Euro V"* phase are as follows:

- **CO** 1,5 gm./kW h
- **HC** 0.46 gm./kW h
- **NO_x** 2.0 gm./kW h (generic name given to NO and NO_2)
- **SO_2** Regulated through fuel standards.
- **PM_{10}** 0.02 gm./kW h

(Source: http://www.dieselnet.com/standards/eu/hd.php)

The Environmental Protection Agency of the United States (which takes a slightly different approach to the EC) on December 21, 2000 signed emission standards for heavy duty highway engines after 2007. The emission is controlled in two ways through:

i) Emission standards and

ii) Diesel fuel regulations.

The emission levels are consequently more stringent than those of EC.

From the above it can clearly be seen that the incidentals to the project will exert important negative impacts on the environment which cannot be ignored, but will be extremely difficult to control for a multitude of reasons.

The above discussion serves to underline the impacts involved and bring them into focus; the attempt to possibly attenuate these impacts is an issue which will be discussed in Chapter 6.

Emission of methane which result from digestion of POME in anaerobic ponds

Cameroon legislation dealing with the discharge of effluents, domestic and industrial, Decree 2001/165/PM of May 8 2001, is concerned with the pollution of surface and underground water sources and consequently does not allow the Palm Oil Mill Effluent (POME), in this case, to be discharged directly into nature without prior treatment.

According to Ma (2000), the analysis of average POME effluent indicates high levels of:

- **Chemical Oxygen Demand (COD)** (levels of +/- 50 000 mg/l can be reached),
- **Biological Oxygen Demand (BOD)** (levels of +/- 25 000 mg/l can be reached),
- **Total Suspended Solids (TSS) ,** and
- A low **pH value** (+/- 4.7) indicating high acidity.

Therefore by law, the POME requires to be stripped of these characteristics prior to being discharged into nature or any municipal drainage system.

In order to strip the effluent produced by the POME of these characteristics it is necessary to allow it to stand in specially constructed anaerobic ponds. This long residence in the ponds, will allow the anaerobic bacteria to decompose the POME (through naturally attenuate), lowering the COD, BOD, TSS charges and bring up the pH level sufficiently to allow it to be discharged legally into the surface water courses.

Though this permits one to respect the legislation with respect to the pollution of natural water courses, it takes no notice of the fact that the anaerobic bacteria decomposition of the POME produces large quantities of methane, a Greenhouse Gas which has a Warming Potential (GWP) of 21; in other words, it is a powerful pollutant of the atmosphere, an emission which is not legislated or regulated in Cameroon.

The situation that exists here is the fact that there are regulations controlling surface water pollution, however, we emit large quantities of an atmosphere pollutant which is legal (but certainly not desirable) because it is not regulated. Environmentally this is not a satisfactory state of affairs but it is compatible with the existing legislation.

Methane capture

To obtain an idea of the magnitude of the amount of Greenhouse Gases that are emitted as a result of the anaerobic digestion we give below an approximate calculation of the quantities of the methane gas that could be emitted on an annual basis.

The capacity of the Oil Mill is:	**60 T/hour of FFB**
Approx. number of hours worked in the year:	**6,240 hours** (20 hrs x 26 days/month x 12 months/year) **(Source: Agrinexus Implementation Plan for SGSOC)**
POME effluent produced per hour:	**42 m^3 per hour (Source: Agrinexus)**
POME generated per annum:	**42 x 6,240 hours = 262,080 m^3 per annum**
COD charge	**50 000 mg/l or 50 gm/liter**
Total COD charge per annum:	**50 x 262,080 x 1000 / 1000 = 13,104,000 kg of COD per annum**
Methane production capacity (default values IPCC AM0013 /version 02)	**0.21 kg of CH4/kg of COD charge**
Methane conversion factor (default values IPCC)	**0.738**
Total methane CH4 emission	**13,104,000 x 0.21 x 0.738 = 2,030,858 kg of Methane CH_4 per annum**
Same in equivalent CO2 carbon dioxide	**2,030,858 x 21 (CH_4 GWP) = 42,648,018 kg of equivalent CO_2 per annum = 42,648 T of equivalent CO_2 per annum**

The above calculation indicated that some 42,648 T of equivalent carbon dioxide gas might be dumped into the atmosphere per annum from the digestion process of POME in the shallow ponds.

These calculations were done using the UNFCCC/CCNUCC CDM IPCC AM0013/version 02 Approved Baseline Methodology (Source: http://cdm.unfccc.int/EB/015/eb15repan4.pdf).

The above discussion serves to underline the impacts on the atmosphere involved in treating POME within the existing legislation. The capture and attenuation of methane thus generated will be discussed in Chapter 6.

Impact due to the use of ODS or ozone depleting substances

The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted on 16 September 1987 in Montreal. On the same date Cameroon subscribed to the International Convention of the Montreal Protocol.

However, the Protocol came into force only on 1st January 1989; the ban on the use of a number of CFCs (namely: CFC 11, 12, 113, 114, and 115) and several Halons (namely 1211, 1301, 2402) came into force on the same day.

Further, Cameroon adopted the modifications of the 29th of June 1990 in London, relating to the use of substances that deplete the Ozone Layer and in particular use of Chloro–Flouro–Carbon (CFC) gases in refrigeration and air conditioning.

The use of these gases is to be completely phased out over a period of time (which varies from country to country and continent to continent). Cameroon promulgated new legislation to honor the international agreement, namely:

- 64/MINDIC/CAB of 12/5/95 relating to phasing out the CFCs
- 985/MINDIC/CAB of 15/10/96 relating to importation of equipment containing CFCs

The probability of using CFC's in the project is, therefore, relatively remote as all the refrigeration and air conditioning equipment entering Cameroon now uses alternative refrigerants.

The project under the Environmental and Social Impact Assessment will therefore automatically conform to this new legislation.

5.4.3.3. Impacts on water and surface water courses

The production of palm oil results in the generation of large quantities of polluted water commonly referred to as palm oil mill effluent (POME).

Typically, the production of 1 ton of crude palm oil (CPO) requires 5 to 7.5 ton of water; over 50 % of which ends up as POME (Ma, 1999).

The POME comprises a combination of wastewater from three main sources: clarification (60 %), sterilization (36 %) and hydrocyclone (4%) units (Ma, 2000).

Table 10: Typical Characteristics of the Palm Oil Mill Effluent (POME)

Parameter	*Average	Metal	*Average
pH	4.7	Phosphorous	180
Oil and Grease	4000	Potasium	2270
Biochemical Oxygen Demand (BOD_5)	25000	Magnesium	615
Chemical Oxygen Demand (COD)	50000	Calcium	439
Total Solids	40500	Boron	7.6
Suspended Solids	18000	Iron	46.5
Total Volatile Solids	34000	Manganese	2.0
Ammonical Nitrogen	35	Copper	0.89
Total Nitrogen	750	Zinc	2.3

*All in mg/l except pH.

(Source: Ma, 2000)

The discharge of POME, sometimes called liquid waste, has briefly been discussed above. The effluent which is heavily charged with COD and BOD has high TSS and low pH all these negative characteristics require to be attenuated prior to exiting POME into the environment. This POME pollution is regulated by Decree 2001/165/PM of May 8 2001.

Although POME is non – toxic, it cannot be safely discharged into local waterways due to its high acidity, high TSS, high BOD, and COD. If it is discharged into water courses, the biological reaction might deplete the dissolved oxygen in the water depriving aquatic species completely from this essential gas and thus, in effect, killing them. The suspended solids will deprive any aquatic vegetation of sunlight on which it is thriving and again, in effect, probably killing off the vegetation. The water as a result of being deprived of living organisms might become unfit for consumption in streams many kilometers down the line.

In addition to these characteristics, the various organic constituents of POME decompose in presence of anaerobic bacteria and aerobic bacteria into methane gas and carbon dioxide and thus as previously discussed, will contribute to Greenhouse Gases.

If POME is discharged on land, the consequences are less damaging. The decomposition, however, due to the aerobic bacteria, will emit carbon dioxide which again is not desirable from the point of view of climate change.

The usual treatment of POME is allowing it to stagnate for long periods of time in shallow lagoons where over time it is digested by anaerobic bacteria and loses its COD as well as BOD charge and its acidity is reduced through various natural chemical processes. When the COD charge drops to 250 mg/l and for BOD to 50 mg/l, it can safely be allowed to exit into the environment (Limits prescribed by Cameroon and the World Bank).

The attenuation of POME effluent is discussed further in details in Chapter 6.

5.4.3.4. Impacts on soil

The impacts on soils, which are of concern here, are those mainly by Hydrocarbons; Hydrocarbons and fuels which are omnipresent in all the ancillary activities associated with the extraction of Palm Oil.

The soil is generally impacted through accidental spills that can happen without warning during the dispensing of fuels, lubricating oils, through bad work practices, and non respect of correct procedures in the garage, workshops, or just through bad "Housekeeping" and general carelessness of personnel.

The impacts of hydrocarbons spills can have adverse effects on surface water courses and possibly also on shallow underground water sources. Soils contaminated by hydrocarbon spills must be remediated, a relatively expensive procedure which can be easily avoided through good work practices and a "Spill Response Plan".

The impacts discussed here are secondary and potential impacts and not impacts that result directly from the extraction of palm oil. They mostly can be attenuated through the personnel being aware of the right work procedures and practices, possessing basic environmental education, and concern for their environment. In addition, a well designed work space for mechanical activities and a drainage system

completely independent of any other drainage system is an essential element. The effluent exiting from this drainage system must be enhanced with an oil/water separator to ensure that no hydrocarbon exits to the outside.

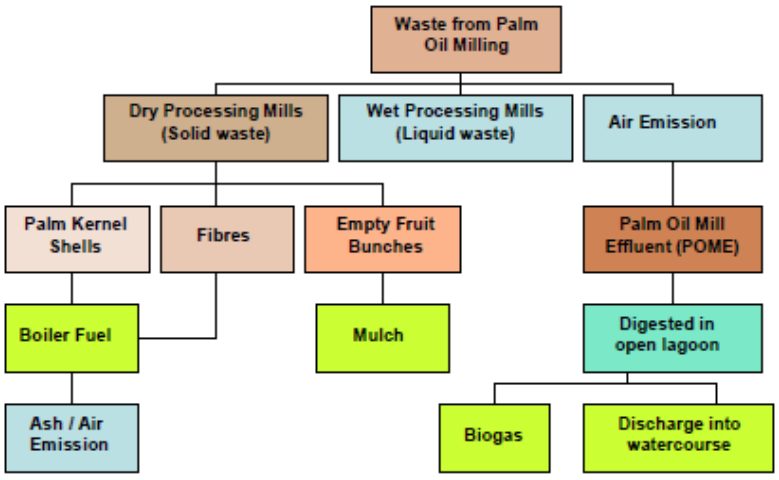
Discussion as to how this can be achieved and the spill preventing measures will be found in Chapter 6.

5.4.3.5. Impacts on the environment through the generation of solid waste

Waste as a rule is not desirable but it is unavoidable. All human processes generate waste which requires being absorbed one way or another to reduce its harm in the environment.

As in all agricultural industries the palm oil extraction industry are responsible for the production of a notable amount of agro-residues. In the past such residues have been utilized as animal feed or were allowed to decay naturally in fields, they were sometimes discarded or burnt. Such practices contributed adversely to water, soil and air quality as well as the survivability of living organisms in the surrounding ecosystems. Thus, it is apparent that new methods of treating agro-residues are needed in order to achieve sustainable management of agricultural waste.

The overall waste picture of palm oil extraction is presented below:



(Source: http://www.adb.org/Documents/Reports/Consultant/36557-INO/36557-INO-TACR-AppendixVII.pdf)

Figure 17: Sources of waste from a Palm Oil Mill

The air emission and the palm oil mill effluent (POME) also known as liquid waste have been discussed earlier (see above).

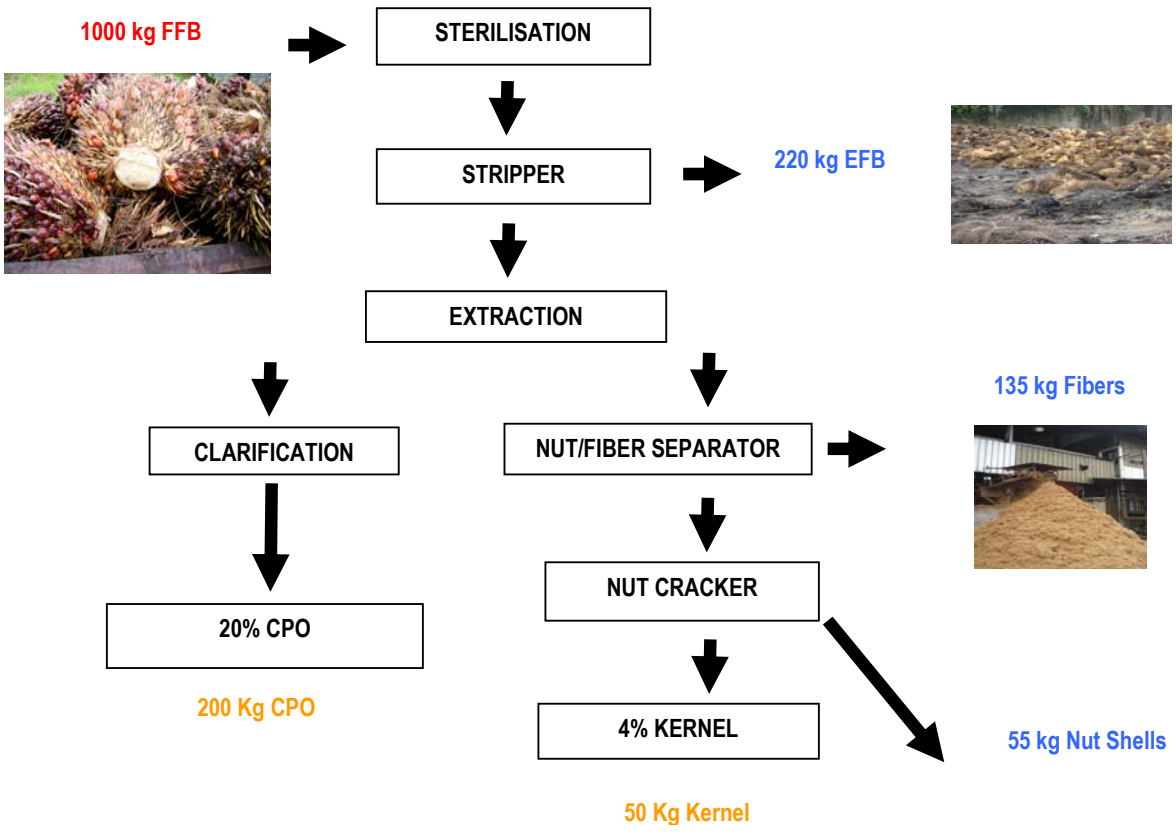
The solid waste resulting from the production of palm oil can be divided into two categories:

- Agri – Waste and
- General Waste.

The agri - waste comprises:

- The empty fruit bunch (EFB),
- The fibers, and
- The palm kernel shells.

Using the Agrinexus Implementation Plan for SGSOC's schematic flow diagram for Palm Oil and kernel extraction, the approximate waste production per 1,000 kilograms of Fresh Fruit Bunch (FFB) are drawn below:



Raw materials shown in red
Waste (agri - waste) in blue
Final product in orange

The first type of agri - waste that is produced in the process of palm oil extraction is the palm bunch stem, sometimes referred to as Empty Fruit Bunches (EFB). These are the stems to which the palm nut, together with its mesocarp which contains the sought after oil, is attached.

It is estimated that this agri – waste represents about 22% by weight of the total of fresh product that enters the facility for the extraction of oil.

The second type of agri – waste that is generated is the fiber that surrounds the palm nut or the fiber contained in the mesocarp (this mesocarp fiber holds the valuable oil which is being extracted).

It is estimated that this agri – waste represents about 13.5% by weight of the total of fresh product that enters the facility for the extraction of oil.

The third type of agri – waste generated consists of shells of the palm nut. This agri – waste is generated in the extraction of the kernel of the palm oil nut.

It is estimated that this agri – waste represents about 5.5% by weight of the total of fresh product that enters the facility for the extraction of oil.

In addition to the agri – waste the project will generate waste from other sources. The quantities will be considerably smaller but the generated waste will require correct recycling or disposal in order to not impact the environment.

This waste will consist of discarded car and equipment batteries, empty drums, paint debris, hydrocarbon contaminated debris from workshops; these come under the category of Hazardous waste and Non – Hazardous waste such as office waste, and household waste, paper, cardboard, glass, wood waste, building materials rubbish etc.

In order to rationally treat this waste in accordance with the legislation of Cameroon (Law 96/12 or 5/8/96 Articles 42 - 56), SGSOC requires to have a Waste Management Plan and an organization to implement the plan.

The education of personnel is another area of importance as far as respect of environmental procedures is concerned that Management should address.

Details of the anticipated waste stream that will be generated is to be found in Chapter 6 including the measures to be taken to attenuate the effect of this generated waste stream.

In the Environmental Management Plan Chapter of this Environmental and Social Impact Assessment suggestions will be given as to how to go about this problem. How should SGSOC structure its organization to satisfactorily cope with the stream of generated waste (Domestic and Industrial) in order to avoid or minimize impacts in the environment.

5.4.3.6. Social, economic and cultural impacts on population

See sub chapter 5.4.2. *"Environmental and Social Impacts of the Project: The Plantation Development"*

The public meetings were held with the population concerned, some with the different branches of Administration and another meeting was held with the different stakeholders.

In Yaoundé, the MINADER – Ministry of Agriculture and Rural Development, MINEE – Ministry of Water and Energy, MINIMIDT – Ministry of Industry, Mines, and Technological Development, MINCOMMERCE – Ministry of Commerce, MINSANTE – Ministry of Public Health, and the MINTSS – Ministry of Labor and Social Security were consulted.

In Buea, a meeting with the different stakeholders was held which included: Development and Conservation Organizations [GTZ (German Technical Cooperation), DED (German Development service), KfW/GFA (German Cooperation), PNPD, MUDEC (Municipal Development Counseling Group), WCS (World Conservation Society – USA), SODEWA (South West Development Authority), WWF], Local NGOs (Korup Rain Forest and Kreo-Kogan), the different Regional Delegates (MINEP, MINFOF, MINADER, MINEE, MINIMIDT, MINCOMMERCE, MINSANTE, MINDAF, MINTSS, MINAT) and the major company in the region: PAMOL.

Public consultation meetings were conducted with the 36 villages in the project area that will be affected by the project. Two meetings were held:

- Nguti Subdivision,
- Mundemba and Toko Subdivisions.

Some important observations have been made and they are discussed and addressed in Chapter 7.

5.5. Evaluation of relative importance and nature of the impacts

5.5.1. Introduction

The purpose of impact assessment and mitigation is:

- to identify and evaluate the significance of potential impacts on identified receptors and resources according to defined assessment criteria;
- to develop and describe measures that will be taken to avoid or minimize any potential adverse effects and enhance potential benefits; and
- to report the significance of the residual impacts that remain following mitigation.

We will use the **Leopold matrix** (Leopold et al., 1971), which is the best known matrix methodology available for predicting the impact of a project on the environment. We will be looking at the magnitude and the importance of each impact.

A matrix is a tool used for recognizing interactions between stakes, thrusts and phases. These interactions constitute impacts. Clarifying an interaction implies quantifying the magnitude and importance of such impact.

The Leopold matrix is a well known example which represents 88 environmental components on one axis and 100 actions on the other. Potential impacts are marked with a diagonal line in corresponding boxes and one can assign a numeric value to indicate their size or importance. The Leopold matrix is mainly used to develop other, less complex, matrices. The Leopold matrix is a two-way table that lists project activities at different stages and components of the biophysical, human and economic environment.

That is why for this ESIA, we will use a simpler matrix called Fecteau matrix.

The Fecteau matrix or grid in environmental and social impact assessment (ESIA) is a double-entry table that lists project activities at different stages and components of the biophysical, human and socio-economic environment, on the one hand, and measures impact on the basis of logical methods to give an esteemed value, on the other hand. It is used to evaluate one by one the most important interactions in the Leopold matrix based on the following indicators: the sensitivity of the environmental component, the magnitude, intensity and duration of impact. In each unit that shows a significant interaction between

an environmental action and element, evaluate the magnitude of impact by a subjective value and enter it in the corresponding unit (André, P. 2003, chap. 9.2).

Characteristics of environmental impacts vary. The main parameters used to characterize and assess impacts are:

- nature of the impact;
- magnitude;
- extent or location;
- duration;
- reversibility (or irreversibility);
- importance.

Nature

The most obvious impacts are those directly related to the project and can be directly attributed in space and time to the causal action. Indirect or secondary impacts generally cause less obvious changes occurring later and far from the source of impact. In general, cumulative effects are caused by the amplification of an impact when combined with the impacts of other projects completed recently or underway. Considered individually, these impacts may be insignificant, but together, they become important by virtue of their concentration in one place and frequency. The effects may be cumulative through the addition or interaction of different impacts such that the overall effect is greater than the sum of individual effects.

Magnitude

It is important to assess the magnitude of impacts. In general, magnitude is expressed in terms of severity (major, moderate or minor). Gravity, as opposed to the importance, also takes into account other aspects of the magnitude of impact, including its reversibility or irreversibility.

Reversibility or irreversibility

An impact is reversible when it can be remedied and it is irreversible when it is continuous even after the repeated application of mitigation measures.

Extent or Location

It is possible to predict the extent or geographical area of impact for each site. Depending on the type of impact, it is necessary to evaluate variation in magnitude. The extent of the impact refers to the range or magnitude, that is, the spatial distribution of the impact. Thus, an impact may be international, regional or local.

- The magnitude of an impact is regional if the impact is felt on a component in a large area or affects a large number of people.
- The magnitude of an impact is local if the impact is felt over a limited study area or a small group of people.
- The magnitude of an impact is sporadic if the impact is felt in a small and limited area or only by a few people.

Duration

An impact may last for a short term; in this case, it is referred to as a temporary impact. When it lasts for a long term, it is referred to as a permanent impact. A temporary impact may span several days, weeks or months. However, it must be reversible. In contrast, a permanent impact is irreversible and lasts a long term or is even permanent.

Importance

At this stage, the evaluation of the importance of the ESIA depends on the characteristics of the expected impact and its importance in decision-making. Generally, the importance of an impact is evaluated in terms of standards or criteria for determining what is tolerable. The significance of impact is evaluated according to three criteria:

- *Minor importance:* the magnitude of impact is low or almost nil. It is below the standards or laws in force. The effects are temporary and remain at the level of natural variation.
- *Moderate Importance*: negative impacts are moderate and include a wide scope of impacts, from the point where the impact is considered as minor to the point where the magnitude of impact is close to exceeding an established (legal) standard / limit. Reversibility is possible over a period of several years.
- *Major importance*: the impact is above standard and is sometimes irreversible.

Sometimes it is impossible to determine the significance of impact, or lack of knowledge or because the impact can be positive and negative.

Once an assessment is made of the magnitude and likelihood, the impact significance is rated through a matrix process (Fecteau Matrix). See below:

Intensity	Extent	Duration	Importance
High	Regional	Long Term	Major
		Short Term	Major
		Temporary	Major
	Local	Long Term	Major
		Short Term	Moderate
		Temporary	Moderate
	Precise	Long Term	Major
		Short Term	Moderate
		Temporary	Minor
Medium	Regional	Long Term	Major
		Short Term	Moderate
		Temporary	Moderate
	Local	Long Term	Moderate
		Short Term	Moderate
		Temporary	Moderate
	Precise	Long Term	Moderate
		Short Term	Moderate
		Temporary	Minor
Low	Regional	Long Term	Major
		Short Term	Moderate
		Temporary	Minor
	Local	Long Term	Moderate
		Short Term	Moderate
		Temporary	Minor
	Precise	Long Term	Minor

Magnitude	
Extent	**Local** – impacts that affect the project area.
	Regional – impacts that affect the region as determined by administrative boundaries (here the South West region of Cameroon).
	National – impacts that affect nationally important environmental resources.
	International – impacts that affect internationally important resources such as areas protected by international conventions.
Duration	**Temporary** – impacts are predicted to be of short duration and occasional.
	Short-term – impacts that are predicted to last only for the duration of the construction period.
	Long-term – impacts that will continue for the life of the Project, but ceases when the Project stops operating.
	Permanent – impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.
Intensity	**Negligible** – the impact on the environment is not detectable or there is no perceptible change to people's way of life.
	Low – the impact affects the environment in such a way that natural functions and processes are not affected or the communities are able to adapt.
	Medium – where the affected environment is altered but natural functions and processes continue, albeit in a modified way or the communities are able to adapt with some difficulties.
	High – where natural functions or processes are altered to the extent that it will temporarily or permanently cease or the communities affected will not be able to adapt to changes.

The rating of the matrix will be as follow:

IMPORTANCE				
		LIKELYHOOD		
		Unlikely	**Likely**	**Definite**
		The Impact is unlikely to occur.	The Impact is likely to occur under most conditions.	The impact will occur.
MAGNITUDE	**Negligible**	Negligible	Negligible	Minor
	Low	Negligible	Minor	Minor
	Medium	Minor	Moderate	Moderate
	High	Moderate	Major	Major

5.5.2. Evaluation of the importance of the impacts

Table 11: importance of impacts evaluation matrix

Project Phase	Activity/Source of Impact	Medium affected	Effects of the impact	Evaluation of the importance of the impact			
				Extent	Duration	Intensity	Importance
Nursery Establishment (15 hectares)	Site clearing	Biodiversity	Loss of habitat (Fauna and Flora)	Local	Permanent	Medium	Major
		Water	Flood incidents downstream	Local	Long term	Low	Moderate
			Turbidity of the water	Local	Short term	Low	Minor
		Soil	Soil erosion - Loss of arable soil in the area	Local	Long term	Low	Moderate
	Open burning of the biomass	Air	Elevated particles in the air - atmospheric pollution + Climate change	Regional	Temporary	Medium	Moderate
	Construction of the base camp	Visual impact	Land use	Local	Permanent	Negligible	Minor
	Traffic	Air	Dust and noise	Local	Long term	Low	Moderate
	Degradation of the biomass	Soil	Pest infestation	Local	Short term	Low	Minor
	Use of agrochemicals	Water and soil	Pollution of the soil and water courses	Local	Permanent	Medium	Major
	Use of petrochemicals			Local	Permanent	Medium	Major
	Sewage from workers			Local	Long term	Medium	Moderate
	Waste from the nursery: - Domestic waste	Waste management	Soil pollution	Local	Long term	Negligible	Moderate
	Waste from the nursery: - Hazardous waste (Used oils, empty chemical products containers, used polybags)	Waste management	Soil pollution	Local	Long term	Medium	Moderate
Plantation Development	Site clearing, construction of roads, and establishment of the base camp	Biodiversity (Habitat)	Loss of habitats	Local	Permanent	Medium	Major
			Loss of species	Local	Permanent	Medium	Major
			Loss of Non-Timber Forest Products (NTFPs) (Ex. country onion, bush pepper, bush mango, bitter kola, red Cola, monkey cola, Njabe, and many other spice species)	Local	Permanent	Medium	Major

Plantation Development	Site clearing, construction of roads, and establishment of the base camp	Biodiversity (Habitat)	Limited natural resources for the villagers and the new migrants (foods, wood as fuel for cooking, etc.)	Local	Permanent	Medium	Major
			human – elephant conflict with destruction of the plantations near the Bayang Mbo Wildlife Sanctuary	Local	Temporary	Low	Minor
			The connectivity and biodiversity corridors will be impacted because the proximity with the Korup National Park and the Bayang Mbo Wildlife Sanctuary.	Regional	Permanent	Medium	Major
			Increase in poaching by the population.	Regional	Permanent	Medium	Major
		Land	Loss of the villagers' farmland.	Local	Permanent	High	Major
		Water	Increase in surface runoff due to the reduction of infiltration and soil erosion	Regional	Permanent	Medium	Major
		Soil	Soil erosion	Regional	Permanent	Medium	Major
	Open burning of the biomass	Air	Massive atmospheric pollution with elevated ambient total suspended particulates.	Regional	Temporary	Medium	Moderate
			The release CO_2 into the atmosphere will contribute to climate change.	Interna-tional	Temporary	High	Major
	Degradation of the biomass	Soil	Biomass will provide shelter for certain pests such as rodents	Local	Temporary	Low	Minor
	Usage and application of agro-chemicals (fertilizers, pesticides, fungicides, insecticides, etc…)	Water	"Euthrophication" in the surface water causing growth of vegetation and affecting aquatic life.	Regional	Permanent	High	Major
			High levels of chemicals can affect the quality of water, the aquatic life and even the supply of freshwater.	Regional	Permanent	High	Major
	Use of generators in the plantation for the water pump or the camp	Water and Soil	Pollution by hydrocarbons by spillage.	Regional	Permanent	High	Major
	Sewage generated in the base camp	Water	An increase in the level of COD, BOD, and microbiological contents in	Local	Long term	Medium	Moderate

Plantation Development			the water system. It will lead to a bad odor and breeding of mosquitoes and flies.				
	The plantations will allow a certain type of pest infestation		Leaf-Eating Caterpillars – Nettle Caterpillars and Bagworms.	Local	Long term	Medium	Moderate
			Mammalian Pests – Rats (vertebrate pest).	Local	Long term	Medium	Moderate
			Insect Pests – Rhinoceros Beetle.	Local	Long term	Medium	Moderate
	Transportation of the Fresh Fruit Bunch (FFB) to the palm oil mills and of the oil palm to the port.	Air	Dust and noise pollution.	Local	Temporary	Low	Minor
	Waste	Soil	Soil pollution by empty containers (agrochemicals, hydrocarbon substances such as oil, grease, lubricant, etc…), dirty towels, etc…	Local	Long term	Medium	Moderate
	Plantation development	Population	Loss of land and NTFP (such as "bush meat", medicinal plants, and wood for cooking).	Local	Permanent	Medium	Major
			Destruction of community-based economy.	Regional	Long term	Low	Major
			Exposure to health risks (Malaria, HIV AIDS, STD, etc…).	Regional	Long term	Medium	Major
			Food security.	Regional	Long term	Medium	Major
			Insecurity.	Regional	Long term	Low	Major
			Destruction of indigenous cultural values.	Local	Permanent	Medium	Major
Palm Oil Mill Construction	Exhaust emission of CO, SO_2, NO, NO_2 and Particulate Matter PM_{10} which result from the combustion of the palm oil fiber and nut shell			International	Long term	Low	Major
	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the combustion of the stand-by fossil fuel generators			International	Long term	Medium	Major

Palm Oil Mill Construction	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the transportation of the FFB to the Palm Oil Mill for processing from the plantation by trucks	Air	Air pollution	International	Long term	Medium	Major
	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the transportation of Crude Palm Oil (CPO) for export or to the port by third party trucks			International	Long term	Medium	Major
	Emission of Methane CH_4 from the shallow ponds as a result of digestion by anaerobic of the Palm Oil Mill Effluent (POME)			International	Long term	Medium	Major
	Possible use of Ozone Depleting Substances (ODS)			Local	Long term	Low	Moderate
	The discharge of untreated process effluent (POME) and other contaminated effluents	Water	Water pollution and eutrophication of water courses	Regional	Long term	Medium	Major
	Spill of hydrocarbon (or other hazardous substances)	Soil	Undesirable effects affecting underground water sources and human health	Regional	Long term	Medium	Major
	Generation of solid waste • Agri waste	Soil	Soil pollution	Local	Long term	Low	Moderate
	Generation of solid waste • Office waste such as paper • Used oils, • Towels dirtied with oils, • Empty containers from the workshop and the garage, • Etc.…	Soil	Soil pollution	Local	Long term	Medium	Moderate

6.0. MEASURES ENVISAGED TO ELIMINATE, ATTENUATE, OR COMPENSATE FOR THE IMPACTS OF THE PROJECT (PLANTATIONS + PALM OIL MILL) ON THE ENVIRONMENT

6.1. Introduction

The chapter will help assist in determining possible preventive, remedial or compensatory measures for each of the adverse impacts evaluated as significant in chapter 5. The implementation of the mitigations is ensured through the Environmental & Social Management Plan (ESMP) (Chapter 9).

SGSOC is a member of the Roundtable on Sustainable Palm Oil (RSPO), a non-profit organization that aims to produce sustainable palm oil worldwide. The mission of the RSPO is to promote the growth and use of sustainable palm oil through co-operation within the supply chain and open dialogue with its stakeholders.

The RSPO has adopted and published a set of principles and criteria to help oil palm producers be more sustainable. They are listed below:

Principle 1: Commitment to transparency

Criterion 1.1 Oil palm growers and millers provide adequate information to other stakeholders on environmental, social and legal issues relevant to RSPO Criteria, in appropriate languages & forms to allow for effective participation in decision making.

Criterion 1.2 Management documents are publicly available, except where this is prevented by commercial confidentiality or where disclosure of information would result in negative environmental or social outcomes.

Principle 2: Compliance with applicable laws and regulations

Criterion 2.1 There is compliance with all applicable local, national and ratified international laws and regulations.

Criterion 2.2 The right to use the land can be demonstrated, and is not legitimately contested by local communities with demonstrable rights.

Criterion 2.3 Use of the land for oil palm does not diminish the legal rights, or customary rights, of other users, without their free, prior and informed consent.

Principle 3: Commitment to long-term economic and financial viability

Criterion 3.1 There is an implemented management plan that aims to achieve long-term economic and financial viability.

Principle 4: Use of appropriate best practices by growers and millers

Criterion 4.1 Operating procedures are appropriately documented and consistently implemented and monitored.

Criterion 4.2 Practices maintain soil fertility at, or where possible improve soil fertility to, a level that ensures optimal and sustained yield.

Criterion 4.3 Practices minimize and control erosion and degradation of soils.

Criterion 4.4 Practices maintain the quality and availability of surface and ground water.

Criterion 4.5 Pests, diseases, weeds and invasive introduced species are effectively managed using appropriate Integrated Pest Management (IPM) techniques.

Criterion 4.6 Agrochemicals are used in a way that does not endanger health or the environment. There is no prophylactic use, and where agrochemicals are used that are categorized as World Health Organization Type 1A or 1B, or are listed by the Stockholm or Rotterdam Conventions, growers are actively seeking to identify alternatives, and this is documented.

Criterion 4.7 An occupational health and safety plan is documented, effectively communicated and implemented.

Criterion 4.8 All staff, workers, smallholders and contractors are appropriately trained.

Principle 5: Environmental responsibility and conservation of natural resources and biodiversity

Criterion 5.1 Aspects of plantation and mill management that have environmental impacts are identified, and plans to mitigate the negative impacts and promote the positive ones are made, implemented and monitored, to demonstrate continuous improvement.

Criterion 5.2 The status of rare, threatened or endangered species and high conservation value habitats, if any, that exist in the plantation or that could be affected by plantation or mill management, shall be identified and their conservation taken into account in management plans and operations.

Criterion 5.3 Waste is reduced, recycled, re-used and disposed of in an environmentally and socially responsible manner.

Criterion 5.4 Efficiency of energy use and use of renewable energy is maximized.

Criterion 5.5 Use of fire for waste disposal and for preparing land for replanting is avoided except in specific situations, as identified in the ASEAN guidelines or other regional best practice.

Criterion 5.6 Plans to reduce pollution and emissions, including greenhouse gases, are developed, implemented and monitored.

Principle 6: Responsible consideration of employees and of individuals and communities affected by growers and mills

Criterion 6.1 Aspects of plantation and mill management that have social impacts are identified in a participatory way, and plans to mitigate the negative impacts and promote the positive ones are made, implemented and monitored, to demonstrate continuous improvement.

Criterion 6.2 There are open and transparent methods for communication and consultation between growers and/or millers, local communities and other affected or interested parties.

Criterion 6.3 There is a mutually agreed and documented system for dealing with complaints and grievances, which is implemented and accepted by all parties.

Criterion 6.4 Any negotiations concerning compensation for loss of legal or customary rights are dealt with through a documented system that enables indigenous peoples, local communities and other stakeholders to express their views through their own representative institutions.

Criterion 6.5 Pay and conditions for employees and for employees of contractors always meet at least legal or industry minimum standards and are sufficient to meet basic needs of personnel and to provide some discretionary income.

Criterion 6.6 The employer respects the right of all personnel to form and join trade unions of their choice and to bargain collectively. Where the right to freedom of association and collective bargaining are restricted under law, the employer facilitates parallel means of independent and free association and bargaining for all such personnel.

Criterion 6.7 Child labor is not used. Children are not exposed to hazardous working conditions. Work by children is acceptable on family farms, under adult supervision, and when not interfering with education programs.

Criterion 6.8 The employer shall not engage in or support discrimination based on race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation, or age.

Criterion 6.9 A policy to prevent sexual harassment and all other forms of violence against women and to protect their reproductive rights is developed and applied.

Criterion 6.10 Growers and millers deal fairly and transparently with smallholders and other local businesses.

Criterion 6.11 Growers and millers contribute to local sustainable development wherever appropriate.

Principle 7: Responsible development of new plantings

Criterion 7.1 A comprehensive and participatory independent social and environmental impact assessment is undertaken prior to establishing new plantings or operations, or expanding existing ones, and the results incorporated into planning, management and operations.

Criterion 7.2 Soil surveys and topographic information are used for site planning in the establishment of new plantings, and the results are incorporated into plans and operations.

Criterion 7.3 New plantings since November 2005 (which is the expected date of adoption of these criteria by the RSPO membership), have not replaced primary forest or any area containing one or more High Conservation Values.

Criterion 7.4 Extensive planting on steep terrain, and/or on marginal and fragile soils, is avoided.

Criterion 7.5 No new plantings are established on local peoples' land without their free, prior and informed consent, dealt with through a documented system that enables indigenous peoples, local communities and other stakeholders to express their views through their own representative institutions.

Criterion 7.6 Local people are compensated for any agreed land acquisitions and relinquishment of rights, subject to their free, prior and informed consent and negotiated agreements.

Criterion 7.7 Use of fire in the preparation of new plantings is avoided other than in specific situations, as identified in the ASEAN guidelines or other regional best practice.

Principle 8: Commitment to continuous improvement in key areas of activity

Criterion 8.1 Growers and millers regularly monitor and review their activities and develop and implement action plans that allow demonstrable continuous improvement in key operations

(Source - RSPO Principles and Criteria for Sustainable Palm Oil Production. Guidance Document. March 2006.)

In compliance with the RSPO guidelines, SGSOC has conducted a *High Conservation Value Forest (HCVF) Assessment* on its concession. The study was conducted in December 2010 by Augustus Asamoah, an Approved RSPO Assessor and the following observations were made:

HCV1: Globally or Nationally Significant Concentrations of Biodiversity Values

Aside from the African forest elephant whose feeding activity was identified at the eastern side of the concession near the Bayang Mbo Wildlife Sanctuary, no globally threatened or nationally protected fauna species known to occur in the region of the concession were identified within the concession during the baseline survey. The baseline flora study however identified eleven globally threatened plant

species, comprising of four endangered species, six vulnerable and one near threatened plant species on the concession. All the eleven globally threatened plant species are common and abundant within the moist evergreen lowland Congolian forest.

HCV 2: Globally, Regionally or Nationally Significant Large Landscape Level Forests

The 80,506 ha concession consists largely of degraded secondary forest and completely lacking any significant stretch of un-fragmented and undisturbed forest cover. HCV 2 does not exist within the concession.

HCV 3: Forest Areas that are in or contain rare threatened and Endangered Ecosystems

Baseline flora studies did not record the presence of any rare, threatened or endangered ecosystems on the concession and therefore the area as it is now does not contain any habitat or ecosystem that constitute HCV 3.

HCV 4: Forest Areas that Provide Basic Services of Nature in Critical Situations

The entire area of the concession may not be a watershed of any major river or stream, but there are clearly patches of forest areas which are important for some of the rivers and streams within the concession and as such constitute a HCVF. There is however the need for proper identification and documentation of all such habitats in order to design and implement the appropriate intervention measures.

Terrain models of the site show that some areas of the concession are at an altitude in excess of 650 meters above sea level. Isolated hills with steep-sided peaks are usually prone to erosion especially when their natural cover vegetations are removed. All such areas on the concession constitute HCVF and must be identified for appropriate intervention measures.

HCV 5: Forest Areas Fundamental to Meeting Basic Needs of Local Communities

The baseline socio-economic study on the concession showed that the thirty-eight communities have a high degree of livelihood dependency on the resources in the concession area. Being primarily farmers, the people are dependent on the land for farming which is their main occupation, consume bushmeat and fish from the streams and rivers for animal protein, use herbal medicine for their health care and streams and rivers in the concession area for their daily water needs. The communities also depend primarily on chain-sawn wood for the construction of their houses. Thus the livelihoods of the people in the thirty-eight communities are inextricable linked to the natural resources on the concession area.

The concession area therefore constitutes an HCVF. Appropriate intervention measures would be required to manage the situation and avoid potential land use conflicts.

HCV 6: Forest Areas Critical to Local Communities Traditional Cultural Identity

There is a lack of information on the socio-economic and cultural study regarding the cultural and traditional belief system of the thirty-eight communities within the concession area, however, during the site visit of Fabe Village, two sacred sites were found. The sites are a burial and traditional ritual ground which the community regards as sacred and would want to maintain them as such. These sites are potential HCVFs and there is the possibility that similar sites may exist in some of the other communities on the concession. With the proposed plan to exclude each of the major settlements and their farmland areas, any such traditional sacred sites are likely to be protected from oil palm plantation development.

To conclude on the HCVF assessment findings, the information available on the SGSOC concession area indicates gross habitat degradation following years of intense selective logging, land clearance for farming and settlement development. Although there are small isolated forest fragments in the inaccessible areas of the concession, some of which are in relatively good condition, the concession area as a whole is grossly degraded and does not in any way constitute a primary forest. Implementation of the proposed oil palm plantation development will therefore not contravene the existing Roundtable on Sustainable Palm Oil (RSPO) principle that prohibits the development of new oil palm plantations on primary forests.

Further details, including recommendations, can be found in the HCVF report in the Annex section.

6.2. Nursery Establishment – Mitigation of the impacts

Zero burning

As a member of the RSPO, SG Sustainable Oils Cameroon will practice zero burning for the nursery development. This technique will eliminate air pollution.

The biomass will be left to decompose naturally and be use as mulch for the seedlings.

The Zero Burning policy will help the conservation of organic soils and reduce the possibility of wild fire.

During the development of the plantations, buffer zones will be maintained around sensitive areas and water courses.

Optimal use and application of the agro-chemicals

The use of agrochemicals should follow strictly the plant requirements.

Chemical use for pest control

Application of the zero burning method can result in a pest infestation because of the decomposition of the biomass. If the infestation is extensive, the problem can be mitigated by controlled usage of pesticides.

Sanitation

When building the workers' houses, toilets with a septic tank should be constructed because improper sanitation facilities can lead to a disease outbreak.

A system to dispose of domestic waste should also be put in place to prevent and avoid scavengers.

Decree No. 039/MTPS of 26 November 1984 lays down general measures for hygiene and safety at the work place. This decree regulates the respective obligations of employers and employees; there are a specific number of restrooms, washroom and boxes to be provided by SGSOC to its employees.

Management of hazardous substances

The nursery will have oil/grease wastes from fuel and other petrochemical substances such as lubricants that will be used for the generators. These substances can be a source of soil and/or water pollution. Fuel dispensers have to be used by a well trained person to prevent accidental spillage.

All empty containers that contained hazardous substances (agrochemicals or petrochemicals) have to be collected for proper disposal.

The used oil has to be stored carefully for reuse or disposal (it can be recuperated by a recycling company).

Traffic

Traffic signals and speed limits should be placed along the roads to the nursery.

All SGSOC drivers should be trained by a road safety specialist.

Occupational health and safety

According to decree No. 039/MTPS of 26 November 1984 laying down general measures for hygiene and safety at the work place, All SGSOC workers should have Personnel Protective Apparels (Safety boots, heavy duty gloves, respiratory masks, etc…).

6.3. Plantations – Mitigation of the impacts

6.3.1. Mitigation of the ecological impacts

In chapter 5, we identified several ecological impacts due to the development of the plantation. Amongst those impacts, the most important ones are: the loss of habitats and species.

To attenuate the effects of those impacts, a number of measures have to be taken into consideration:

1. Being a member of the RSPO, SGSOC cannot cut down primary forest to develop an oil palm monoculture. SGSOC made sure through a High Conservation Value Forest (HCVF) assessment that its concession contains no environmental and social values, such as unique biodiversity, watershed protection, soil stabilization or an archaeological site. The use of the HCVF concept is an important step towards better forest management and protection. It provides a rational basis for use and protection of forests of high conservation value.

2. The SGSOC concession area is adjacent to two protected areas as listed by the World Database on Protected Areas (WDPA 2006 version): the Korup National Park and Bayang Mbo Wildlife Sanctuary**.**

   The present Korup National Park is part of a Forest Reserve declared in 1937. Korup National Park (KNP) is the first park created in Cameroon's forest zone and gazetted in 1986 by Presidential Decree N^{o}. 86/1283 of October 30th 1986. A Ministerial Decision N° 0636/D/MINEF/SG/DFAP of 13th November 2002 to reorganize the Park and its first Management Plan was implemented by the Ministry in charge of Forestry and Wildlife for a period of five years (2002-2007). The second KNP Management Plan runs from 2008 to 2013.

   Bayang Mbo Wildlife Sanctuary lies between the towns of Nguti and Bangem. The Decree No. 96/119/PM of 12 March 1996 created the Banyang Mbo Wildlife Sanctuary.

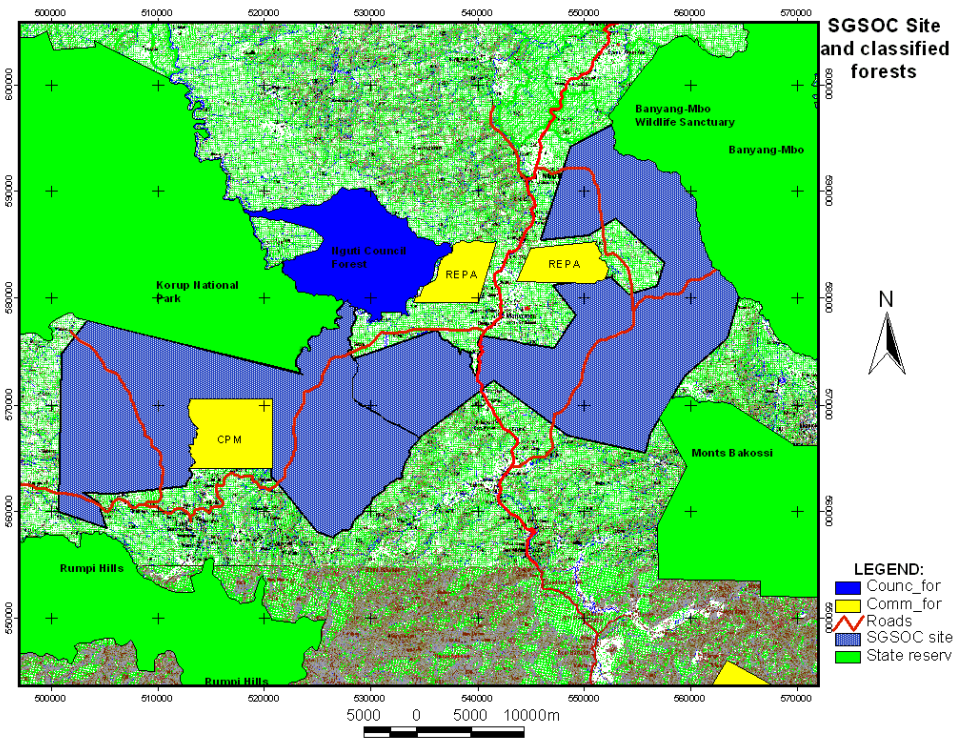
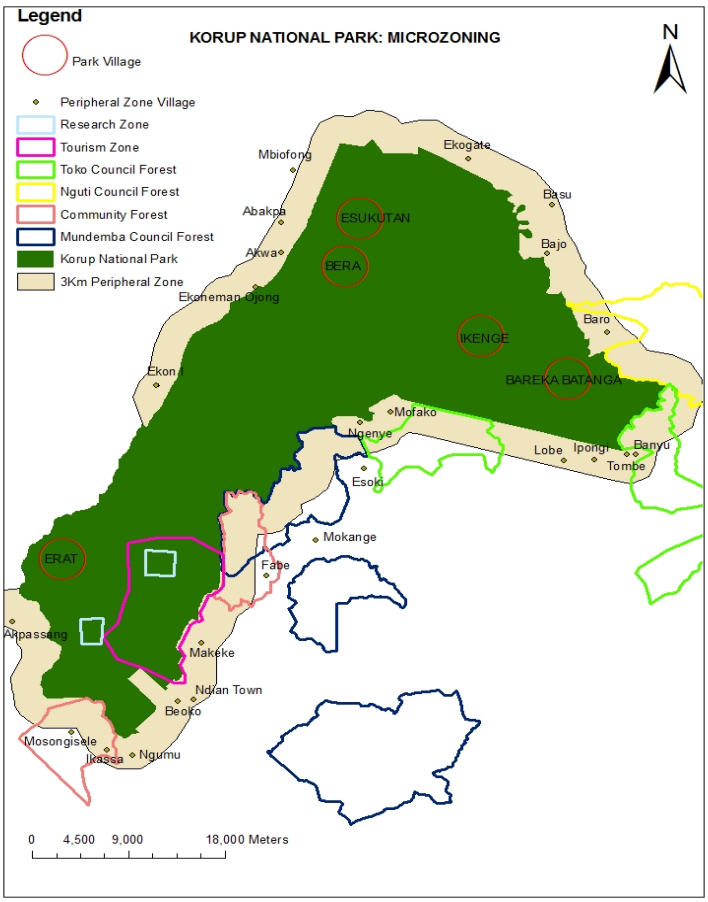


Figure 18: SGSOC Concession, the Korup National Park and the Banyang Mbo Wildlife Sanctuary

The **Management Plan of Korup National Park and its Peripheral Zone (2008-2013)** was written to assure the management of the biodiversity, maintenance of the integrity of KNP, and to contribute to the socio-economic development at the local, regional, national, and sub-regional levels through the full involvement of all stakeholders.

The KNP Management Plan states that a three (03) kilometers peripheral zone should be left around the park as a buffer zone. A Ministerial Decision N° 0636/D/MINEF/SG/DEFAP/CEP/SIF of 13th November, 2002 made the Peripheral Zone a legal entity in the management of KNP.

There is already a 500 meter distance between the KNP and the SGSOC concession, an additional 2,500 meters has to be left out to complete the buffer zone.



(Source: Management Plan of Korup National Park and its Peripheral Zone (2008-2013))

Figure 19: The Korup National Park and its 3 km buffer zone

The Bayang Mbo Wildlife Sanctuary has no management plan, but a buffer zone has to be left out for its protection. The Mbu river acts as a natural boundary between the Bayang Mbo Wildlife Sanctuary and the SGSOC concession, however, in addition to the river, a 500 meters buffer zone will be implemented between the BMWS and the SGSOC.

Protected area buffer zones can be defined as areas adjacent to protected areas on which land use is partially restricted to give an added layer of protection to the protected area itself.

See figure below.

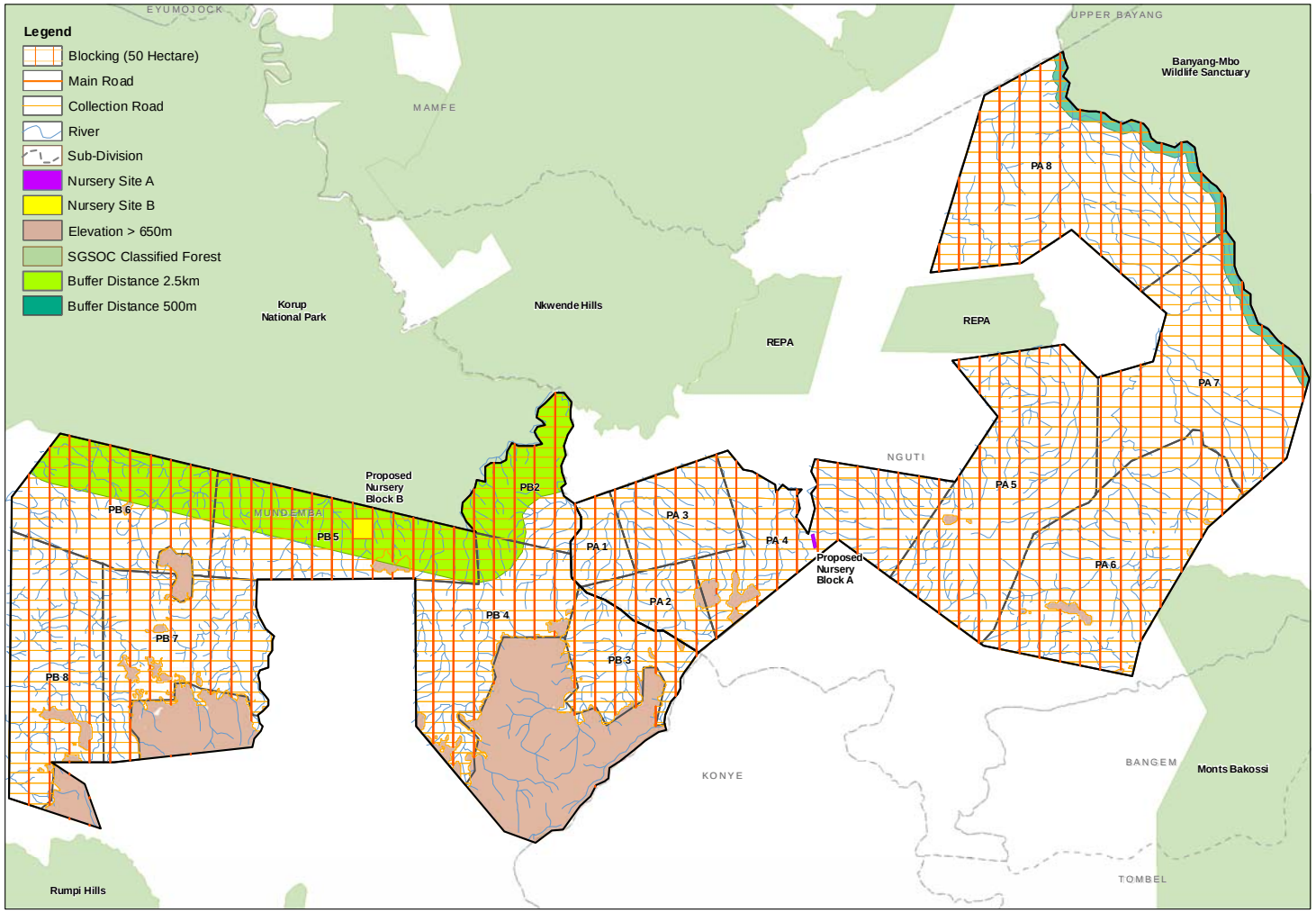


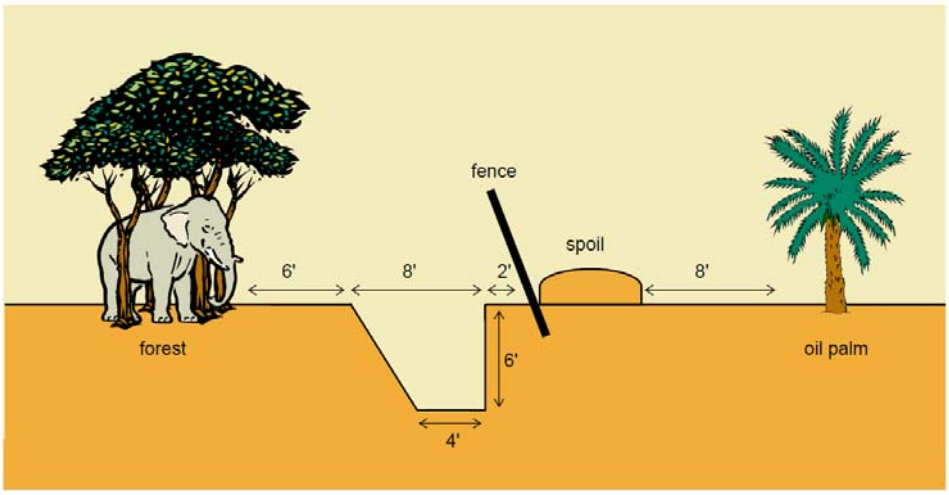
Figure 20: The buffer zones

3. To attenuate the loss of species, corridors should be left out to help the evacuation of the animals. Corridors facilitate the natural patterns of migration and will probably be most successful at protecting species.

4. In the SGSOC Project area, the Flora survey has pointed out the presence of eight trees species that were on the IUCN red list with 06 being classified as vulnerable [VU], 01 endangered [EN] and 01 as near threatened [NT] (see appendix 2 in the Annex – Flora Survey). These species are all abundant in the lowland rain forest region of Cameroon; hence the impact will be minor. As land is converted, some part of the forest can be fragmented as patches and remain undisturbed to save those species.

5. In the event that any IUCN or wildlife species protected by the Cameroon Wildlife Law move from the protected areas into the concession and is trapped or hurt during land clearing operations, the Ministry of Wildlife and Forestry (MINFOF) Divisional Wildlife Services must be informed for possible trans-location or saving the species in question. SGSOC should allocate fund for such an eventuality.

6. The human – elephant conflict should be resolve by using the WWF Better Management Practice (Chong Kah Fui, 2005). They are:
    - Leave a buffer zone
    - Leave a corridor
    - Install electrified fences
    - Build trenches
    - Use repellents
    - Guard the plantation



[Source: WWF Better Management Practice (Chong Kah Fui, 2005)]

Figure 21: Trenches with the recommended dimensions in inches.

7. The SGSOC concession is 80,506 hectares. The development of this area is phased out over 8 years. SGSOC should plan its development every year over a large period of time. By clearing smaller blocks (250 to 500 hectares), it will minimize the impact on the fauna as they will have time to move.

The phasing out of the plantation development will also help identify and control impacts such as flood zones and a lower amount of biomass to manage.

8. There will be no loss in village farms because by SGSOC signing the Memorandum Of Understanding (MOU) with the villages' chiefs, it has giving its word of not touching any farm or village plantations (Palm oil, Cocoa, Banana, etc…) and leaving farmland for the future generation.

Before the plantation development, a team composed of the villagers, SGSOC personal, Subdivision Farm Council, and Regional Delegation of the Ministry of State Property and Land Tenure will go on the field and do the "Demarcation".

9. The problem of the loss of Non-Timber Forest Products (NTFPs) (for example, country onion, bush pepper, bush mango, bitter kola, red cola, monkey cola, Njabe, and many other spice species) can be resolved by leaving some forest area in the plantations. This forest can act as a

buffer zone and can be used as a shelter for the animals that are going to be used for pest control.

10. There are several ways to attenuate the impact resulting from the limited natural resources for the villagers and the new migrants (foods, wood as fuel for cooking, etc.):
    - A ranch should be created by SGSOC to provide its workers and the villagers with meat (Cows, Sheep, Poultry, etc….)
    - The Palm Oil Mill can provide every one with fuel for cooking. The waste (Fiber + Nut shelves) can be compacted into briquettes and be sold or given to the workers and the population around the area. SGSOC can invest into a Bio Compactor to produce the briquettes.

11. SGSOC should have a no poaching policy; there should be strictly no hunting within the plantation area as well as the surrounding area. SGSOC must set up security gates on roads leading into all the coupes in the blocks. Security men must also conduct search for weapons, trapping materials and carcasses when vehicles enter or leave the Project site.

12. SGSOC should also work closely with the KNP management to help minimize the impacts of the SGSOC plantation on the KNP. Same with the BMWS.

6.3.2. Mitigation of the impacts due to the open burning of the biomass

As a member of the RSPO and referring to criteria 5.5, 5.6, and 7.7 of the RSPO guidelines, SGSOC will practice the RSPO "Zero Burning" Policy. This practice will help minimize or eliminate the air pollution problem and therefore the problem of the emission of greenhouse gases.

With the "Zero Burning" technique, the biomass will be left to decompose naturally and will be used as mulch to improve the fertility of the soil.

The big trees will be used in the construction of the base camps, offices, and storage rooms.

According to *WWF Palm Oil Best Management Practices: Eliminating burning*, "the main benefit derived from zero burning is the nutrients from the biomass decomposition that can be utilized by newly planted trees. This reduces per-hectare inorganic fertilizers needed at the time of planting and the organic

matter also improves the soil and when used properly, can help with terracing and the reduction of runoff".

6.3.3. Mitigation of the impacts on hydrological and drainage system

The Impact on the hydrological and drainage system due to the site clearing can be attenuated by a good management of available fresh water to minimize soil erosion and nutrient losses.

According to the Agrinexus Implementation Plan, leguminous cover crops will be use to help minimize soil erosion by reducing the depressive power of raindrops and acts as an impediment to surface run-off.

Detailed hydrological studies should be carried out for each phase of the proposed plantation development to help determine the flood areas and help design the sizes of the drains and culverts.

The status of surface and ground water should also be monitored. SGSOC should develop a Water Management Plan.

SGSOC should leave a riparian reserve of about 20 meters (HCVF Assessment Report) around the rivers and streams for the purpose of minimizing the amount of sediments entering the river system and erosion of riverbanks.

6.3.4. Mitigation of the impacts on water due to the use of agrochemicals

The use of agrochemicals is very expensive thus the application of the fertilizer should be based on the plant requirements. Mulch from the decomposed biomass can be used as fertilizer as well as the Empty Fruit Bunch from the Palm Oil Mill. The use of organic fertilizer will minimize the impacts of the chemicals in the soil, waterways, and lighten the fertilizers' budget.

For pest control, an Integrated Pest Management Program was put in place by Agrinexus for SGSOC. This program will use chemical, cultural, biological, and physical practices to control the infestations.

The agrochemicals should be well stored and handled to avoid spills.

Workers should be warned of the danger of these products and trained on the way to handle them, use them, and dispose of their used containers.

All the Agrochemicals listed in chapter 5 that will be use in the SGSOC plantations are approved by the *Secretariat of the Commission of the National Registration Commission of Phytosanitary Products and Certification of Sprayers of the Ministry of Agriculture and Rural Development.* See in the Annex, the List of Approved Products – February 16, 2010.

The application of pesticides and fertilizers should be in strict accordance with the manufacturer's instructions and generally established safety procedures. Every chemical product must have their Material Safety Data Sheet (MSDS).

SGSOC should have these procedures and instructions available as a form of Company Instruction for Application of Pesticides and Fertilizers.

SGSOC should consider the preparation of such instructions which would incorporate all elements including of safe handling of some of the chemicals and integrate in these instructions the guide for "Pesticide Handling and Application" (International Finance Corporation 1998 B; World Bank private sector arm).

It should also be noted that the SGSOC should not make use of POP or Persistent Organic Pollutants banned under Stockholm Convention which came into force on the 17th of May 2004 and which Cameroon subscribed to on the 5th of October 2001. This International Convention banned:

- Aldrin
- Chlordane
- Dieldrin
- Dioxinx (PCDDs)
- DDT
- Endrin
- Furans
- Heptachlor
- Hexachlorobenzene
- Mirex
- Polychlorinated biphenyls
- Toxaphen

6.3.5. Mitigation of the impacts on water and soil due to hydrocarbons

The development of a plantation will use machineries such as generators for the water pumps and the life on the base camps, bulldozers for the site clearing, trucks, cars, chainsaws, etc… All these equipments will use fuel to function. There will also be oil, grease, and lubricants for the equipments.

All these petrochemicals should be well stored, handled, and disposed of to avoid spillage, and thus avoid soil and waterways pollution. SGSOC will have to put in place an oil/water separator next to the workshop drainage system. Workers should be warned of the danger of these products and trained on the way to handle them, use them and dispose of their used containers. SGSOC has to put in place a "Spill Response Plan".

6.3.6. Mitigation of the impacts on water due to sewage from the base camps

It is recommended that proper sanitation be provided to all staff as human gastrointestinal parasites and pathogens can be spread to wildlife via water.

During pre-construction and construction stage, sufficient units of temporary septic tank will be provided to treat the raw sewage from site workers.

During the operational phase, toilets with septic tank have to be build and maintained. The Cameroonian Decree No. 039/MTPS of 26 November 1984 lays down general measures for hygiene and safety at the work place states that there should be:

- 1 washroom for 15 employees
- 1 restroom for 15 employees
- A sufficient number of boxes.

6.3.7. Mitigation of the impacts on soil due to soil erosion

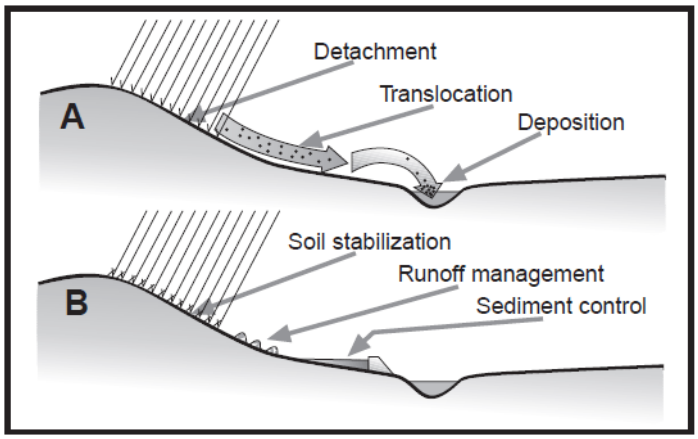
The proposed site will be developed by phases. So the site clearing and earthwork activities will also be carried out phase by phase in order to reduce soil erosion.

According to the Agrinexus Implementation Plan, leguminous cover crops will be use to help minimize soil erosion.

Leguminous cover crops also assist soil conservation and moisture retention by:

1. Intercepting of rainfall (absorbing the energy of the raindrops, thus reducing runoff).
2. Retarding erosion by decreasing surface velocity.
3. Restraining soil movement.
4. Improvement of soil porosity.
5. Increasing biological activity in the soil.

In addition, soil stabilization, runoff control, and sediment trapping (Figure 22) can mitigate the detachment, translocation and deposition stages in the process of soil erosion.



(Source: Broz et. al. 2003, University of Missouri, USA)

Figure 22: (A) Erosion process and (B) possible points of intervention.

6.3.8. Pest infestation mitigations

According to *Agrinexus Implementation Plan*, "an effective Integrated Pest Management program should involve chemical, cultural, biological, and physical practices as well as the implementation of a proper Monitoring and Surveillance System (MSS). The MSS will provide information on the pests' presence and activity to determine the right time to control a particular pest. This systematic pest control strategy will result in effective control with minimal chemical usage and minimal damage to other living organisms and the environment."

Leaf-eating caterpillars such as nettle caterpillars and bagworms are kept under control by various insect predators. To promote and sustain high predator population, beneficial host plants e.g. *Cassia cobanensis*, *Euphorbia heterophylla* and *Antigonon leptosus* should be established in the field to provide food, shelter and breeding sites for the beneficial insects.

Cassia cobanensis *Euphorbia heterophylla*

Antigonon leptopus

(Source: Agrinexus Implementation Plan)

Pictures 12: Beneficial host plan for Integrated Pest Management

Mammalian Pests An integrated approach of rat control should be practiced using the barn owl (Tyto alba) as a biological control agent and the use of rat baits.

Insect Pests The Rhinoceros beetle is a major pest in Oil Palm new plantings and various methods are implemented to keep their population under control. To prevent beetle population build-up, good ground covers such as *Mucuna bracteata* and *Pueraria javanica* should be established rapidly to reduce breeding sites in Oil Palm fields.

The Integrated pest management system (Agrinexus) will involve the following:

- Encouragement of biological control of pests, including planting nectar producing plants.
- The adoption of agronomic methods that minimize the risk of pest outbreak.
- Use of selective chemicals and application methods with minimal side-effects.

IPM practices should be recorded and monitored.

6.3.9. Transportation (FFB and Palm Oil) and Traffic mitigations

The dust and noise generated that will be generated by the transportation of the fresh fruit bunch and the palm oil can be attenuated by the installation of traffic signage, speed limitation, installation of speed bumps.

6.3.10. Waste management

Domestic waste should be properly disposed of to avoid an invasion of scavengers such as rodents.

Hazardous waste in a plantation is composed of:

- Empty agrochemical substances containers (fertilizers, pesticides, fungicides, etc…);
- Empty petrochemical substances containers (oil & grease, lubricants, etc…);
- Used lubricants;
- Used towels soaked with oil & grease or lubricants.

According to Criteria 5.1 of the RSPO Guidelines, all sources of waste and pollution would need to be identified and targeted for improvement.

SGSOC has to put in place a “Waste Management Plan”.

6.3.11. Mitigation of the impacts on the human population

See Below – Sub Chapter 6.4.5. Mitigation of impacts on population.

6.4. Palm Oil Mill – Mitigation of the impacts

6.4.1. Mitigation of the impacts on air

Mitigation of air pollution resulting from combustion of fiber and palm nut shell

Chapter 5 identified the various atmosphere pollutants that are generated in the process of combustion of fiber and palm nut shells. Typical composition of the exhaust gases and the approximate quantities of emission per cubic meter of its constituents from combustion of the agro – waste mentioned above, expressed in mg/m^3 are given below:

- **CO** **No Trace**
- **CO_2** **52,728 mg/m^3**
- **NO_4** **2,900 mg/m^3**
- **SO_2** **200 mg/m^3**
- **PM_{10}** **0.01 mg/m^3** **= 10 $\mu g/m^3$ (micrograms/cubic meter)**
- **Dust Concentration** **50 mg/m^3**

The preoccupying issues here are the emission of Oxides of Nitrogen NO_4 and those of Sulfur Dioxide SO_2. The CO_2 in the atmosphere forms part of the carbon recycling process as already explained and consequently, is not taken into consideration.

Oxides of Nitrogen NO_4 in combustion can be controlled through:

- Choice of fuel (which is not applicable in this case as the fuel is imposed)
- Combustion Control
- Flue Gas Treatment or FGT

Two means of control are therefore left for the attenuation of NO_4 emission namely: Combustion Control and Flue Gas Treatment.

The equipment and consequently the burners in the Project are all of modern and environmentally motivated design. The burners in the Project are automatically fitted with new type of *"low – NO burner"* which is standard equipment these days (they are also specified in the design of the plant). These *"low – NO burners"* have the capacity to reduce emission of NO_x between 40 and 60%.

Flue Gas Treatment (FGT) is also an effective attenuation process. It is often more effective than Combustion Control but it is much more costly. It is more frequently used in ammonia and Nitric Acid manufacturing plants rather than in burners.

Control of Sulfur Dioxide SO_2 emission during combustion can be achieved through the following:

- Choice of fuel (which is not applicable in this case as the fuel is imposed)
- Fuel Cleaning (de - sulfurization of fuel is not possible here, hence not applicable)
- Selection of burner technology (e.g. Fluidized Bed Combustion, FBC technology is not applicable here)
- Emission Control Techniques

Emission Control Techniques is the only control method available. They can be varied and include:

- Sorbent injection (suitable more for coal fired boilers)
- Flue de sulfurization gas (FCD)

The FCD consists of using scrubbing medium which rids the flue gases of Sulfur Dioxide SO_2 prior to exhausting them into the atmosphere. The wet process which consists of a scrubbing medium of lime slurry can remove up to 90% of Sulfur Dioxide SO_2. The process can be either re - generable or throw away. If it is throw away, it involves disposal of waste with costs involved; the re – generable process produces byproducts such as sulfur, sulfuric acid, and gypsum.

The FCD will most probably not be installed initially in the project (as it is not specified). It is suggested that the installation of FCD be left until a later date to see if real problem with sulfur emission exists.

It is important to mention here that the Cameroon Environmental Legislation, does not specify limits of the above mentioned pollutants (NO_4 and SO_2) in its legislative texts and there appears to be no specific reference to these pollutants anywhere with exception of a document entitled *"Normes Environnementales et Procedure d'Inspection des installations industrielles et Commerciales au Cameroon"* (which does not appear in its description, a Text to the Law 96/12 of 5/8/96 neither a Decree or a Ministerial Order but a simple Guide Book yet to be signed).

It may be necessary here to fall back on Article 9(f) of Law 96/12 of 5/8/96 and follow the Directive of the World Bank or other reference to the limits imposed on emission of pollutants into the atmosphere. The limits for NO_x and SO_2 are given below together with Ambient Levels of Exposure to these pollutants, specified by the World Bank and other international authorities.

The above pollutants are not major culprits with reference to Global Warming, however, their damage is done through formation of "Acid - rain" and production of Ozone (in the lower atmosphere, not in the Ozone layer of the upper atmosphere).

TABLE 2-3
AIR EMISSIONS GUIDELINES[1]
(all units are milligrams per normal cubic meter, mg/Nm^3)

Pollutant	Maximum Value (mg/Nm^3)
Particulate Matter (PM)[2]	100
Sulfur Oxides (SO_X as SO_2)	100
Nitrogen Oxide (as NO_2) from liquid fuels	460
Nitrogen Oxide (as NO_2) from solid fuels	750

Table 1. Reference Standards and Guidelines for Ambient Levels of Nitrogen Dioxide
(milligrams per cubic meter)

Standard or guideline	Annual average	24-hour average	1-hour average
EU limit values (1985)	200[a]		
USEPA standards (1992)	100[b]		
WHO guidelines (1977)			190–320[c]
WHO guidelines for Europe (1987)		150	400

a. 98th percentile calculated from the mean values per hour or per period of less than an hour taken throughout the year.
b. Arithmetic mean.
c. Not to be exceeded more than once a month. Only a short-term exposure limit has been suggested.
Sources: European Community 1985 (EU); United States 1992, 40 CFR, Part 60; WHO 1977, 1987.

Table 1. Reference Standards and Guidelines for Ambient Sulfur Dioxide Concentrations
(milligrams per cubic meter)

Standard or guideline	Annual average: Sulfur dioxide	Annual average: Associated particulate levels	Winter: Sulfur dioxide	Winter: Associated particulate levels	24-hour: Sulfur dioxide	24-hour: Associated particulate levels	1-hour, sulfur dioxide
EU limit values	80[a] 120[a]	> 40[b] ≤ 40[b]	130[c] 180[c]	> 60[b] ≤ 60[b]	250[d] 350[d]	> 150[b] ≤ 150[b]	
	80[a] 120[a]	> 150[e] ≤ 150[e]	130[c] 180[c]	> 200[e] ≤ 200[e]	250[d] 350[d]	> 350[e] ≤ 350[e]	
USEPA standards	80[f]				365[g]		
WHO guidelines	40–60[f]				100–150[a]		
WHO guidelines for Europe	50[f]				125[f]		350
ECE critical value	10/20/30		20/30				

a. Median of daily values taken throughout the year. b. Black smoke method c. Median of daily values taken throughout the winter. d. 98th percentile of all daily values taken throughout the year; should not be exceeded more than 7 days a year. e. Gravimetric method. f. Arithmetic mean. g. Not to be exceeded more than once a year. *Sources:* European Community Directive 80/779 (July 5, 1980) and amending Directive 89/427 (July 14, 1989); USEPA 1990; WHO 1979, 1987

Cameroon on the 19th of October, 1994 has ratified the UNFCCC International Convention for Climate Change and is a signatory of the Kyoto Protocol, but as a Non-Annex I party and consequently, has no obligations with reference to the reduction of emission of CO_2 the Greenhouse Gas (or for that matter other Greenhouse Gases) into the atmosphere. The first compliance period of Kyoto Protocol terminates in 2012. Discussions are now in progress with reference to the second compliance period and modifications to be brought to some Articles of the Kyoto Protocol.

UNFCCC Convention Art 4 (1a) requires that Cameroon only develop and periodically update, national inventories of anthropogenic emission of Greenhouse Gases (those not controlled by the Montreal Protocol) by sources and removal by sinks. It further requires for Cameroon to formulate (Art. 4 (1b)) and implement a national program containing measures to mitigate climate change by addressing anthropogenic emissions (this is a voluntary approach to the control of Climate Change in which emission of Carbon Gases, mainly CO_2, should be mitigated but it is not illegal to emit them.

This of course, applies only to non - renewable energy sources such as fossil fuels and it does not apply to renewable sources of energy such as Bio – fuels.

This basically implies that Cameroon is not internationally obliged to control or reduce the emission of Greenhouse Gases through legislation, but implies that control should be exercised and emission should be minimized voluntarily as just mentioned above. The gases involved are Carbon Dioxide (CO_2) and to a large extent Carbon Monoxide (CO) which becomes quickly oxidized into Carbon Dioxide in the atmosphere, Methane (CH_4) has a Global Warming Potential (GWP) of 21, and N_2O can be sometimes generated as a byproduct of Oxides of Nitrogen in combustion of fuels and) has a Global Warming Potential (GWP) of 310.

As far as the Palm Oil Mill is concerned, meaning the combustion of the palm oil fiber and nut shell, the control should be exercised through the application of limits of emission of the World Bank or those of the Cameroon Guide Lines from *"Normes Environnementales et Procedure d'Inspection des installations industrielles et Commerciales au Cameroon"* to SO_2, NO, NO_2 and Particulate Matter of less than PM_{10}.

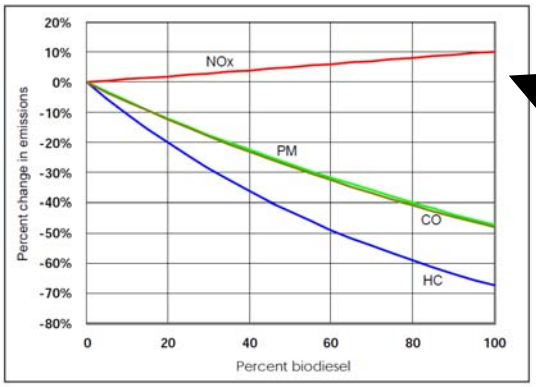
The emission of Greenhouse Gases namely CO_2 and CO, are not legislated in Cameroon this however, does not imply that they should be emitted freely.

Mitigation of air pollution resulting from standby generators

The discussion relating to the emission of air pollutants from the operation of the standby generators can be found in Chapter 5 (see Emission of pollutants which results from combustion of fossil fuel in standby generators).

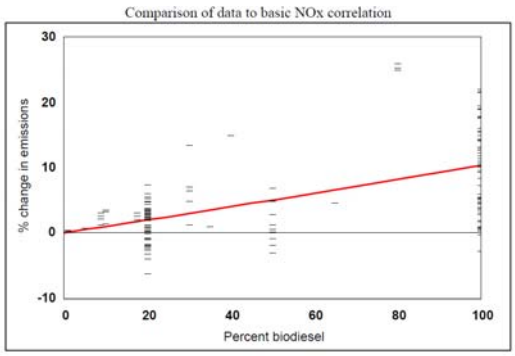
It was pointed out that these generators will not be used frequently, but only in emergency situations and consequently are not permanent pollutants. Nevertheless, it was suggested that on account of the fact that SGSOC took the initiative to manufacture bio diesel in the near future from the Crude Palm Oil, the standby generators should be operated using biodiesel and not fossil fuels.

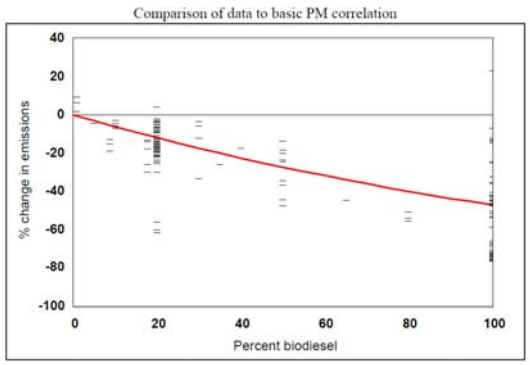
It was also pointed out that the switch to biodiesel would automatically and dramatically reduce to a very large extent all the pollutants such as CO, Particulate Matter PM, HC hydrocarbons and Sulfur. It would however increase slightly the NO_x emission namely NO and NO_2, but only by about 10% (see diagram enclosed).

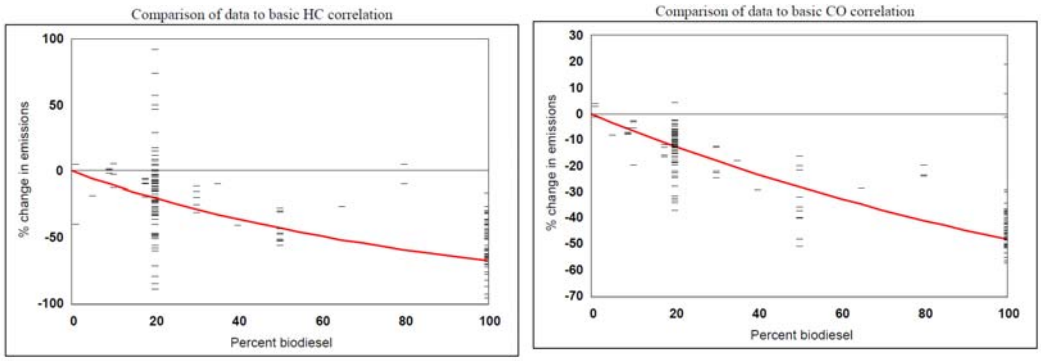


Dramatic decrease in emission of CO, PM and HC but a modest increase in NO_x

Probably a small price to pay.







(Source : www.epa.gov/oms/models/analysis/biodsl/p02001.pdf)

This might be a small price to pay for the reduction of all other pollutants and in particular the Carbon Monoxide CO which is produced in quantities.

Mitigation of air pollution resulting from transportation of raw materials and finished product

As was indicated in Chapter 5, this is a very complicated issue on account of the fact that it does not, strictly speaking, form part of the project and therefore not under, the direct control of the Promoter, but is nonetheless extremely important environmentally.

Also, transportation is usually sub - contracted to a number of small transport businesses which furnishes job opportunities and employment, an important social benefit of the project and must be retained as such.

Furthermore, it involves many different types of transport equipment, different makes, different age, different standards of maintenance and repair levels, which, if all combined, defies rational approach to suggest a method to attenuate air pollution from fossil fuels used in the propulsion of these vehicles.

As can be seen from the previous chapter, we are concerned with potential emission of Carbon Dioxide gas (from fossil fuels) into the atmosphere not counting any pollutants such as HC, NO_x, SO_2 and Particulate Matter which would be emitted concurrently in varying quantities depending on the type, age and condition of the engine.

One approach which springs immediately to mind that could be effective in controlling this air pollution is the FUEL – SWITCHING approach. Some benefits of this Fuel – Switch approach can be seen in the first section of this chapter above. This approach is based on the fact that SGSOC will produce its own biodiesel from the Crude Palm Oil (CPO). The sub – contractors could be issued biodiesel against the

tonnage of FFB or CPO transported, cost of which biodiesel would be deducted from their transportation invoices. This arrangement could substantially reduce the Greenhouse Gases emitted into the atmosphere from the varied fleet of vehicles and solve, through attenuation, a considerable extent, of the air pollution problem and that of Greenhouse Gases.

It is suggested that SGSOC initiates a study to evaluate the possibility of a Fuel -Switching proposal on a scale proportionate to the project in question. The evaluation should first consider the possibility of doing it with the present capacity of the biodiesel plant to ascertain whether or not the existing capacity would permit such a scheme, or maybe a simple modification to the plant is needed in order to increase its capacity. If additional investments are not to be made, the proposed switch of biodiesel 100 could be modified to biodiesel 80 or biodiesel 60, both would substantially cut down the pollution. The study should evaluate the economic aspect which at first sight would appear to be highly beneficial; evaluate the environmental benefits of air emission attenuation which would also be highly beneficial; evaluate the political side of the proposal; evaluate it from the aspect of the existing or possibly anticipated future legislation which might certainly be forthcoming (environmental); taxation; social implications, and the like.

It is also worth while taking into consideration the fact that the first compliance period of the Kyoto Protocol ends in 2012. Considerable changes will most likely be incorporated in the second compliance period which could push Cameroon, and probably some other developing countries, to modify its legislation with reference to Greenhouse Gases.

Such a study is suggested in the Environmental and Social Action Plan of this Environmental and Social Impact Assessment.

Mitigation of atmospheric pollution resulting from the Palm Oil Mill Effluent (POME)

The decomposition of POME or in other words, the stripping of its high charges of BOD and COD (as required by Decree 2001/165/PM of 8/5/2001), by anaerobic bacteria during its period of residence in shallow lagoons emits Methane. Methane is a Greenhouse Gas which requires to be controlled, not because it is illegal to emit it, but because the UNFCC convention (Art. 4 (1b) to which Cameroon is signatory, requires its emission to be control voluntarily.

The calculations in Chapter 5 entitled “Identification and description of possible environmental impacts resulting from the project (plantation, palm oil mill)” indicate that the Project could emit some **2,030,858**

kg of Methane CH_4 per annum (this is an equivalent of **42,648 T of equivalent CO_2 per annum**) all this from **262,080 m^3 of POME exited annually** from the process.

This carbon from the atmosphere is recycled into a gas that, from the point of view of Global Warming, is 21 times more virulent than Carbon Dioxide gas which is initially absorbed from the atmosphere by the palm oil tree.

It is extremely difficult to capture and use methane, a valuable fuel, from the shallow lagoons where the POME is discharged. A process using specially constructed digestion tanks in which anaerobic bacteria reaction is accelerated, is the only available technology on the market for satisfactory extraction and capture of the gas.

The installation of a digester is envisaged in the project. The POM will be equipped with a Decanter / Drier System, to dry the solids from the Decanter and the Nozzle Separators. The liquid from the Clarification Station will be discharged from the mill to Treatment Ponds for **Anaerobic and Aerobic Treatments to bring down the BOD level below 100 ppm** before applying the treated effluent to the plantations.

Biogas capture will help reduce the acceleration of the ozone depletion through the combustion of the biogas that will eliminate methane gas which has 21 times global warming potential (GWP) compare to Carbon Dioxide (CO_2) gas.

The most economic way to achieve this would be through the CDM - Clean Development Mechanism of Kyoto Protocol. This would permit SGSOC to benefit from the generated Carbon Credits and in effect reducing substantially the costs of such an installation. The project would be done as per the methodology described in AM0013/ Version 02 of UNFCCC CDM – Executive Board document in order to qualify for Carbon Credits.

Elimination of impacts on atmosphere due to the use of ozone depleting substances

This issue was discussed at some length in Chapter 5 which dealt with the Ozone depletion due to the use of substances such as coolants in refrigeration and air conditioning. The conclusions reached there are reiterated here below.

The Cameroon Legislation being a signatory to the Montreal Protocol 985/MINDIC/CAB of 15/10/96, prohibits the importation of equipment containing CFCs.

Therefore, the probability of using phased out CFC's in the project is relatively remote as all the refrigeration and air conditioning equipment entering Cameroon now uses alternative refrigerants. The problem therefore carries little weight.

Use of solvents such as Carbon Tetrachloride and similar in cleaning operations should be avoided.

6.4.2. Mitigation of impacts on surface waters and underground waters

Discharge of all effluents, be they industrial or domestic in Cameroon, are regulated primarily by the Framework of Environmental Law 96/12 of 5/8/1996 and by relevant Decree to this legislation, namely: Decree 2001/165/PM promulgated by the Prime Minister's office in the name of the MINEE - Ministry of Water and Energy on 8/5/2001, Ministry which is responsible for protection of surface and underground water against pollution.

Other Decrees relating to water in this group are Decree 2001/161/PM Organization and functioning of the National Water Committee; Decree 2001/162/PM Inspection and control of Water Quality; Decree 2001/163/PM Protection of the Water Sources at the point of treatment; Decree 2001/164/PM Regulations with reference to Industrial and Commercial Water Usage all of the same date, namely: 8/5/2001.

The Decree 2001/165/PM of 8/5/2001 spells out the conditions under which effluents, of whatever category they may be, can be discharged legally into nature or into municipal drainage system of a city. It further lists all the different types of effluents that are controlled, describes the procedure to be followed in order to obtain an effluent discharge permit, etc., etc. The discharge limits permissible, though frequently not defined clearly in the Cameroon legislation or not yet defined, and if not defined at all, are those that are in conformity with Article 9(f) of the Framework of Environmental Legislation 96/12 of 5/8/1996; or in other words: World Bank standards or International body such as WHO, European Community standards or the US Environmental Protection Agency standards.

As previously indicated the POME or the processed effluent requires to be treated prior to being discharged into environment (Decree 2001/165/PM of 8/5/2001 relating to the protection of surface

water courses and underground water sources). This treatment consists of allowing the processed raw effluent to reside a number of months in specially constructed shallow ponds in order to lose its charge of BOD and COD (Biological and Chemical Oxygen Demand charges). Taking into consideration the quantities of effluent that the project will generate annually, estimated at 262,080 m^3 per annum, this is the most economical method of treatment.

The effluent after treatment has to comply with the IFC Standards.

Table 12: Effluent levels from the IFC environmental, health and safety guidelines: vegetable oil processing

Table 1. Effluent levels for vegetable oil processing		
Pollutants	**Units**	**Guideline Value**
pH	pH	6 – 9
BOD_5	mg/l	50
COD	mg/l	250
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Temperature increase	°C	<3[b]
Total coliform bacteria	MPN[a] / 100 ml	400
Active Ingredients / Antibiotics	To be determined on a case specific basis	

Notes:
[a] MPN = Most Probable Number

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

However, the treatment of POME in this fashion, though economical, opens the door to atmospheric pollution as the elimination of the BOD and COD charges by the anaerobic bacteria in the shallow ponds emits large quantities of Methane which is a Greenhouse Gas (see section above). The solution to this problem has been proposed above: the capture of the Methane.

With reference to protection of the Underground Water Sources from pollution by Fossil fuel (Hydrocarbons), all Underground Fuel Storage Tanks MUST BE DOUBLE WALLED, preferably of fiber glass with an automatic fuel leak control system incorporated. No reliance on any other form of construction should be made. Petroleum distribution companies are fully acquainted with modern

Underground Fuel Storage Tank systems that are leak proof. They should be contacted to furnish such leak proof tank systems to be installed at the new facility (this only applies to hydrocarbon fuel and oil storage tanks).

This is one reason why low echelon personnel should be initiated into simple environmental procedures and have some understanding of what environment and pollution is all about. Environmental & Social Management Action Plan suggests that they be given this basic environmental training.

6.4.3. Mitigation of impacts on soil

As already pointed out in Chapter 5 the impacts on soil will result mainly from secondary operations of the facility. They will result from accidental spills and bad "housekeeping" procedures of mostly mechanical personnel. The impacts on soils, which are of concern here, are those mainly from Hydrocarbons though spills of other hazardous substances which are not excluded such as lubricating oils and fuels (but less fuels than lubricants since SGSOC will use Biodiesel).

Most of the time soil is impacted through accidental spills that can happen without warning during the dispensing of fuels or lubricating oils, or through bad work practices and non respect of correct procedures in the Garage or the workshop, or just through bad "Housekeeping" and general carelessness of personnel. These surface spills, if not immediately attended to, can find their way into water courses and possibly also on shallow underground water sources.

In order to avoid such eventualities a Spill Response Plan is required to be available in all of the operations of SGSOC. Such a Spill Response Plan is explained in the Environmental Management Plan Chapter.

The impacts of hydrocarbons spills can have very adverse effects on the environment. Soil contaminated by hydrocarbon spills must be remediated, a relatively expensive procedure which can be easily avoided through good work practices and a "Spill Response Plan".

Furthermore, all effluent exiting from mechanical workshops, garages, and similar areas must have their own INDEPENDENT drainage system. This drainage system must be enhanced with an Oil/Water separator to ensure that no oily hydrocarbon exits to the outside of the facility.

6.4.4. Mitigation of impacts resulting from solid waste stream

The issue of generated Solid Waste Stream was discussed in Chapter 5 in which the various impacts resulting from the project were identified. Two separate Solid Waste Streams were identified, namely:
Solid agri - waste stream which will be generated in very large quantities during the operations of the facility. There are three types of agri – waste:

1. The Empty Fruit Bunch (EFB)

The EFB contain many nutrients and as a result, this agri – waste is used at the plantations and the nurseries as fertilizer. A mulch of EFB can supply high amounts of Potassium K to the soil. Likewise, soil Phosphorus P can be substantially increased and much higher pH values of soil can be obtained (less acidic).
According to the *Environmental Management Guideline for the Palm Oil Industry by GTZ (1997),* several possibilities of EFB application exist:
a) Direct application of unconverted EFB on land.
b) Use of EFB as covering material to protect the soil against erosion, for improvement of moisture retention in the soil surface, and as a nutrient.
c) Application as an organic fertilizer.
The EFB may be incinerated to produce potash which is applied in the plantation as fertilizer by mulching (Thani *et al.,* 1999).

2. The Fiber

The fiber, after the extraction of oil, is used for firing the furnaces which generate steam and electrical energy for the process. Its use as fuel is, therefore, a highly welcomed element in the process as it allows at the same to dispose of large quantities of generated agri – waste.
The facility is designed to use this agri – waste product in its operation. Practically all of this type of agri – waste will be consumed in the operations of the facility.

3. The Nut Shell

The nut shell is use to supplement the fiber in firing the furnaces.
Boiler ash is recycled as fertilizer and factory floor cleaning agent.

The agri - waste products described above are associated with the extraction of the palm oil and the project process. These wastes come in large quantities but are consumed in the production process and

therefore can be considered as being “recycled” in two ways: within the facility and also on a larger scale through the “Carbon Cycle“. For example, the palm trees during the growing process and fruit production initially absorb carbon dioxide from the atmosphere through the process of photosynthesis; subsequently they convert this carbon through plant chemistry into fruit. The waste product of oil extraction from the fruit, which is then burnt for energy, returns the same carbon back into the atmosphere in form of carbon dioxide. This is a recycling process, not an additive process as in the case of fossil fuels where carbon is sequestered for millions of years, resurrected, and then added to the atmosphere.

The surplus shell and fiber not required for fuel can be compacted into briquettes and given away to the employers and villagers to use as fire wood for cooking to compensate for the loss of NTFP.

The generated decanter cake can be utilized as a fertilizer like EFB.

The solids from effluent ponds (sludge) can be recycled to the field as a fertilizer.

The general solid waste stream consists of both Hazardous and Non – Hazardous waste generated in relatively small quantities and chiefly from secondary operations of the facility.

As it has already been explained, virtually 100% of all solid agri - waste stream is automatically “recycled” within the process of oil extraction mostly for generating steam and electric power required for the process. There is no pollution associated with this “recycling” process as it falls within the natural “Carbon Cycle” as was explained in Chapter 5.

With reference to the general solid waste stream which may consist of Hazardous or Non – Hazardous waste, SGSOC should avail itself with a Waste Management Plan and an organization necessary to put such a Waste Management Plan into operations.

Such a Waste Management Plan is described in detail in the Environmental and Social Management Plan of this Environmental and Social Impact Assessment.

6.4.5. Mitigation of impacts on population

A number of impacts on the human population living in and around the SGSOC concession were listed in Chapter 5.

As a reminder, the different chiefs of the villages in the SGSOC concession signed in July 2010 two Memorandums of Understanding (MOU) (see Annexes), one for the Nguti Block and another one for the Mundemba/Toko block. In those MOU, they have come to an agreement with SGSOC to satisfy their needs which are listed in Chapter 7.

For the other impacts reveal during the impact assessment, we have some mitigation measures listed below:

1. Loss of land and NTFP (such as bush meat, medicinal plants, wood for cooking, etc…)
   SGSOC will take neither farm from villagers or farmland for the future generation. The villagers' plantation will all be left untouched. There will be some buzzer zones left as patches. For the fire wood, we suggest that SGSOC make fire briquettes from the left over fibers and shells to distribute them to its workers and the population.
2. Destruction of community-based economy
3. Exposure to health risks (Malaria, HIV AIDS, STD, waterborne diseases, etc…)
   SGSOC should work closely with the Health Districts of the Ministry of Public health and promote sensitization campaigns.
4. Food security
   SGSOC should have a cow ranch to provide meat to the workers and the villagers.
5. Insecurity
   SGSOC should have a security patrol to control the plantations and its installations.
6. Quality of life and working conditions of workers and laborers in plantations and mill factories
   Laborers and workers should all have Personnel Protective Equipment (PPE).
7. Workers and laborers wages.
   Make sure that the workers and laborers are paid the Cameroonian minimum wage.

6.5. Synthesis of the mitigation measures

Table 13: Mitigation Measures of Impacts Evaluation Matrix

Project Phase	Activity/Source of Impacts	Medium affected	Effects of the impacts	Importance of the impact	Mitigations of the impacts
Nursery Establishment (15 hectares)	Site clearing	Biodiversity	Loss of habitat (Fauna and Flora)	Major	The nursery sites are very small (15 ha). The animals will migrate to a close by location. Being a secondary forest, the sites do not contain endangered vegetations.
		Water	Flood incidents downstream	Moderate	Make boundaries around the nursery sites.
			Turbidity of the water	Minor	
		Soil	Soil erosion - Loss of arable soil in the area	Moderate	
	Open burning of the biomass	Air	Elevated particles in the air - atmospheric pollution + Climate change	Moderate	Practice zero burning.
	Construction of the base camp	Visual impact	Land use	Minor	Use of local material such as wood to build the base camp.
	Traffic	Air	Dust and noise	Moderate	Speed limitation signals.
	Degradation of the biomass	Soil	Pest infestation	Minor	Use of pesticide and insecticide to control the infestation.
	Use of agrochemicals	Water and soil	Pollution of the soil and water courses	Major	The use of agrochemicals should follow strictly the plant requirements.
	Use of petrochemicals			Major	Fuel dispensers have to be used by a well trained person to prevent accidental spillage.
	Sewage from workers			Moderate	Toilets with septic tank should be constructed.
	Waste from the nursery: - Domestic waste	Waste management	Soil pollution	Moderate	Domestic waste should be collected and disposed of in a proper manner.

Nursery Establishment (15 hectares)	Waste from the nursery: - Hazardous waste (Used oils, empty chemical products containers, used polybags)	Waste management	Soil pollution	Moderate	All empty containers (agrochemicals or petrochemicals) have to be collected for proper disposal. The used oil has to be stored carefully for reuse or disposal (it can be recuperated by a recycling company). The used polybags should be collected for proper disposal.
Plantation Development	Site clearing, construction of roads, and establishment of the base camp	Biodiversity (Habitat)	Loss of habitats / Loss of species	Major	Do not cut down primary forest to develop an oil palm monoculture.
					A three (03) kilometers buffer zone should be left between the Korup National Park and the SGSOC concession.
					Mbu river acts as a natural boundary between the Bayang Mbo Wildlife Sanctuary and the SGSOC concession, however, an additional 500 meters buffer zone between the BMWS and the SGSOC concession should be incorporated.
					Corridors should be left out to help the evacuation of the animals.
					Some part of the forest can be fragmented as patches and remain undisturbed to save some tree species.

Plantation Development	Site clearing, construction of roads, and establishment of the base camp	Biodiversity (Habitat)	Loss of habitats / Loss of species	Major	SGSOC should plan its development every year over a large period of time by clearing smaller blocks (250 to 500 hectares). Phasing out of the plantation development.
					SGSOC should also work closely with the KNP and the BMWS managements.
			Loss of Non-Timber Forest Products (NTFPs) (Ex. country onion, bush pepper, bush mango, bitter kola, red cola, monkey cola, Njabe, and many other spice species)	Major	Leave some forest area in the plantation; this forest can also act as a buffer zone and can be used as a shelter for the animals that are going to be used for pest control.
			Limited natural resources for the villagers and the new migrants (foods, wood as fuel for cooking, etc.)	Major	A ranch should be created by SGSOC to provide its workers and the villagers with meat (cows, sheep, poultry, etc.…) The waste (fiber + nut shelves) from the POME can be compacted into briquettes and distributed to the villagers.
			Human – elephant conflict with destruction of the plantations near the Bayang Mbo Wildlife Sanctuary	Minor	The human – elephant conflict should be resolve by using the WWF Better Management Practice (leave a buffer zone, leave a corridor, install electrified fences, build trenches, use repellents, guard the plantation).

Plantation Development	Site clearing, construction of roads, and establishment of the base camp	Biodiversity (Habitat)	The connectivity and biodiversity corridors will be impacted because the proximity with the Korup National Park and the Bayang Mbo Wildlife Sanctuary.	Major	A three (03) kilometers buffer zone between the KNP and the SGSOC concession. Mbu river acts as a natural boundary (BMWS and SGSOC), however, an additional 500 meters buffer zone between the BMWS and the SGSOC concession should be incorporated.
			Increase in poaching by the population.	Major	SGSOC should have a no poaching policy.
		Land	Loss of the villagers' farmland.	Major	SGSOC has giving its word in the MOU to not touch any farm or village plantations and to leave farmland for the future generation. Before the plantation development, there will be a "demarcation" exercise with a team composed of SGSOC, villagers, and the government.
		Water	Increase in surface runoff due to the reduction of infiltration and soil erosion	Major	SGSOC should develop a Water Management Plan. SGSOC should leave a riparian reserve of a few meters around the rivers and streams.
		Soil	Soil erosion	Major	Phasing out the development. Leguminous cover crops will be use to help minimize soil erosion by reducing the pressure from raindrops and act as an impediment to surface run-off.
	Open burning of the biomass	Air	Massive atmospheric pollution with elevated ambient total suspended particulates.	Moderate	Practice zero burning.
			The release CO_2 into the atmosphere will contribute to climate change.		

Plantation Development	Degradation of the biomass	Soil	Biomass will provide shelter for certain pests such as rodents	Minor	
	Usage and application of agro-chemicals (fertilizers, pesticides, fungicides, insecticides, etc…)	Water	"Euthrophication" in the surface water causing growth of vegetation and affecting aquatic life.	Major	Mulch from the decomposed biomass can be used as fertilizer as well as the Empty Fruit Bunch from the Palm Oil Mill. SGSOC will put in place an Integrated Pest Management Program. This program will use chemical, cultural, biological, and physical practices to control the infestations.
			High levels of chemicals can affect the quality of water, the aquatic life and even the supply of freshwater.		
	Use of generators in the plantation for the water pump or the camp	Water and Soil	Pollution by hydrocarbons by spillage.	Major	Put in place an oil/water separator next to the workshop drainage system. Train workers on how to handle these products. SGSOC has to put in place a "Spill Response Plan".
	Sewage generated in the base camp	Water	An increase in the level of COD, BOD, and microbiological contents in the water system. It will lead to a bad odor and breeding of mosquitoes and flies.	Moderate	Toilets with septic tank have to be built and maintained.
	The plantations will allow a certain type of pest infestation		Leaf-Eating Caterpillars – Nettle Caterpillars and Bagworms.	Moderate	They can be kept under control by various insect predators. To promote and sustain high predator population, beneficial host plants e.g. *Cassia cobanensis*, *Euphorbia heterophylla* and *Antigonon leptosus* should be planted in the field for the beneficial insects.
			Mammalian Pests – Rats (vertebrate pest).	Moderate	An integrated approach of rat control should be practiced using the barn owl (*Tyto alba*) as a biological control agent and the use of rat

Plantation Development					baits.
	The plantations will allow a certain type of pest infestation		Insect Pests – Rhinoceros Beetle.	Moderate	To prevent beetle population build-up, good ground covers such as *Mucuna bracteata* and *Pueraria javanica* should be established rapidly to reduce breeding sites in Oil Palm fields.
	Transportation of the Fresh Fruit Bunch (FFB) to the palm oil mills and of the oil palm to the port.	Air	Dust and noise pollution.	Minor	The installation of traffic signage, speed limitation, and installation of speed bumps.
	Waste	Soil	Soil pollution by empty containers (agrochemicals, hydrocarbon substances such as oil, grease, lubricant, etc…), dirty towels, etc…	Moderate	SGSOC has to put in place a "Waste Management Plan".
	Plantation development	Population	Loss of land and NTFP (such as "bush meat", medicinal plants, and wood for cooking).	Major	There will be some buzzer zones left as patches. For the fire wood, SGSOC should make fire briquettes from the left over fibers and shells to distribute them to its workers and the population.
			Destruction of community-based economy.	Major	
			Exposure to health risks (Malaria, HIV AIDS, STD, etc…).	Major	SGSOC should work closely with the Health Districts of the Ministry of Public health and promote sensitization campaigns.
			Food security.	Major	SGSOC should have a cow ranch to provide meat to the workers and villagers.
			Insecurity.	Major	SGSOC should have a security patrol to control the plantations and its installations.
			Destruction of indigenous cultural values.	Major	No shrine or cultural site will be destroy by SGSOC.

Palm Oil Mill Construction	Exhaust emission of CO, SO_2, NO, NO_2 and Particulate Matter PM_{10} which result from the combustion of the palm oil fiber and nut shell	Air	Air pollution	Major	There are two means of control for the attenuation of NO_x emission, namely: Combustion Control and Flue Gas Treatment. The FCD consists of using a scrubbing medium which rids the flue gases of Sulfur Dioxide SO_2 prior to exhausting them into the atmosphere.
	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the combustion of the stand-by fossil fuel generators			Major	SGSOC took the initiative to manufacture biodiesel in the near future from the Crude Palm Oil, the standby generators should be operated using biodiesel and not fossil fuels.
	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the transportation of the FFB to the Palm Oil Mill for processing from the plantation by trucks			Major	The approach here is FUEL – SWITCHING to biodiesel produced by SGSOC.
	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the transportation of Crude Palm Oil (CPO) for export or to the port by third party trucks			Major	
	Emission of Methane CH_4 from the shallow ponds as a result of digestion by anaerobic of the Palm Oil Mill Effluent (POME)			Major	Methane will be captured from the digesters and cleaned of sulphur and moisture before feeding it to the gas engine to generate electrical power.
	Possible use of Ozone Depleting Substances (ODS)			Moderate	No CFCs or halon containing equipments should be imported. Use of solvents such as Carbon Tetrachloride and similar in cleaning

					operations should be avoided.
Palm Oil Mill Construction	The discharge of untreated process effluent (POME) and other contaminated effluents	Water	Water pollution and eutrophication of water courses	Major	The Palm Oil Mill Effluent (POME) will be collected in anaerobic ponds which will help lower its COD, BOD and TSS numbers + take up the pH.
	Spill of hydrocarbon (or other hazardous substances)	Soil	Undesirable effects affecting underground water sources and human health	Major	Underground Fuel Storage tanks MUST BE DOUBLE WALLED. The mechanical workshops, garages, and similar areas must have their own INDEPENDENT drainage system. This drainage system must be enhanced with an Oil/Water separator. Elaboration of a "Spill Response Plan" for the SGSOC Site.
	Generation of solid waste • Agri waste	Soil	Soil pollution	Moderate	
	Generation of solid waste • Office waste such as paper • Used oils, • Towels dirtied with oils, • Empty containers from the workshop and the garage, • Etc….	Soil	Soil pollution	Moderate	Elaboration of a « Waste Management Plan » for the SGSOC Site.

7. PUBLIC CONSULTATIONS

7.1. Introduction

The section on public consultations provides an overview of the consultation carried out for the ESIA at the time of preparation of this report. It also highlights some of the key issues raised and proposed recommendations. The main objectives of the public consultations undertaken with the ESIA process have been to:

- introduce the project to key stakeholders,
- adhere to the public consultation requirements of Cameroon legislation and the IFC Standards, and
- hear and address stakeholder's issues and concerns.

Public Consultations, according to the International Finance Corporation (IFC), *"is a tool for managing two-way communication between the project sponsor and the public. Its goal is to improve decision-making and build understanding by actively involving individuals, groups and organizations with a stake in the project. This involvement will increase a project's long-term viability and enhance its benefits to locally affected people and other stakeholders."* (IFC, 1998). In accordance with IFC and World Bank guidelines the project, has placed consultation at the centre of its activities that affect the local community. Consultation with the affected population and with government, development organizations and other representatives of the affected population is essential for gaining a comprehensive understanding of the types and degrees of adverse effects.

The decree 0577 of the Cameroonian Environmental Law provides the following requirements for consultation:

- The determination of the acceptability of the ESIA involves consultation and public hearings.
- The promoter must provide 30 days notification prior to the first consultation meeting.
- Minutes of all meetings must be included in the ESIA report.

Public consultations were carried out amongst the affected communities, non-governmental organizations and government agencies that provided valuable information into the nature and extent of potential social and environmental impacts associated with or resulting from the Mundemba, Toko and Nguti palm oil project in question.

7.2. Method

As described above, public consultations in environmental decision-making is an important element of the Environmental and Social Impact Assessment (ESIA) process. In line with this, public consultations have been an integral and on-going part of the ESIA process for the SGSOC project.

Methods used during the public consultations included: public hearings, open houses, focus groups, administering village and household questionnaires, and production of participatory maps for the socio-economic and need assessment surveys.

Specific objectives pursued during the public consultation included, providing information and education of stakeholders, gathering information on various environmental and social aspects, and seeking input from stakeholders on the planned intervention including its scale, timing, and ways to reduce its negative impacts.

In accordance with the 2005 Cameroon law on Environmental Impact Assessment and the accompanying Terms of References for the SGSOC project approved by the Ministry of Environment and Nature Protection (MINEP), a program on public consultation was established for the proposed SGSOC palm oil project in Nguti, Mundemba and Toko Sub-divisions in the South West Region of Cameroon. Table 14 below gives you the date, place, and the stakeholders involved in the public consultation.

Minutes of the different public consultation meetings are in the Annexes of the ESIA Report.

Table 14: The public consultations program

Date	Place	Stakeholder concerned
22/09/2010	MINIMIDT, Yaoundé	Ministry of Industry, Mines and Technological Development (MINIMIDT)
22/09/2010	MINEE, Yaoundé	Ministry of Energy and Water (MINEE)
22/09/2010	MINSANTE, Yaoundé	Ministry of Public Health (MINSANTE)
22/09/2010	MINAGRI, Yaoundé	Ministry of Agriculture and Rural Development (MINADER)
23/09/2010	MINCOMMERCE, Yaoundé	Ministry of Commerce (MINCOMMERCE)
23/09/2010	MINTSS, Yaoundé	Ministry of Labor and Social Security (MINTSS)
27/09/2010	Chariot Hotel, Buea	Development & Conservation Organizations, Some Local Traditional Authorities, Regional Delegates of various ministries, Agro-industries (PAMOL)
28/09/2010	Nguti Council Hall, Koupe Manengouba Division, South West Region	Chiefs, notables, Mayor, Councilors, Local Non-governmental Organization, Gendarme officer, politician, members of the local think tank for SGSOC project,
30/09/2010	Mundemba Council Hall, for Mumdemba and Toko Sub-Divisions, Ndian Division, South West Region.	Chiefs, notables, Mayor, elites, Chief of Konye in Meme Division.

7.3. The public consultations team

- Mrs. Haman Bako Salamatou (Director of H & B Consulting)
- Dr. Timti Isidore (Director of SGSOC)
- Dr. Andrew Allo (Consultant H & B Consulting)
- Mr. Chi Napoleon Forpah (Consultant H & B Consulting)
- Mrs. Luisa Feliciano (H & B Consulting USA)

7.4. Summary of the main issues and recommendations raised during the public consultations

Main issues:

- outcome of land lease still pending;
- social, cultural and environmental changes stemming from project have not been addressed;
- palm plantations will decrease biodiversity of surrounding area;
- overlap areas between community forest and community driven palm oil plantations;
- the rate of conversion of land into plantations is not clear;
- demarcation strategy and criteria still not clear; concerned with the creation of the nursery at Talangaye when demarcation has not been set in place
- primary forest and species of high conservation value will be lost;
- the terms of the MOU are not being respected;
- previous socio-economic survey was not properly done;
- land ownership issues are very complex;
- company should employ the local population before the non-locals;
- confusion by the several company's names and their role (Sithe Global, Herakles farms, and SGSOC);
- the MOU is in question in reference to whether or not it is the ideal step towards addressing the community's needs;
- overlap of SGSOC project areas with farmlands and issues of compensation;
- Diseases non-locals may bring to the population

Some Recommendations:

- Obtaining information about similar projects being carried out in Cameroon is very strategic;
- SGSOC will need permits from MINEE to exploit water and discharge waste water;
- SGSOC should write to MINSANTE for support and guidance from some of their funded programs;
- Various Regional Delegations of the Ministries are well placed to assist with some practical recommendations;
- SGSOC needs to apply to MINCOMMERCE for tax exoneration for certain equipments and materials during the production phase;
- Parents should start training their children in certain strategic field linked to the project.

The public consultation process is ongoing and will continue even during project implementation.

8. SAFETY MANAGEMENT (risks study and emergency plan)

8.1. Introduction

It is necessary, within the framework of the Environmental and Social Impact Assessment of the SGSOC, to indicate that the project comprises two main phases: the construction phase and the operating phase:

- during the *construction phase*, SGSOC will be responsible for safety in the project site and will ensure that all works are carried out in compliance with the rules and regulations in force concerning health and safety in the construction sites. Accordingly, it will be necessary for the different project stakeholders to endorse and comply with a Site Risk Prevention Plan, a sample of which is presented below. It will be fine-tuned before the start-off of works, notably by including details that are not yet available at this stage of the project, but that will be provided by the different stakeholders in due course.
- during the *operating phase*, SGSOC will analyze all risks related to its activities, conduct a study on hazards related to classified facilities and prepare an emergency plan which is an integral part of the Environmental and Social Management Plan.

This implies that at the outset SGSOC should describe in a background document or a safety manual the safety policy it intends to implement in all domains to check the risks identified.

This document will also include strategic aspects in the form of procedures to be implemented and to ensure compliance by all staff assigned specific responsibilities by category, after sensitization, information, and training.

Finally, the foregoing will function only if a specific service is set up to handle safety issues, manage staff safety, and advise Management for whom it will prepare trend charts to monitor end results.

8.2. Safety Management Objectives

The main objective of safety management in an organization is to limit the impact of accidental losses. Its implementation will enable SGSOC to check any accident that may lead to losses such as destruction of property, damage of physical integrity (or death) of workers, environment degradation, etc.

8.3. Site Prevention Plan (sub-contractors)

HERAKLES FARMS

SG Sustainable Oils Cameroon Limited

SITE RISK PREVENTION PLAN

(CONSTRUCTION PHASE)

NATURE OF OPERATION:

WORK SITE:

DATE OF COMMENCEMENT AND COMPLETION OF WORKS:

PROJECT PROMOTER

CORPORATE NAME:

ADDRESS:

TEL: **FAX:** **E-MAIL:**

NAME, QUALITY AND SIGNATURE

OF THE MANAGER OF SGSOC:

PROJECT IMPLEMENTING AGENCY

CORPORATE NAME:

ADDRESS:

TEL: **FAX:** **E-MAIL:**

NATURE OF WORKS TO BE CARRIED OUT:

PLACE OF INTERVENTION:

NUMBER OF WORKERS ENVISAGED:

DATE OF COMMENCMENT OF WORKS:

DATE OF COMPLETION OF WORKS:

NAME, QUALITY AND SIGNATURE OF THE

MANAGER OF THE SITE OFFICER:

HEALTH AND SAFETY ORGANIZATION

- **Site Preparation**

  Site exploration
  Inspection of the immediate surrounding area
  Information on installations, circulation and other risks

- **Staff Induction and Safety**

  Indicate the precautions to be taken before, during and after work
  Provide any other information on workers' safety
  Present the location plan and available emergency measures
  Comment on and distribute an occupational safety manual

- **Hygiene and Health**

  Construct toilets with wash-hand basins, urinals, showers and drinking water
  Provide the possibility of hot meals under shelter
  Verify the provision of standard work clothes that are clean and in good condition
  Justify recruitment and aptitude medical examination
  Provide for a medical unit, first aid attendants and equipment
  Prohibit alcohol and drug consumption

- **Safety at Work**

  Provide a correct list of duly identified staff
  Keep a record of and identify tools, materials, machines and equipment
  Inspect and verify them regularly
  Use staff that is qualified and certified for work and operations of machines
  Justify the training of staff on specific risks
  Sensitize staff on instructions to be complied with in the event of an accident
  Organize meetings on safety and analyze hazardous jobs
  Systematize the use of permit and safety forms
  Make the wearing of PPE during work compulsory
  Prohibit night-work without authorization and supervision
  Formalize a minimum emergency plan (health facility, first aid attendants, firemen, etc.)

WORK SAFETY ANALYSIS

MAIN TASKS	PREVENTIVE MEASURES
Tree cutting and weed control	- Mark the work area - Make the wearing of PPE compulsory - Monitoring of works - Qualified staff/operation of machines - Respect safety distance
Use of site machines	- Staff training and retraining - Compliance with operation instructions - Inspection of machines
Transportation of materials	- Respect the code of conduct - Prepare the road safety procedure - Establish a traffic plan - Mark the course - Install road signs
Mechanical lifting works	- Verification of equipment and accessories - Certification of the operator - Prohibitory sign - Marking of the zone
Manual handling	- Training in gests and postures - Wearing of protective equipments - Load verification
Masonry	- Compulsory wearing of gloves, eyeglasses and shoes - Respect of safety distance - Training in gests and postures
Welding works	- Compulsory wearing of specific PPE - Safety measures / gas bottle - Institute a fire permit
Electrical works	- Issue work permits - Safety procedure - Staff certification - Specific PPE
Height works	- Stabilize materials on the ground - Harnesses and helmets shall be compulsory - Inspect the material
Handling of chemicals	- Wearing of PPE compulsory - Provision of data sheets - Information and sensitization of staff

WORK ANALYSIS PROCEDURE

Occupational safety analysis consist in identifying real and potential hazards inherent in each stage of a specific task or work process and design actions likely to eliminate, reduce or control such hazards.

Occupational Safety Analysis Procedure:

1. divide tasks into observable stages
2. identify risks corresponding to each stage
3. specify preventive measures for each risk

It is advisable to Conduct Occupational Safety Analysis for the following tasks:

1. less frequent, unusual tasks
2. key tasks
3. accident-prone tasks
4. tasks newly introduced in the work process
5. tasks whose routine procedure should be modified

Benefits of Occupational Safety Analysis:

1. Development and reflection by the worker
2. Risk control awareness
3. Assistance in task planning
4. Assistance in work reflection
5. Standardization of work practices

WORK PERMIT

SITE	DATE	PRIME CONTRACTOR	DURATION

WORK DESCRIPTION:	EQUIPMENT USED:

SUPPLEMENTARY INSTRUCTIONS		WORKS		ANNEXES	
		Mechanical		Diagram	
Confined space		Sanding			
		Handling		Drawing	
Electricity		Height			
		Grinding		Procedures	
Access control		Painting			
		Others		Standards	

STATE OF INSTALLATIONS		SAFETY OBLIGATIONS	
Isolated equipment		Eye protection	
Isolated electrical installation		Auditory protection	
Disconnecting switch		Respiratory protection	
Fuse remover		Wearing of helmets, shoes, gloves	
Additional earthing		Special purpose clothing	
Display of instructions		Safety harness	
Drained equipment		Fence / Scaffolding	
Depressurized equipment		Access control	
Ventilated equipment		Display of instructions	
Freed zone		Security Lighting	
Marked zone		Emergency plan	
Supervisor on duty		AST meeting	

NAME and SIGNATURE	NAME and SIGNATURE
Construction Manager	**Security officer**

PERMIT VALIDITY: I have verified and accepted the abovementioned conditions and authorized the execution of work

TRANSMISSION OF INSTRUCTIONS AND REVALIDATION

DATE AND TIME	PRIME CONTRACTOR	CONSTRUCTION MANAGER	VALIDITY

END OF EXECUTION	NAME	DATE	SIGNATURES
CONSTRUCTION MANAGER			
SECURITY OFFICER			
PRIME CONTRACTOR			

WE HEREBY DECLARE HAVING VERIFIED AND APPROVE THE RESUMPTION OF NORMAL OPERATIONS AND THAT WORK DONE WAS PROPERLY EXECUTED AND COMPLETED WITHOUT ANY DAMAGE TO EQUIPMENT AND INSTALLATIONS

FIRE PERMIT

PRIME CONTRACTOR

Name: ……
Function: ……
Department/Coordination: ……
……

SUB-CONTRACTOR (probable)

Corporate Name: ……
……
Qualified Representative: ……
……

WORK TO BE EXECUTED

(Date, time and duration of validity of the permit
Signed on …..... by…..... at…..
Up to…..... at…..
Place: ……
……
Organs to be processed:

Operations to be carried out:

CONSTRUCTION MANAGER AND THE SECURITY OFFICER

1. Security Officer

2. Works Operator

3. Their assistants (if appointed)

DATES AND SIGNATURES

Prime Contractor

Security Officer

Operator

SPECIAL INSTRUCTIONS ACCORDING TO TYPE OF EXORATION

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……
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……
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……
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……

RISKS IDENTIFIED (storage, contiguity, others)

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MEANS OF PROTECTION AGAINST PROJECTIONS

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……

MEANS NEAR THE WORK PLACE

1. Means of alert: ……
……
……
2. Means of initial intervention: ……
……
……
3. Means of communication in the event of emergency: ……
……
……

8.4. Risk Identification

8.4.1. Risks related to implantation and vicinity

SGSOC industrial unit will be located inland and in plantations far from the city and any facility. Accordingly, it will not pose any risk to any third party facility and vice versa. However, at least two situations should be complied with during the construction and operation phases: passage for elephants and a mandatory safety (buffer) zone around the Korup Park.

Recommendations: Adhere to the authorized safety zone around the Korup Park; identify passages for elephants and place flagmen throughout during construction and the functioning of the unit.

Picture 13: Entrance to the korup park

8.4.2. Installations- and equipment-related risks

Incomplete list of equipment and installations provided:

mechanical and electrical technical workshops, garages, laboratories, loading docks and weigh bridge, palm oil storage tanks, petrol and fuel storage and distribution stations, emergency power generators, the oil mill itself will include the following: production line, sterilization area, boiler, power plant, stalk incinerator, chimneys and extraction pits, sterilizers, separators, mixers, presses, grit-removal tank, clod breaker, dusters, screens, silos, decanters, juice extractors, heaters, dehydrators, crushers, florentins, power stations including generators, steam rooms and turbines...

Possible related risks:

- Electrical installations: electric shock on direct contact with conductors and indirect contact with masses powered up, burns, fire and explosion;
- Mechanical equipment: tool blasting or matter risk, crushing of fingers, wounds, equipment shock....;

- Lifting devices: crushing risk, injury caused by appurtenances, falling, collision;
- Machinery and vehicles: risk of accident on contact with other materials, collision with or knocking down of persons, obstacle shock, fall by the operator, collision with a vehicle or machine;
- Hand tools, electric or other welding equipment: risk of injury, electrocution, poisoning, dazzle;
- Workshops and garages: risk of mechanical injury, shock and collision with machines ...;
- Sterilizers and boilers: risk of burns due to heat and steam from furnace, explosion risk;
- Power plant, processing lines and workshops: noise-related risks, electrocution risk.

Recommendations: equip staff in the areas indicated against noise with ear plugs or acoustic muffs, whenever prolonged exposure is necessary or reported, analyze risk station by station, sensitize staff and provide staff with specific protective equipment, train staff on the use, handling and storage of industrial gas cylinders; verify the existence of fire equipment and ensure that staff are trained on how to use them.

8.4.3. Risks related to chemicals and hazardous products

Glyphosate and 2, 4 – D used as herbicides and insecticides, as well as glufosinate-ammonium, trictopyr and metsulfon-methyl, NPK, *kieserite* and MOP used as fertilizers. Finally, the mill will be equipped with a gas station to supply fuel (petrol and diesel) to vehicles, machines and generators.

These products present fire and explosion hazards, especially in case of large-scale storage (gas station, boilers and sterilizers), risk of burns and other skin injuries, intoxication during their handling by staff, and soil pollution risk in the event of spill.

Recommendations: inform and sensitize staff on chemical hazards, mandatory wearing of PPE by staff; display safety messages; provide safety data sheets; ensure compliance with procedures.

8.4.4. Works- and operations-related risks

Site operations concern mechanical and electrical works, welding and grinding, manual handling, lifting, height works, operation of vehicles and machines, unloading of tankers, product handling, painting and masonry, and various manual works whose risks include:

- Electrocution, injury and diverse shocks during electrical and mechanical repair and maintenance works;
- Burns, wounds, dazzle and blasting of particles in the eyes during welding, grinding and machining works near boilers and sterilizers;
- Lumbago, hernia, sciatica, tendonitis, twinge and discal compression caused by manual handling;
- Risk of falling with wounds and fractures and crushing by a load for lifting and height operations;
- Collision, bumping against people and shock against obstacles while operating vehicles and machines.

Recommendations: Train staff in work gestures and postures, safe operation of machines and defensive driving of vehicles; sensitization on the use of chemicals and provision of specific PPE; development and dissemination of suitable procedures for machining.

POTENTIAL RISK MAPPING

IN FUTURE MILL AND SGSOC PLANTATION

AREAS	POTENTIAL HAZARDS	PREVENTIVE MEASURES
In unit premises	▪ Vehicle collision ▪ Collision between vehicles ▪ Shock against obstacles ▪ Skidding and falling	▪ Speed restriction + road signs ▪ Retraining in defensive driving ▪ Equipment removal, zone lighting ▪ Concrete premises + wearing of shoes
In workshops and garages	▪ Body movement / snapping ▪ Blasting of particles into the eyes ▪ Crushing by load ▪ Various wounds and cuts ▪ Fracture of the limps ▪ Shock against equipment ▪ Electrocution ▪ Fire ▪ Noise	▪ Close-fitting clothing + vigilance ▪ Wearing of safety goggles ▪ Qualification + authorization + instruction ▪ Maintenance procedure + authorization ▪ Vigilance, alcohol policy, wearing of PPE ▪ Vigilance, alcohol policy, wearing of PPE ▪ Installation maintenance + permits ▪ Training + fire extinguisher ▪ Wearing of acoustic muff
In the Mill	▪ Burns and cuts ▪ Falling of loads from height ▪ Electrocution ▪ Fire / Explosion ▪ Chemical hazard ▪ Noise	▪ Wearing of PPE ▪ Lighting of area and compliance with procedures ▪ Instruction + PPE + Authorization ▪ Maintenance / Facilities + procedures ▪ PPE + compliance with instructions + training ▪ Wearing of AB helmet / ear plugs
In the service station area	▪ Fire / Explosion ▪ Chemical hazard ▪ Spill hazard	▪ Maintenance / installations + emergency plan ▪ Mandatory wearing of PPE ▪ Drafting + Application procedure

8.4.5. Identification of resources needed

Material resources

- An infirmary having all the necessary equipment and premises for a well-stocked pharmacy, a treatment room with beds, an ambulance, first aid kits ...;
- Fire extinguishing system with RIA comprising fixed (powder and CO2) and wheeled fire extinguishers;
- Sandboxes and shovels in the service station;
- Annual distribution of work clothes and personal protective equipment (PPE).

Human resources

- Train fire-fighters and rescue workers (10% of staff);
- Integrate security guards into the emergency response team;
- Appoint staff representatives to the Health and Safety Committee;
- Appoint an Occupational Health and Safety Officer for the unit;
- Provide the infirmary with a qualified staff, supervised by a physician.

Organizational resources

- Establish an Occupational Health and Safety Committee in keeping with Order No. 039/MTPS/IMT of 29 November 1984;
- Set up an emergency response team comprising fire-fighters, rescue workers and security guards;
- Set up a specific Occupational Health and Safety Service headed by a qualified staff member;
- Develop and implement an emergency plan.

8.5. Missions of the Occupational Health and Safety Service to be Set Up

8.5.1. Management missions

(a) Plan occupational health and safety actions

After identifying risks, Occupational Health and Safety Service programmes measures in time and space to improve the company's situation in the domain of safety and the environment by setting priorities and taking into account technical and budgetary constraints.

(b) Organize required resources

Required (material and technical, human and organizational) resources should be commensurate with stakes and set objectives in terms of quantity and quality.

(c) Direct and guide staff

All staff must be informed and sensitized on risks and how to cope with them, while staff responsible for HSE issues must be given adequate training under the responsibility of qualified guidance.

(d) Control management results

The objective is to periodically verify the results obtained after the implementation of the actions described above to gradually correct or enhance them.

8.5.2. Decision missions

(a) Identify risks associated with the activity

This is the first step to be carried out which will determine the success of the HSE policy and help clearly define, on the basis of the key activity, the way it is carried out, the competence of staff chosen, various equipment, facilities and installations, as well as the products involved or generated by the activity.

(b) Implement risk mitigation instruments

The aim will be to focus on four instruments:

- **Prevention:** training, studies, analysis, information, sensitization, meetings, procedures;
- **Protection:** purchase of materials and equipment, construction of facilities ...;
- **Intervention:** organization of a response team, liaising with external rescue, exercises, contingency and emergency plan ...;
- **Insurance:** risk coverage by appropriate contracts.

(c) Control the results of decisions taken

Anomalies, discrepancies and dysfunctions concerning safety should be regularly monitored during the works execution to correct them as work progresses.

8.6. Risks Study

8.6.1. Characteristics of stored products

Stored hydrocarbon products will emit vapours that may combine with air which is inflammable under certain temperature and pressure conditions, producing a spark. When in contact with flame it can also burn or explode spontaneously under atmospheric pressure.

8.6.2. Risks linked to the storage of flammable products

- Risks related to fire in the catch pit

Damage caused by a fire may stem from heat radiation on the individual or matter (see table below). The fire can be caused by the appearance of a hot spot during welding, grinding or cutting of metal after an impact of metals with a spark as a result or another defect.

EFECTS OF HEAT RADIATION
(FIRE)

HEAT FLUX	DAMAGE
40 KW/ m^2	Ignition of wood in 40 seconds
36 KW/ m^2	Spread of fire on oil tanks
27 KW/ m^2	Ignition of wood between 5 and 15 minutes
20 KW/ m^2	Concrete works resist for several minutes
12 KW/ m^2	Water-cooled oil tanks removes the danger
9.5 KW/ m^2	Pain threshold in 6 seconds; lethal flux in 30 seconds
8.4 KW/ m^2	Beginning of burning of wood and paint; unlikelihood of spread of fire on oil tanks not cooled
5 KW/ m^2	Glass breakage; pain after 12 seconds; shock after 30 seconds; lethal flow in 60 seconds; intervention by protected firemen
2.9 KW/ m^2	Pain in 30 seconds; lethal flow in 120 seconds
2 KW/ m^2	Damage to PVC cables
1.5 KW/ m^2	Acceptable radiation threshold for unprotected persons
1 KW/ m2	Solar radiation in the equatorial zone
0.7 KW/ m2	Reddening of the skin, burn in case of prolonged exposure

- Risks related to tank explosion

Overpressure (sudden increase in pressure), which causes a blast effect, a wave and sometimes projections, may cause considerable damage to individuals and buildings. This hazard is also posed in SGSOC storage areas for flammable products in service and fuel stations.

EFFECTS OF PRESSURE WAVES (EXPLOSION)

OVERPRESSURE (mb)	**DOMAGE**
5	5% of exposed windows are shattered
20	50% of exposed windows are shattered
50	Light damage to structures; risk of injury
80-100	Light damage to metal structures
140	Serious damage to structures; first mortality effects
150-200	Collapse of concrete walls
200	Breakage of metal structures
250	Rupture of storage tanks
250-400	Grubbing of large trees
500	Inversion of trucks; shattering of walls 20 to 30-cm thick

- Risk of toxic fumes

These flammable products are also toxic and in the event of fire, release smoke containing carbon monoxide which is harmful to man; they are harmful when inhaled, ingested, contact with the skin or eyes.

PHYSICAL EFFECTS LINKED TO CARBON MONOXIDE EXPOSURE (FIRE)

CO (ppm) concentration	**CO content in the air**	**PHYSICAL EFFECTS**
100	0.01	No symptom
250	0.025	Light headache after 2/3 hours of exposure
500	005	Headache after 1-2 hours - Nausea, giddiness
750	0.075	Headache after 0.5-1 hour Nausea, unconsciousness after 2 hours of exposure
1000	0.10	Headaches, giddiness, nauseas - Unconsciousness after 1 hour. Death after 3-4 hours of exposure if not treated
1500	0.15	Headaches, giddiness, nausea - Unconsciousness after 30 minutes. If not treated, death after 2-3 hours of exposure
2000	0.20	Unconsciousness after 20 minutes If not treated, death after 1 - 2 hours of exposure
5000	0.50	Unconsciousness after 10 minutes If not treated, death after 30 minutes exposure
> 10 000	> 1	Immediate unconsciousness, death after 2 - 3 hours

- Risk of soil and sub-soil pollution

In the event of PPE rupture during discharge or due to explosion and overflow of catch pit, the products can sip into ground polluting surface and underground water.

8.6.3. Safety distance

To address these hazards, Order No. **12/01/2001/MINMEE lays down terms and conditions to determine safety perimeter** and recommends that a 30m-radius should be reserved around catch pits in which there is no public access buildings (PABs), railway, or another classified establishment, or fixed work station.

8.7. Emergency Plan

The different elements of the emergency plan below are examples that should be adapted to the real situation during the operation of SGSOC site.

On the basis of the hazard study, the emergency plan will define the organization methods of intervention and required resources to be implemented by SGSOC on its site under its responsibility in the event of an accident, to protect staff and property and to prevent harmful effects on the local population and the environment. It should also facilitate the alert of rescue services and information of the competent authorities.

EMERGENCY PLAN

(Operation Phase)

SGSOC INDUSTRIAL UNIT

HERAKLES FARMS

EMERGENCY PLAN

CONTENTS

HERAKLES FARMS

EMERGENCY PLAN

RECIPIENTS

SERVICES / OFFICIALS IN CHARGE	NUMBER OF COPIES
SITE DIRECTIONS	1 copy
SITE HSE OFFICER	1 copy
HEAD OF EMERGENCY RESPONSE TEAM	1 copy
HEAD OF SECURITY POST	1 copy
RESCUE TEAM	1 copy
FIRE TEAM	1 copy
ALL CHS MEMBERS	1 copy each
SECURITY DEPARTMENT SITE ENVIRONMENT	1 copy

HERAKLES FARMS

EMERGENCY PLAN

UPDATE

DATE	FORM

HERAKLES FARMS

EMERGENCY PLAN

GENERAL INSTRUCTIONS

1. ALERT

In the event of fire outbreak (flame, abnormal smoke), in line with special instructions: **Inform mill management** which will alert the fire team and firemen, specifying the venue, extent of disaster, and type of fire, if possible.

If Mill Management cannot immediately be reached, inform firemen straight away.

2. EVACUATION

When the evacuation signal is given by ....., stay calm, leave the premises unhurriedly: if SMOKE invades the exit aisle, bend down and close your nose and mouth with a dry or wet handkerchief.

3. EXTINCTION

Fire outbreak can easily be controlled within the first few seconds: **TACKLE** or cause the hearth to be **TACKLED** using first aid measures; distributed and indicate location of extinguishers corresponding to local risks:

CLASS A FIRE (wood, textiles, cardboard, straw, etc.)		**USE** jet and fog water, quench with a blanket, sand, foam
CLASS B FIRE (flammable liquid pain, oil)		**USE** powder, foam, CO^2, paint, halogenated hydrocarbon, sand
FIRE in the presence of powered **electric** conductors		**DISCONNECT**, **USE** CO^2, powder, dry sand
Low-by ignited or not		**TURN OFF** the tap or valve
FIRE on a person		**STOP RUNNING - LAY** him on the ground or floor**, WRAP** him in a cloth or blanket

4. PREVENTION

. Avoid causes of fire: fire is generally the result of ignorance, imprudence or negligence

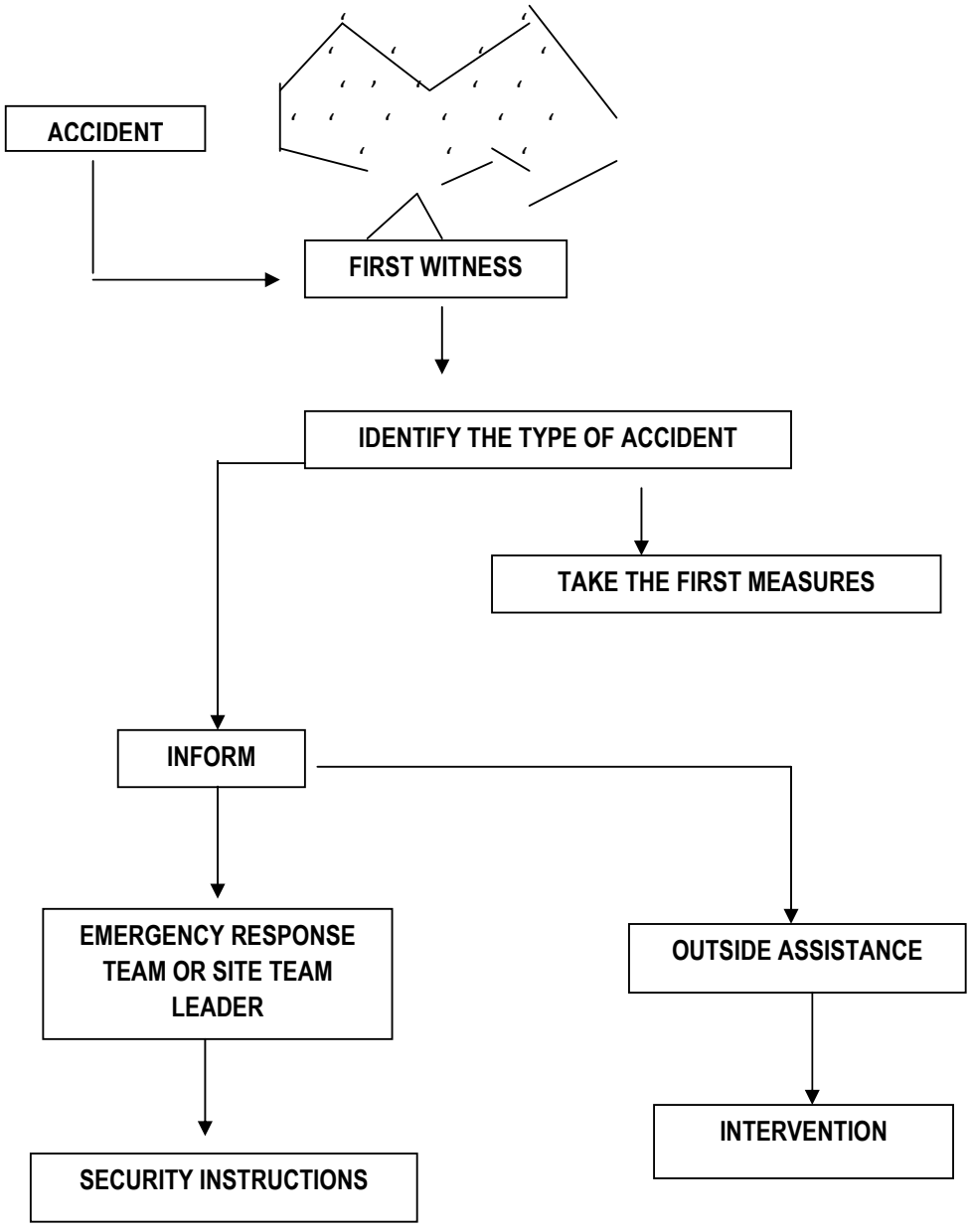
- DO NOT SMOKE in places where a prohibition sign is posted
- DO NOT USE cooking or heating appliances without precaution
- DO NOT USE electrical apparatuses in bad condition.
- DO NOTCLUTTER the exit aisle and outlets under any pretext

BUT

- COMPLY WITH security instructions
- ASK for advice when doubt or embarrassment.
- ENSURE the clearance of outlets and alleys.
- LOCATE emergency apparatus against fire
- MASTER their operating procedure in advance

EMERGENCY PLAN

ALERT: DIAGRAM



EMERGENCY PLAN

ALERT: CALL PROCEDURE

(1) BE ACCURATE AND SHORT

(2) IDENTIFY YOURSELF

(3) SPECIFY THE EXACT VENUE OF THE DISASTER

(4) SPECIFY THE NATURE OF THE DISASTER (FIRE, ACCIDENT

(5) NOTE THE NAME OF THE ADDRESSEE

(6) NOTE THE TIME OF COMMUNICATION

SAMPLE MESSAGE

- Hello! Fire Service?
- This is **SGSOC Mill of .....**
- Call to report the outbreak of oil fire with (without) seriously injured persons
- Request your emergency assistance
- Repeat message twice

Ask your correspondent to repeat the message

EMERGENCY PLAN

EMERGENCY CALL NUMBER

EMERGENCY RESPONSE TEAM

EMERGENCY RESPONSE TEAM LEADER	
ASSISTANT EMERGENCY RESPONSE TEAM LEADER	
SECURITY POST	

MEDICAL ASSISTANCE SERVICES

	TEL. MOBILE	**TEL. STATIONARY PHONE**
EMERGENCY MEDICAL ASSISTANCE SERVICE (SAMU)	**119**	**19**
SAMU MEDICAL OFFICER		
SGSOC MEDICAL OFFICER		
NEARBY HOSPITAL		

SERVICES D'ASSISTANCE PUBLIQUE

	TEL. MOBILE	**TEL. STATIONARY PHONE**
FIRE SERVICE	**118**	**18**
POLICE	**117**	**17**
GENDARMERIE	**113**	**13**

SGSOC HIERARCHY

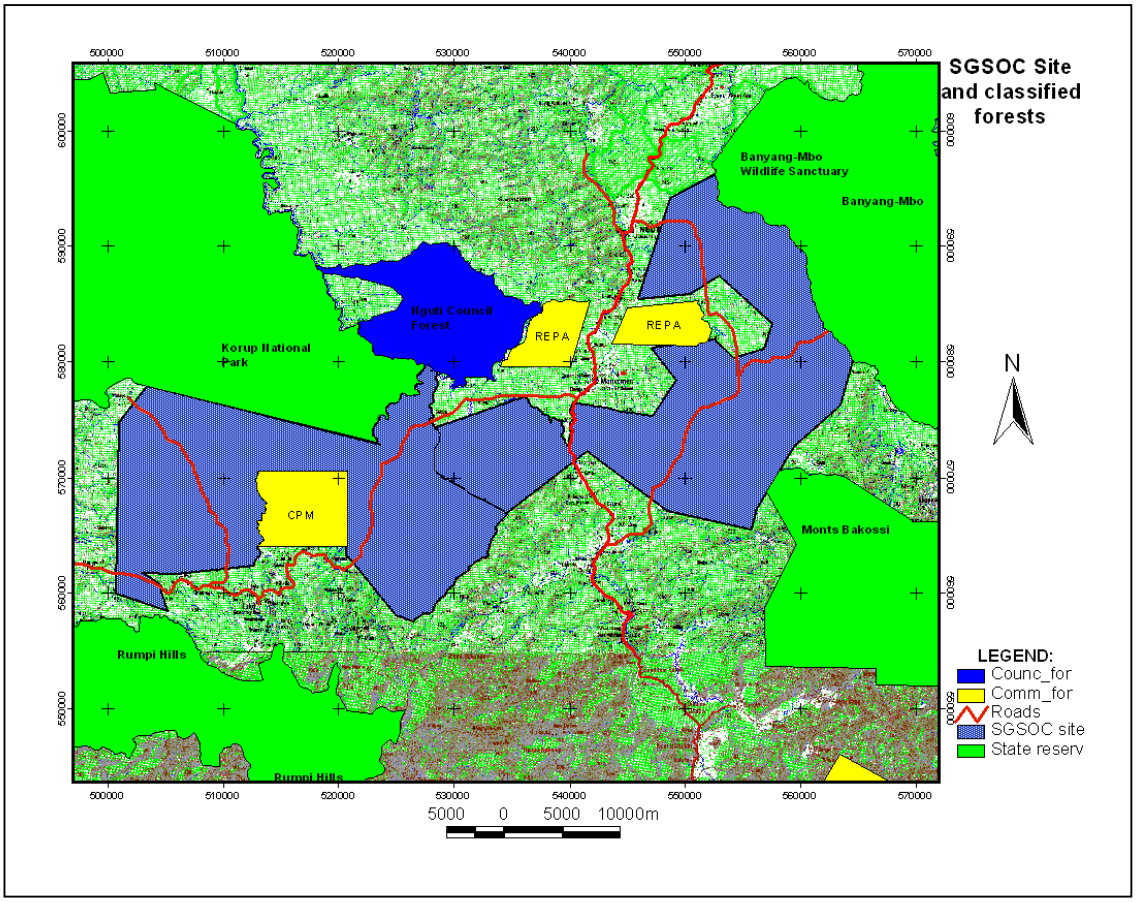
SITE MANAGEMENT	
SITE HSE OFFICER	
GENERAL MANAGEMENT	
TECHNICAL DIRECTOR	
LOGISTICS PRODUCTION DIRECTOR	
HSE DEPARTMENT AT THE HEAD OFFICE	
DEPARTMENT OF HUMAN RESOURCES	
LEGAL SERVICE	
COMMUNICATION OFFICER	

MEASURES TO BE TAKEN IN AN EMERGENCY SITUATION UNDER THE SUPERVISION OF AN EMERGENCY RESPONSE TEAM

- Remain calm and go immediately to the assembly area
- Scrupulously follow the instructions of the emergency response teams
- Alert as the case may be using the abovementioned numbers
- Do not smoke or collect fuel that may be dripping from tanks
- Ensure that one's own resources are adequate for a response
- Remove injured from the disaster area and rescue them
- Move children and the public away from the disturbed zone
- Gather, count and evacuate persons from the site, where necessary
- Tackle the fire, making sure not to remain exposed to the wind
- Contain fuel leak (earth break, sawdust, sand…)

EMERGENCY PLAN

GEOGRAPHICAL SITUATION



HERAKLES FARMS

EMERGENCY PLAN

FIRE MATERIAL AND EQUIPMENT

OTHER RESCUE MATERIALS

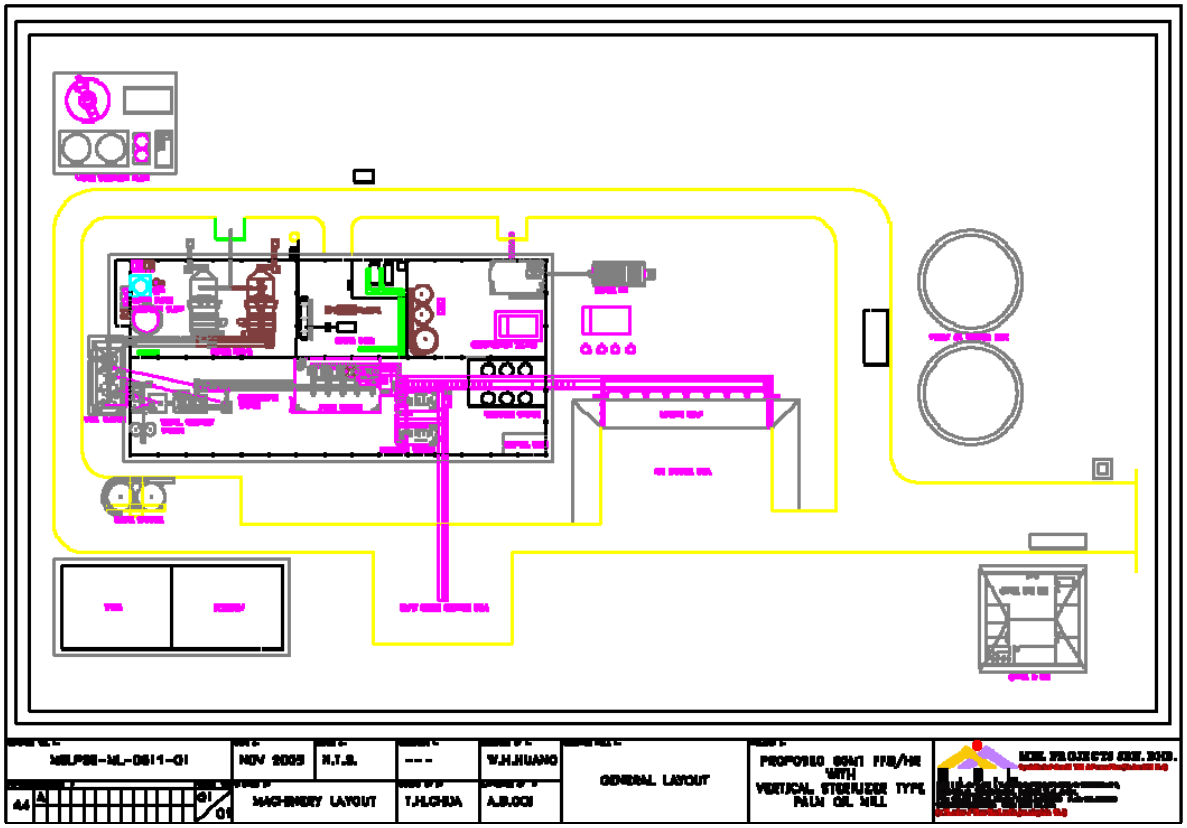
- MEDICAL CENTER WITH QUALIFIED STAFF
- AMBULANCE AND AN EXPERIENCED DRIVER
- FIRST AID KIT PER FIRST-AID WORKER
- ADEQUATE NUMBER OF STRETCHERS
- FIRE BLANKET
- SPLINTS
- ABSORBENT MATERIALS

EMERGENCY PLAN

EMERGENCY RESPONSE TEAM

EMERGENCY PLAN

BLOCK PLAN



SITE REGULATIONS

CONDITIONS OF ACCESS TO THE

Access authorized for vehicles	Service, **SGSOC** staff, Enterprises working on the site
BT/HT CLIENTS	Presentation of receipt serving as authorization to access the site
SGSOC SITE STAFF	Badge presented at the security post
	Badge presented at the security post
OTHER SGSOC STAFF	Place of visit recorded at the security post
VISIT BY OTHER STAFF Without work with tools envisaged on the site Reception authorized only for **SGSOC** officials	Badge presented at the security post Place of visit recorded at the security post HSE induction during first visit
OTHER SGSOC EMPLOYEES CALLED UPON TO WORK ON THE SITE	Badge presented at the security post Place of visit recorded at the security post **HSE induction during** first visit Valid work authorization recorded at the security post
SUB-CONTRACTORS CALLED UPON TO EXECUTE WORK ON THE SITE **(including drivers)**	(Validated) **Work authorization** recorded at the security post (Permanent authorization for current, specific or other work) Helmet, safety shoes (+ specific IPE) required for all staff (including drivers) **Transportation of staff** only in cabins made for that purpose Badge presented at the security post
ANYBODY UNABLE TO ENSURE HIS SAFETY ON THE SITE	**Not authorized to access the site**

WEARING OF INDIVIDUAL PROTECTIVE GEAR

ADMINISTRATIVE AND OFFICE AREAS	No IPE is necessary
	Helmets and safety shoes required
INDUSTRIAL AND WORKS AREAS	Specific IPE (gloves for handling or for chemicals, ear muffs, belts and safety goggles, insulated shoes…) worn according to the nature of work to
INDUSTRIAL BUILDINGS	Complementary IPE recommended border zones
TRANSFORMER AND CONTROL ROOM	**No access authorization**

NB.: Any person called upon to perform work (except administrative work) on the site must wear at least a helmet and a pair of safety shoes.

TRANSPORTATION AND TRAFFIC RULES

Pedestrian movement	In protected areas
Passenger carriage	Specific vehicles only
Maximum traffic speed	20 km/hour
Vehicle parking	Only in delimited or marked areas
Parking position	Starting position

HERAKLES FARMS

EMERGENCY PLAN

FUEL RECEPTION PROCEDURE

BEFORE DISCHARGING
1. GAUGE THE TANKS
2. PARK THE TRUCK ON STARTING POSITION CUT THE ENGINE 3. IDENTIFY DOCUMENTS 4. MARK OUT THE DISCHARGING AREA 5. PLACE FIRE EXTINGUISHERS AT THE DISCHARGING AREA 6. CONNECT THE TRUCK CISTERN TO THE GROUND
7. REMOVE IGNITION SOURCES FROM THE DISCHARGING AREA 8. ENSURE THAT SAFETY RULES ARE COMPLIED WITH 9. VERIFY THE COMPLIANCE WITH SCDP LEAD 10. VERIFY THE PRODUCT QUANTITY IN THE TRUCK CISTERN (Verify value of the void space of the valid gauging certificate) 11. LIFT THE VALVE ON THE TRUCK 12. CHECK THE PRODUCT QUALITY (thermo thermohydrometer, odour, sedimentation; etc.) 13. CONNECT THE DISCHARGE HOSE
WHEN DISCHARGE
14. DISCHARGE COMPARTMENT BY COMPARTMENT 15. MONITOR THE HOSE TO DETECT AIR INTAKE IN TIME 16. DISCONNECT THE HOSE STARTING WITH THE TRUCK, EMPTY THE HOSE 17. RECOVER THE CISTERN BOTTOM AND PUT BACK IN THE TANK
AFTER DISCHARGING
18. GAUGE THE TANKS AFTER DISCHARGE, CLOSE THEM ONCEMORE 19. CONFIRM THE QUANTITY DISCHARGED BY THE DISCHARGE METER 20. SIGN THE DELIVERY FORM 21. PREPARE THE RECEPTION SLIP ACCORDING TO PROCEDURE (LABEL) 22. PREPARE THE ORDER FORM ACCORDING TO PROCEDURE 23. REMOVE THE BEACONS AND FIRE EXTINGUISHERS 24. GUIDE THE TRUCK DURING EXIT MANEUVERS 25. CLEAN THE DISCHARGE AREA
• **PROHIBITION OF DISCHARGING BETWEEN 18:00 P.M AND 6:00 A.M. EXCEPT IN THE EVENT OF EMERGENCY WHEN AUTHORIZED BY THE STORAGE SITE MANAGER AFTER TAKING SAFETY MEASURES.** • **GAS OIL AND LUBRICANTS ARE INTENDED ONLY FOR THE PRODUCTION OF ELECTRICAL ENERGY.** • **THE CONSIGNEE AND THE DRIVER MUST BE PRESENT DURING DISCHARGING.**

EMERGENCY PLAN

SPECIFIC INSTRUCTIONS IN CASE OF FIRE OUTBREAK

If you notice a fire during a visit to a **SGSOC** site:

1. Alert site emergency response teams:
   - **Emergency Response Team Leader** **Tel.:**
   - **Fire Team Leader** **Tel.:**
   - **Guard Team Leader** **Tel.:**
2. Place yourself at the disposal of the emergency response teams for intervention consisting in:
   - Determining the nature of products on or likely to be on fire;
   - Tackling the fire at the base, moving from the edge towards the centre with the adequate fire extinguishers, making not to remain exposed to the wind;
   - Assess the security and ecological impact of the disaster;
   - Alert the **SGSOC** hierarchy (see emergency call numbers):
     - **Plant Manager** **Tel.:** **(mobile)** **Tel.:** **(fixed)**
     - **HSE Officer** **Tel.:**
     - **SGSOC Medical Officer** **Tel.**
   - Requesting the support of public assistance services: (indicate the place, uncongested route, nature of fire…)
     - **Firefighters** **Tel.:** **118 (mobile)** **Tel.:** **18 (fixed)**
     - **SAMU** **Tel.:** **119 (mobile)** **Tel.:** **19 (fixed)**
     - **SAMU Medical Officer** **Tel.:** **(for emergency counselling)**
3. Isolate/limit the disaster area by creating an anti-fire propagation belt (remove flammable objects from the fire)
4. Pending the arrival of firefighters and/or during intervention:
5. Open emergency exits
6. Move children, curious onlooker and spectators away
7. Move away from disaster areas before using the mobile telephone
8. Do not collect (possibly) spilled products
9. In case of explosion risk (fuel tanks, gas bottles…), alert and evacuate workers, visitors and family members the site

EMERGENCY RESPONSE MEASURES	Electrically isolate live equipment that is burning before response, Compulsory wearing of safety shoes, gas masks, safety goggles during response, In a confined place, close openings to avoid currents of air, If there is much smoke: - cover nose and mouth using a wet handkerchief - move while crouching or bent as the air near the ground is more breathable

EVACUATE THE SITE IF FUEL TANKS OR GAS BOTTLES ARE ON FIRE	Local operations managers will count their staff at the assembly point before evacuation. Guards will count visitors and members of their families on the site before evacuation

INSTRUCTIONS IN THE EVENT OF BURN INJURY (CAUSED BY ELECTRICITY, FIRE OR CHEMICALS)	While waiting for help: Remove clothes (excluding the parts sticking to the skin) and cool the disaster victim by sprinkling him with water, give respiratory assistance to the disaster victim Do not induce him to vomit or drink, monitor him

EMERGENCY PLAN

INSTRUCTIONS IN CASE OF SPILL

If you notice chemical spill (gas oil, oils, others…)

1. Alert site emergency response teams:
   - **Emergency Response Team Leader** **Tel.:**
   - **Fire Team Leader** **Tel.:**
   - **Guard Team Leader** **Tel.:**
2. Place yourself at the disposal of the emergency response teams for intervention consisting in:
   - Determining the nature of the chemical spilled
   - Assess the security and ecological impact of the disaster
   - Alert the **SGSOC** hierarchy (see emergency call numbers)
     - **Plant Manager** **Tel.: (mobile)** **Tel.: (fixed)**
   - Request the support of public assistance services:
     - **Firefighters** **Tel. 118 (mobile)** **Tel. 18 (fixed)**
3. Isolate the area by:
   - Closing the drain valve of the storage area, or by
   - Erecting a barrier to limit spill
4. Remove the cause of the spill
5. Pending the arrival of firefighters and/or during intervention
6. Move children, curious onlooker and spectators away
7. Mark out the disaster area taking into account the course product flow
8. Absolutely prohibit smoking
9. Move away from disaster areas before using the mobile telephone
10. Do not try to collect spilled products
11. If the situation so requires, alert and evacuate workers, visitors and family members not participating in the intervention.

HANDLING PRECAUTIONS	Wear plastic gloves, safety goggles and gas masks when handling chemicals

MAIN CHEMICALS USED	WEEDKILLERS, FUNGICIDES AND PESTICIDES GAS OIL AND ENGINE LUBRICATING OILS

INSTRUCTIONS IN THE EVENT OF CONTACT WITH CHEMICALS	Eyes: Wash and rinse the eye(s) thoroughly, or Clean the eyes with the physiological liquid Skin: Wash parts of the body that came in contact with products with a large amount of water

WHERE THE SITUATION SO REQUIRES, EVACUATE THE SITE	Local operations managers will count their staff at the assembly point before evacuation Guards will count visitors and families members on the site before evacuation

EMERGENCY PLAN

INITIAL RESCUE INSTRUCTIONS

Where one is a witness to an accident and in the absence a doctor or an organized rescue group on the spot, it is necessary to:

A- ENSURE PROTECTION

Against fire

When alerting or having firefighters alerted (dial 18 or the number indicated on the calendar - a child can do it) and while waiting for them to arrive…

… TACKLE THE FLAMES IMMEDIATELY

- Throw small amounts of water by violently striking their base

With a fire extinguisher, also target the flame base, moving from the edge towards the centre

- Close doors and windows to avoid air currents

If there is much smoke:

Against gas

- Watch out for the risk of explosion
- Never enter with a naked flame, a lit cigarette…
- When using a flashlight at night, light it before entering
- Do not touch the electric bell, switch, electric meter, telephone; all these appliances produce a spark which, tiny as it is, can cause an explosion
- Have the gas taps or meter turned off, and have the windows opened

Against electricity

- Prevent witnesses or victims from touching the wire before the current is disconnected
- Disconnect the current

B- ALERT

Regarding medical emergency (“vital distress"), it is necessary to immediately call for or have medical assistance called for:

- the company’s medical emergency resources, if they exist and are able to quickly intervene
- or the emergency medical assistance service (SAMU): telephone number 15 or 8 digits)
- or the fire or rescue department (telephone number 18 or 8 digits)

The information given enables them to assess the situation and to put the appropriate resources in motion.

- State the reason for the call
- Indicate the name and exact address of the distressed person (city, street, number, building, staircase, floor, flat; if need be, give the code used to open the door of the building)
- Give the phone number from where you are calling and identify yourself
- If other information is requested, go and inquire about them and return to give them on the telephone. If advice is given, apply it

C- RESCUE

If the victim is no longer breathing, know that:

EACH SECOND GAINED FOR THE START OF EMERGENCY RESPONSE INCREASES THE CHANCE FOR SUCCESS

LIBERATION OF ANATOMICAL AIRWAY AND MOUTH-TO-MOUTH RESUSCITATION

A. The rescuer:

1. Kneels beside the victim, close to its face;
2. Loosens the victim's tie, collar, belt;
3. With one hand placed on his face, he carefully inclines the head backwards;
4. With the other hand, he holds the chin by moving it forward, upwards;
5. Liberates the victim's anatomical airway, if need be;
6. Closes the victim's nose by gripping it between the thumb and forefinger placed on his face;
7. After having breathed in slightly, applies his open mouth on the victim's mouth while pressing hard to avoid any escape of air;
8. Gradually insufflates: the victim's chest swells.

B. The victim's exhalation is passive: the rescuer sits up slightly, gets his breath back while looking at the chest drops.

C. In adults, the frequency of blows should be 12 to 15 per minute and the volume of each blow between 0.6 and 1.2 litres.

WAITING POSITION

- Lay the victim on the lateral security position by pivoting it slowly and regularly without torsion.
- Then cover and watch over him until an organized emergency response team arrives.

SPECIFIC CASES

BLEEDING:

- External: -directly press the wound with the hand or using a compression bandage
- Internal: - lay the victim on the floor by raising the lower limbs.
  - Call out for help.
  - Cover the victim and watch over him.

INTOXICATION:

Call out for help and watch over the victim

Food:	- lay the victim on the floor - do not induce vomiting
Drugs:	- place him in an LSP - where necessary, give artificial ventilation, closed cardiac massage
Household products:	- do not give him something to drink - do not induce vomiting

MALAISE:

- Assess the gravity.
- Place the person in a waiting position (lateral security position).
- Call out for help and watch over him.

FRACTURE:

- Do not touch the victim except to release him or in a life-threatening emergency (loss of consciousness, hemorrhage, and cardioventilatory distress)
- Upper limb: immobilize the limb in the position where it was found with a garment or a piece of cloth folded into a triangle
- Lower limb: wedge the limb, not forgetting the foot
- Call out for help, if necessary, or consult a doctor
- Monitor the victim until emergency medical services arrive

EMERGENCY PLAN

EMERGENCY FIRST-AID FOR BURN INJURIES

In the event of a burn injury and in the absence of a doctor or organized emergency response:

SIMPLE BURNS

(Redness involving a clearly limited surface of the skin)

- Always cool the surface burned as soon as possible by pouring cold water on it, without pressure, for at least 10 minutes
- Do not pierce the blister; protect it with an adhesive bandage

1st degree
Erythema

2nd degree
Bulla or phlyctena

3rd degree
Major burn

- Always cool the surface burned as soon as possible by pouring cold water on it, without pressure, for at least 10 minutes
- The victim's clothes should be removed as soon as possible without removing those sticking to the skin; this may be done when water is poured on the skin or in the shower
- Call the emergency medical service
- Except in case of difficult respiration, lay the burn victim on a clean sheet on the surface not burnt, if possible
- Monitor vital functions and act accordingly

RULE 10/15

- Cooling by aspersion to be done as soon as possible within 10 to 15 minutes after the burn
- With water 10 ° to 15° (room temperature)
- At a distance of 10-15 cm from the tap;
- For about 10 minutes

SPECIFIC CASES

❖ **Burn from chemicals:**
  - Remove clothes immediately soaked with the product and pour plenty of water as soon as possible and until emergency medical service arrives

❖ **Electrical burns:**
  - This is also a severe burn
  - Monitor the victim (ventilation, pulse)

❖ **Internal burns by inhalation:**
  - Monitor the victim (ventilation)

❖ **Internal burns by ingestion:**
  - Do not induce vomiting
  - Do not give fluids
  - Monitor the victim.

ALWAYS CALL FOR EMERGENCY MEDICAL SERVICE

9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1. Introduction

The objective of the ESMP is to outline the arrangements relating to:

1. the identification of environmental and social impacts arising from activities under the SGSOC Project,
2. the implementation of proposed mitigation measures on air, water, soil, noise, etc….,
3. the spill response plan,
4. the proper management of wastes,
5. the monitoring program and
6. the budgetary allocations for the implementation.

Environmental and Social Management Plan or sometimes called Environmental and Social Action Plan is conceived to ensure that the measures proposed in the Environmental and Social Impact Assessment for the protection of the Environment are effectively implemented and that the proposed measures are not just a statement of good will made by the Promoter.

This Environmental and Social Management Plan contains specific descriptions as to the mitigations of impacts and monitoring measures to be adopted by the Promoter which requires obligatorily to be integrated into the project's budget and implementation. By integrating the Environmental and Social Management Plan into the operations the project will be assured to receive funding together with other project components.

The ESAP will be presented in tabular format, setting out the project phase and impact that each mitigation measure or action relates to, the person or entity responsible for implementing each measure or action, details of the mechanisms that will be used to monitor each measure or action and the performance criteria to be utilized in order to define or measure the success or failure of the measure or action.

To help implement the ESAP, an HSE committee will be formed. HSE committee meetings should be undertaken on a weekly basis. The meetings will address pertinent issues for the current phase of works, non-compliances with the ESAP and actions needed in order to conform.

In addition, each contractor will be required to appoint a qualified Health, Safety and Environment Officer (HSEO) prior to work.

The ESAP covers plantation phase through construction and operational phases of the first SGSOC Palm Oil Mill.

This Environmental and Social Management Plan identifies the following:

- Operational procedures essential to avoid Environmental and Social Impacts and risks in every day operations.
- Estimates of feasible and cost-effective measures essential to attenuate potential and adverse Environmental risks and impacts, identified in the Environmental and Social Impact Assessment in order to reduce them to acceptable levels.

The preparation of this Environmental and Social Management Plan takes into consideration and is based on the following:

- Description of the Environmental and Social Impacts identified in the Environmental and Social Impact Assessment executed for the Project area.
- Description of any mitigation measures mentioned in the Environmental and Social Impact Assessment executed for the Project area
- Elements of Cameroon Legislation that may be applicable
- Generally accepted Best Environmental Practices as adopted by the World Bank, the European Community or the United States of America
- The Monitoring Program will follow closely the effectiveness of the Environmental and Social Management Plan by verifying its conformity with reference to :
    - the frequency and location of sampling that may be required to be respected;
    - the Impact Indicators are respected;
    - the proposed procedures, such as Waste Management for example, are being followed; and
    - that written documentation is available for future reference and guidance.

The environmental standards objectives adopted in this report are as follows:

- ✓ Cameroon environmental and social legislation and standards (some of them are listed below, for the full list see chapter 2):

Environmental Management:

Law N° 96/12 of 5th August 1996	Relating to Environmental Management in Cameroon.
Decree N° 2001/718/PM of 3 September 2001	The organization and functioning of the Inter ministerial committee on the Environment.
Decree N° 2005/0577/PM of 23 February 2005	Defines the conditions for undertaking EIA.
Rule n° 0070/MINEP of 22nd April 2005	States the different categories of operations submitted for the realization of an EIA.

Forestry and Wildlife:

Law N° 94/01 of 20th January 1994	Lays down Forestry, Wildlife and Fisheries Regulations
Decree n° 95-531-PM of 23rd August 1995	Determines the conditions for implementation of Forestry Regulations.
Decree n° 95-466-PM of 20th July 1995	Lays down the conditions for the implementation of Wildlife Regulations.

Dangerous Substances:

Law n° 98/015 of 14 July 1998	Relates to installations classified as dangerous, insalubrious, and inconvenient.
Decree N° 98/818/PM of November 1999	Lays down conditions for construction and operation of installations classified as dangerous, insalubrious, and inconvenient.

Water:

Law No. 98/005 dated 14 April 1998	Relates to water.
Decree No. 2001/164/PM dated 8 May 2001	"Decree on Utilization of Water", which sets the conditions of water utilization for business or industrial purposes.
Decree No. 2001/165/PM of 8 May 2001	"Decree on the Protection of Water", sets the conditions of the protection of surface and groundwater against pollution.

- ✓ Relevant International World Bank / IFC standards (see chap 2 for full list):

The World Bank and International Finance Corporation (IFC) guidance have been used in this report. In the absence of Cameroonian standards for environmental discharges and emissions, the standards in the World Bank Pollution Prevention and Abatement Handbook (1998) have been adopted.

- ✓ Relevant international environmental and social agreements to which the country is a party of (see chapter 2).

9.2. Air, soil, surface & underground water pollution

9.2.1. Air

Table 15: Air Emission Requirements for Vegetal Oil Processing: Parameters and Maximum Values (from the World Bank Pollution Prevention Abatement Handbook – 1998)

(mg/Nm³,unless otherwise specified)

Guideline	*PM*	*SO_x*	*NO_x*	*Other; comments*
Vegetable oil processing	50			Odor: acceptable to neighbors

Attenuation of air pollution resulting from exhaust emission of the standby generators

It was suggested that biodiesel to be used for the running of the standby generators instead of fossil diesel.

Attenuation of air pollution resulting from transportation of raw materials and finished product

A study to be initiated to determine if Fuel – Switching is possible and advisable.

Attenuation of atmospheric pollution resulting from POME or palm oil mill effluent

Installation of a digester for the POME, the process effluent and the capturing of methane.

9.2.2. Water

This section of the Environmental and Social Management Plan deals with the palm oil mill effluent (POME).

Cameroon Legislation (Environmental Law 96/12 of 5/8/96 and Decree 2001/165/PM of 8/5/2001 with reference to the discharge of effluents) does not permit industrial or domestic effluents to be discharged untreated into municipal drainage systems or into nature.

Palm Oil Extraction process generates large quantities of effluent, POME, which although is not toxic, it is highly undesirable for the following reasons:

- The effluent, if discharged into nature, it decomposes through action of aerobic and anaerobic bacteria generating Methane or natural gas which is highly counterproductive in combating Global Warming (reference: Kyoto Protocol of the UNFCCC; an International Convention to which Cameroon is a party of).
- The effluent has high level of Chemical and Biological Oxygen Demand (COD and BOD levels) which will have the tendency to deprive living organisms of this essential gas.
- It is also relatively rich in nutrients which could contribute to eutrophication at some point or another.

It is therefore required for SGSOC to treat the POME prior to discharging it into nature. The line of action that is suggested in this Environmental and Social Action Plan is that SGSOC should get a POM that has a POME digester system integrated and also a system which can capture Methane.

In due course SGSOC may consider the option of a Clean Development Mechanism project (CDM) for forced Methane Capturing for which then they will qualify for "Additionality" since the effluent would be captured in lagoons or digesters.

The treatment of the POME eliminates water, soil and atmospheric pollution totally.

All effluents discharged (Industrial and Domestic) in Cameroon are legislated, by the Law 96/12 of 5/8/96 and the corresponding applicable Decree, Decree 2001/165/PM of 8/5/2001.

The application of the Law is explained in the Decree 2001/165/PM of 8/5/2001 which is entitled *"Modalités de protection des eaux de surface et des eaux souterraines contre la pollution".*

Consequently, a license is required as per Article 4 of the above mentioned Decree in order to discharge any effluent as from the date of publication of the Decree. The procurement of the license is described in the following articles of the Decree 2001/165/PM. The license/permit can be obtained by application and payment of a fee from the Ministry in charge of Water Resources.

In the application for the discharge permit or license, initial chemical analysis of the effluent is necessary. The application for the permit is to be made on specially designed forms (enclosed below and in the Annexes) for all effluents that are discharged into the municipal drainage system or into nature.

It is the responsibility of the Promoter to formulate the demand for the license authorizing the discharge.

License application is required for all effluents that may carry pollutants, namely:

- All process effluents;
- Any non-contaminated effluent that may have accidentally come in contact with contaminants (rain water passing over hydrocarbon contaminated concrete surface, for example);
- Domestic effluents ("Gray Sewage" Water and "Black Sewage" Water);
- For uncontaminated rain water or any other clean discharged water no license is required;
- The discharged effluent must be within permissible discharge limits as specified in "World Bank - Pollution and Abatement Handbook 1998" (see below).

The estimated cost of the mitigation measures and training of the personnel is given below in Environmental Action Plan table.

Table 16: Effluent Levels limits for Vegetable Oil Processing (from the World Bank Pollution Prevention Abatement Handbook – 1998)

(milligrams per liter, except for pH and temperature)

Parameter	*Maximum value*
pH	6–9
BOD	50
COD	250
TSS	50
Oil and grease	10
Total nitrogen	10
Temperature increase	≤ 3°C[a]

Table 17: Limits for Process Wastewater, Domestic Sewage, and Contaminated Stormwater Discharged to Surface Waters, for General Application (from the World Bank Pollution Prevention Abatement Handbook – 1998)

(milligrams per liter, except for pH, bacteria, and temperature)

Pollutant or parameter	*Limit*
pH	6–9
BOD	50
COD	250
Oil and grease	10
TSS	50
Metals	
Heavy metals, total	10
Arsenic	0.1
Cadmium	0.1
Chromium	
Hexavalent	0.1
Total	0.5
Copper	0.5
Iron	3.5
Lead	0.1
Mercury	0.01
Nickel	0.5
Selenium	0.1
Silver	0.5
Zinc	2.0
Cyanide	
Free	0.1
Total	1.0
Ammonia	10
Fluoride	20
Chlorine, total residual	0.2
Phenols	0.5
Phosphorus	2.0
Sulfide	1.0
Coliform bacteria	< 400 MPN/100 ml
Temperature increase	< 3°C[a]

Note: MPN, most probable number.

Table 18: Water, soil and produce quality guidelines
(from the IFC – HSE Guidelines Plantation Crop Production – April 1997)

Parameter	Media	Guideline Value
Pesticides, nitrates, coliform or other potential agricultural contaminants	Irrigation water	Concentrations should not exceed national irrigation water quality standards or, in their absence, internationally recognized guidelines (e.g WHO Water Guidelines applicable to irrigation water quality) [a]
Pesticides, nitrates, coliform or other potential agricultural contaminants	On-site water supplies	Concentrations should not exceed national drinking water quality standards or, in their absence, internationally recognized guidelines (e.g WHO Irrigation or Drinking Water Guidelines for compounds potentially present in on-site groundwater wells or surface waters) [b]
Nutrient balance	On-site soil	Nutrient surpluses should remain stable; nitrogen surplus should be preferably below 25kg/ha/yr [c]
Pesticides	On-site soil and produce	Below applicable tolerance levels [d]

Table 19: Liquid Effluents Guidelines for Agriculture and Oil Mill

Industry	Pollutants	Max Concentration Limits in mg/l
AGRICULTURE	Matière en Suspension	15
	Phosphate (PO4)	3
	Fluor (F)	1
	pH :	6-9
	Ammonium (NH 4)	0.1
	Arsenic (AS)	0.1
	NO 3	20
	Pesticide total	0.1
OIL MILL	pH	6 –9
	DB0 5	50
	DCO	250
	Matière en suspension	5O
	Huile et graisse	10
	Azote total (NH4–N)	10
	Elévation max Temp.	≤ 3°C

(Source: Compendium of environmental laws of African countries. Volume VII, pages 248-255 (UNDP and UNEP, 1998); World Bank Guidelines.)

Below, Decree 2001/165/PM for the protection of surface and underground water against pollution to be filled out and submitted to the MINEE for the water discharge permit (See also in Annexes).

ANNEXE N° 1 RELATIVE A LA DEMANDE D'AUTORISATION DE DEVERSEMENT D'EAUX USEES INDUSTRIELLES REGLEMENTEE PAR LE DECRET N° 2001/165/PM DU 08 MAI 2001
Précisant les modalités de protection des eaux de surface et des eaux souterraines contre la pollution.

1 – RENSEIGNEMENTS GENERAUX

1.1 Nom de l'établissement .....
1.2 Adresse du siège social .....
1.3 Adresse du siège d'exploitation .....
1.4 Nature de l'activité de l'établissement
1.5 Personne physique responsable de l'observation des conditions fixées dans l'acte d'autorisation de déversement des eaux usées :

Nom (s) et prénom (s) .....
Fonction dans l'établissement .....
n° téléphone .....

1.6 Représentant de la personne citée au point 1.5, en cas d'absence de celle-ci
Nom (s) et prénom (s) .....
Fonction dans l'établissement .....
n° téléphone .....

1.7 Prière de joindre une copie des autorisations de déversement et/ou de prélèvement d'eau délivrée à l'établissement (s'il en existe).
1.8 Nature et quantité de produits (ou matières premières) fabriqués. Si nécessaire, donner note en annexe.

1.8.1 Quantité moyenne de chaque matière première utilisée

Matières	Par jour	
.....	.....	.....
.....	.....	.....
.....	.....	.....

1.8.2 Production moyenne pour chaque produit fabriqué

Matières	Par jour	par mois
.....	.....	.....
.....	.....	.....
.....	.....	.....

1.8.3 Donner dans une note annexe une description des processus de fabrication avec schéma des circuits d'écoulement des eaux.

1.9 Rayer dans le tableau ci-dessous les périodes de non-fonctionnement de l'établissement.

Heure	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jour	Lundi						Mardi						Mercredi						Jeudi					
	Vendredi						Samedi						Dimanche											
Mois	Janv.	Fév.	Mars	Avril	Mai	Juin	Juillet	Août	Sept.	Oct.	Nov.	dec.												

1.10 En cas de variations saisonnières de production établies (changements de procédés ou de produits, périodes de surproduction, périodes de nettoyage des installations, etc.), veuillez joindre en note un exposé de la succession de ces périodes dans l'année.

2 – RENSEIGNEMENTS CONCERNANT LES EAUX RESIDUAIRES

2.1 Nature et quantité des eaux déversées ;

2.1.1 Quantité maxima des différentes espèces d'eaux usées. Donner ces quantités pour chaque décharge, s'il y a plusieurs décharges pour une même espèce d'eau usée.

	Max.m³/heure	Max.m³/jour	Max.m³/mois
Eaux usées domestiques (1)			
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
Eaux de refroidissement (1)			
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
Eaux usées industrielles proprement dites			
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
Eaux pluviales (3)			
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

2.1.2 Dans le cas des fluctuations saisonnières des quantités des eaux déversées, il y a lieu de donner les quantités respectivement pour chaque période caractéristique (si nécessaire dans une note annexe).

2.1.3 Eventuellement, quelles seraient les quantités respectives dans le cas d'une extension future et la date probable de cette extension ?

2.1.4 Les différentes espèces d'eaux usées doivent être séparément vers les dispositifs de contrôle respectifs, lesquels doivent être situés dans l'enceinte de l'établissement et aussi près que possible de la voie réceptrice. Il convient d'indiquer dans quelle mesure cette disposition est ou sera réalisée.

2.2 Où sont déversées les différentes espèces d'eaux ?
- Eaux usées domestiques ;
- Eaux de refroidissement ;
- Eaux usées industrielles proprement dites ;
- Eaux pluviales

2.3 En ce qui concerne les eaux domestiques

2.3.1 - Nombre de personnes employées
- Nombre d'équipes successives par jour et nombre de personnes par équipe
- Eventuellement, évolution pour l'avenir.

2.3.2 Provenance des eaux usées domestiques

- Installations sanitaires
- Cuisine / Cantine
- Salles de bains
- Lessives, etc.

2.3.3. Source d'alimentation en eau

- Réseau de distribution SNEC
- Puits, forage
- Source
- Autres

2.4 En ce qui concerne les eaux de refroidissement

2.4.1 Existe-t-il un circuit fermé d'eau de refroidissement ? Si oui, quel est le débit de l'eau circulant dans ce circuit fermé ?

2.4.2 Caractéristiques attendues de l'eau déversée :

- pH
- teneur en oxygène dissous ..... mg/l
- Température ..... °C
- Turbidité ..... N.I.U.
- Matières en suspension ..... mg/l
- Demande chimique en oxygène (dichromate) ..... mg/l
- Dureté totale ..... d°Fr
- Phosphates ..... mg/l
- Chromates ..... mg/l
- Silicates ..... mg/l
- Nitrates ..... mg/l
- Autres algicides, tartrifuges et inhibiteurs de corrosion.

2.4.3 Sources d'alimentation en eau utilisée

- Cours d'eau
- Puits
- Autres

Quels sont les débits maxima, horaire et journalier de l'eau prélevée ?

2.4.4 Dans le cas de prélèvement de l'eau dans un cours d'eau, la température et la dureté des eaux déversées sont-elles dépendantes de la dureté de l'eau ? Dans quelle mesure ?

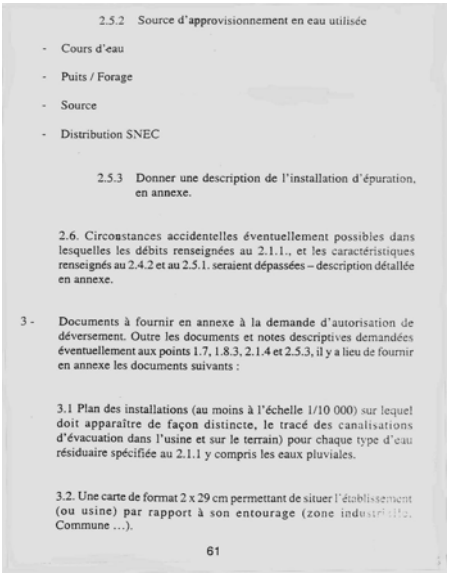
2.5 En ce qui concerne les eaux usées industrielles proprement dites

2.5.1 Caractéristiques des eaux usées industrielles déversées par chacune des décharges, avant et après épurations éventuelles.

Décharge n° .....

Caractéristiques de l'eau déversée	Matières sans épuration	Minimum après épuration	Unité
PH			
Température			°C
Matières sédimentables en 2 heures			mg/l
Matières en suspension après décantation			mg/l
Matières en suspension total			mg/l
Demande biochimique d'oxygène en 5 jours (DBO5)			mg/l
Demande chimique en oxygène / dichromate (DCO)			mg/l
Oxydabilité au permanganate à froid			mg/l
Hydrocarbures non polaires extractibles au Tétrachlorure de carbone			mg/l
Matières extractibles à l'ether de pétrole			mg/l
Détergents (anionique, cationique, et non ionique)			mg/l
Phosphates			mg/l
Chlorures			mg/l
Sulfates			mg/l
Sulfites			mg/l
Nitrates			mg/l
Azote ammoniacal			mg/l
Azote organique			mg/l
Oxygène dissous			mg/l
Conductivité			MHom
Turbidité			NTU

(1) Aux paramètres cités dans le tableau, il faut mentionner, si nécessaire, les teneurs maximales dans les eaux déversées, avant et après épuration, en phénols, cyanures, chlore libre, chlore organique, fluorures, sulfures et mercaptans, zinc, cadmium, mercure, cobalt, plomb, nickel, arsenic, argent, manganèse, sélénium, fer, cuivre, aluminium, étain, autres substances chimiques toxiques, substances radioactives, etc.



2.5.2 Source d'approvisionnement en eau utilisée

- Cours d'eau
- Puits / Forage
- Source
- Distribution SNEC

2.5.3 Donner une description de l'installation d'épuration, en annexe.

2.6. Circonstances accidentelles éventuellement possibles dans lesquelles les débits renseignées au 2.1.1., et les caractéristiques renseignés au 2.4.2 et au 2.5.1. seraient dépassées – description détaillée en annexe.

3 - Documents à fournir en annexe à la demande d'autorisation de déversement. Outre les documents et notes descriptives demandées éventuellement aux points 1.7, 1.8.3, 2.1.4 et 2.5.3, il y a lieu de fournir en annexe les documents suivants :

3.1 Plan des installations (au moins à l'échelle 1/10 000) sur lequel doit apparaître de façon distincte, le tracé des canalisations d'évacuation dans l'usine et sur le terrain) pour chaque type d'eau résiduaire spécifiée au 2.1.1 y compris les eaux pluviales.

3.2. Une carte de format 2 x 29 cm permettant de situer l'établissement (ou usine) par rapport à son entourage (zone industrielle, Commune ...).

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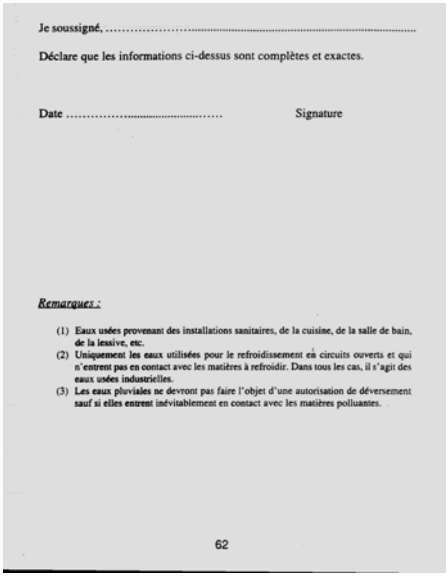

Je soussigné, ...

Déclare que les informations ci-dessus sont complètes et exactes.

Date ..... Signature

Remarques :

(1) Eaux usées provenant des installations sanitaires, de la cuisine, de la salle de bain, de la lessive, etc.
(2) Uniquement les eaux utilisées pour le refroidissement en circuits ouverts et qui n'entrent pas en contact avec les matières à refroidir. Dans tous les cas, il s'agit des eaux usées industrielles.
(3) Les eaux pluviales ne devront pas faire l'objet d'une autorisation de déversement sauf si elles entrent inévitablement en contact avec les matières polluantes.

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There is also a fee to be paid from using ground or river water for industrial purposes. See in the Annexes, the application description under Decree 2001/164/PM.

9.2.3. Soil

This section of the Environmental and Social Management Plan deals with the attenuation of soil pollution by hydrocarbons.

Some measures have to be taken in order to avoid soil pollution by HC:

- The workshops, garages and fuel filling stations have to have their own drainage system and they should not be mixed with the effluent from the process or the regular drainage system for rain water.
- Oil/Water separators have to be installed at the exits of drains from the garage, the fuel filling stations and the workshops. This would eliminate major part of any fuel or oil pollution coming from these installations.
- The best investment, however, would be in the education of the low echelon and daily personnel in simple environmental procedures and a preparation of a simple manual of procedures, a booklet entitled, "*What you must never do*". This booklet should be issued to all personnel to give them basic instructions in environment.

- Elaborate a Spill Response Plan. Train a Spill Response team and invest in Spill Response basic equipment.

9.2.4. Noise and Dust

This section of the Environmental and Social Management Plan deals with the attenuation of noise.

The form of noise attenuation that should be considered here is protection for the personnel's ears that will work on a permanent basis within the enclosed structures. The level of noise allowed by the Cameroonian legislation is 85 dB (A) (see Ministerial Rule 039/MTPS/IMT of 26 November 1984. Article 41). This applies to all personnel who are working in a noisy area on a permanent basis. It does not apply to passersby.

Table 20: Admissible noise levels
(from the World Bank Pollution Prevention Abatement Handbook – 1998)

	Maximum allowable log equivalent (hourly measurements), in dB(A)	
Receptor	*Day (07:00–22:00)*	*Night (22:00–07:00)*
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Silencer units of the POM Machinery, the plantation engines and the vehicles are to be maintained in good working order. Offending machinery and / or vehicles will be banned from use on site until they have been repaired.

Noise levels must be kept within acceptable limits for a protected area (see World Bank Guidelines above).

The HSE coordinator should endeavor to keep noise generating activities associated with construction activities to a minimum and within working hours.

9.2.5. Attenuation of impacts resulting from solid waste stream

Elaborate a Waste Management Plan and train a team to oversee its implementation.

9.2.6. Attenuation of impacts on wildlife/fauna and flora

- Under no circumstances shall any animals be handled, removed, killed or be interfered with by the Promoter, his employees, his subcontractors or his subcontractors' employees.
- The Promoter shall ensure that the site be kept clean, tidy and free of garbage that would attract animals.
- No poaching of fauna and flora shall be tolerated by the Promoter or his personnel on Site or elsewhere.

9.2.7. Attenuation of Social Impacts

If any artifact on site is discovered, work in the immediate vicinity shall be stopped immediately. The Promoter through his HSE coordinator shall take reasonable precautions to prevent any person from removing or damaging any such item.

9.3. Spill Response Plan

9.3.1. Introduction

Spills are intentional or unintentional release of substances (solids or liquids) in a magnitude that could cause substantial negative effects to the system receiving it; the system in question could be, for example, soil, river, lake, sea or the atmosphere.

Spills can occur during many of the everyday operations such as: refueling of equipment, painting, changing oil, during transfer of the liquids or solid from container to another, rinsing drums containing liquid or solid that is harmful; they may also occur as a result of a burst hose or pipe, the mal-functioning of an overflow valve of a tank, road accident of a fuel tanker and the like.

Spills can either be of HAZARDOUS or NON-HAZARDOUS nature. Spills, especially the Hazardous Spills, can have diverse negative effects on both the natural environment and the human environment.

Spills could contaminate water bodies directly if, for example, a spill occurs on a bridge crossing a river. Spills can contaminate streams and aquifers indirectly through run-off waters and through percolation. When a Hazardous solid or liquid is spilled on soil, the composition and texture of the soil can become modified affecting plants or crops growing on it and consequently there could be a loss of vegetation. Loss of vegetation can lead to soil denudation and subsequently soil erosion, loss of soil productivity or valuable food crops.

This is why SGSOC has to hire specialists or a consulting firm who will elaborate a detailed Spill Response Plan for the company.

9.3.2. Structure of a Spill Response Plan

1. Characterize the different levels of spills that can occur in the SGSOC concession
2. Research on the different Cameroonian legislation on water and soil pollution
3. Benefits of having a Spill Response Plan for SGSOC
4. Different types of spills that can be encountered in the operations of SGSOC during the plantation phase, the construction and the operation phases of the Palm Oil Mill
5. Individual responsible in case of a spill
6. Outlines of Spill Response Plan for SGSOC and guidelines for its formulation
7. Spill Response organization

8. Spill Response recovered substances and their disposal
9. Spill Response procedures for notifying the Authorities
10. Spill Response training and drills
11. Spill Response crew's report on completion of mop-up operations, evaluation, critique and suggestion for improvements.
12. Spill Response equipments

9.3.3. Spill Response Equipments

The most important items are illustrated below. To these should be added brooms, pans, picks, shovels and other miscellaneous small tools.

MATERIALS FOR CLEAN UP OF SPILLED PRODUCT FROM CONCRETE AND OTHER SURFACES

SUGGESTED SPILL RESPONSE EQUIPMENT FOR TANKERS

9.4. Waste Management Plan

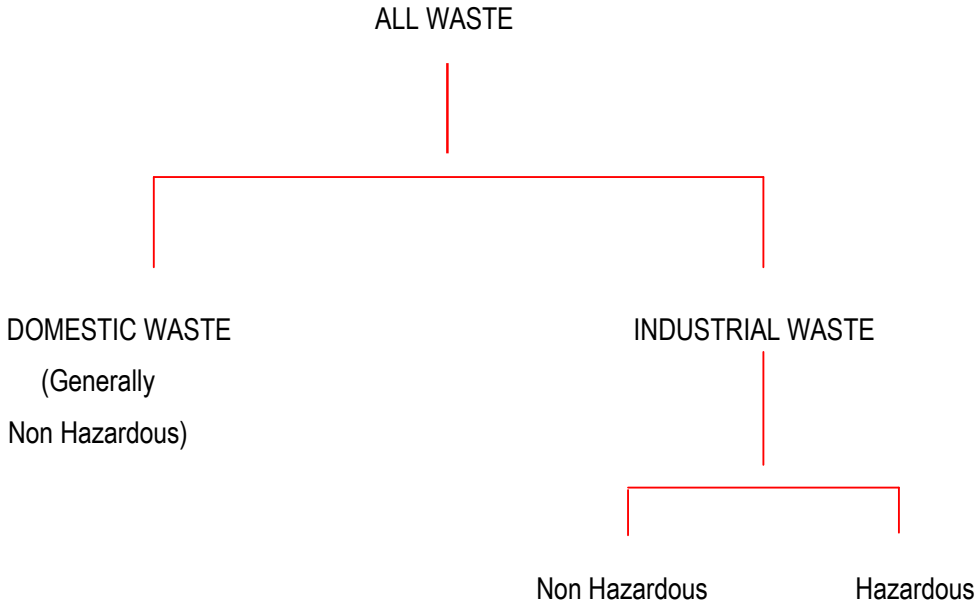
9.4.1. Introduction

Considering the fact that waste by definition (industrial or not) is not desirable but inevitable, the philosophy of "Waste Management" can be expressed as follows:

- do not produce waste as much as possible; if the production of waste is inevitable, decrease this production to the least amount;
- If waste is produced, their re-use or their recovery must be considered as first alternative before their elimination;
- If the re-use or the recovery is not possible, the waste must be treated, neutralized, or transformed into elements considered as not waste;
- If it is not possible, the waste must be eliminated in a way not harmful to the environment or to human beings.

Consequently, "Waste Management" requires recycling or re-use, treatment, transformation or elimination in a way not to damage the environment.

CLASSIFICATION OF WASTE



Article 47 (3) of the Environmental Law N°96/12 of 05/08/96 forbids the elimination of the dangerous industrial waste in dump fields for household waste.

9.4.2. Essentials of a Waste Management Plan

1. Establish the responsibility for Waste Management at each Department of SGSOC (Plantations, POM, Workshops, etc…), and appoint an overall Waste Management Supervisor. This will be a fully trained employee in Waste Management.

Services of a Consultant should be employed to set up such a Waste Management System and train the person involved.

2. A list of all Solid Wastes generated at the different facilities with estimated quantities of each on a monthly or other time basis should be prepared (particularly of the Hazardous Wastes).

3. Provide temporary, well labeled, storage bins for the different categories of Waste in specially designed plastic or metal bins (with lids that are open when the waste is being deposited). The separation of Waste in the case of Hazardous Waste (including Medical Waste) is particularly important as different waste will be treated or disposed of differently. Hazardous Waste cannot be mixed.

It should be noted that Art. 47 (3) of law 96/12 of 5/8/96 does not allow Hazardous waste being deposited with Non – Hazardous waste.

4. Establish a list of Accredited Waste Elimination Contractors and obtain a Certificate of Accreditation from each of them for the record. Ensure that they are accredited and not operating illegally (this is for the protection of SGSOC and comes under the category of responsibility for environmental actions).

SGSOC should have Waste contractors for the following Waste items:

- ✓ Accredited used engine oil recycling facility
- ✓ Accredited lead and lead batteries recycling contractor (also other heavy Metal pollutants)
- ✓ Accredited tire and rubber recycling contractor (Tires must not be burnt for reason of air pollution)
- ✓ Plastic recycling contractor, particularly for plastic containers which must be rinsed prior to disposal DO NOT BURN PVC IN OPEN AIR COMBUSTION (air pollution due to dioxins and furans that are generated)
- ✓ Accredited used batteries (not car and equipment batteries) and e-waste (electronic waste) recycling/exporting contractor
- ✓ Accredited Hazardous Waste incineration contractor (for incineration at high temperatures in specially constructed incinerators that do not emit pollutants into the air)
- ✓ Accredited domestic waste collection contractor

5. At monthly, two or three month intervals (depending on the rate of accumulation of each type of waste), ship out the said waste for destruction or treatment to one of the accredited Waste Contractors (This should be done on SGSOC Waste Manifest form, see proposed example below).

WASTE MANIFEST

FOLLOW - UP DOCUMENT

WASTE GENERATED BY : ***Part A***

Waste stream from:

☐ *Mechanical W/S* ☐ *Field*

☐ *Electrical W/S* ☐

☐ *Stores* ☐

Description		Code		H / NH		Quant.		Unit	Observations

Destination **Elimination Code**

Sender : *I declare that the information in this Part A is correct*

Name in capitals **Signature** **Date**

WASTE TRANSPORTED BY : ***Part B***

Name of transporter

Adress :

Transporter : *I declare that I received the above waste for transportation and that the information in Part B is correct*

Name in capitals **Signature** **Date**

WASTE RECEIVED BY FOR DESTRUCTION OR DEPOSITION ***Part C***

Waste Depot / Incinerator or Recycle depot

Address:

Destination *I the undersigned declare having received the above described waste for disposal*

yes ☐

no ☐

Name in capitals **Signature** **Date**

SGSOC should ensure, as it is its responsibility under the Law that its Wastes are legally disposed of with the Waste Manifest as proof of the disposal by the Waste Management Contractor. In case of an incineration for example, demonstrate how the ashes have been disposed of (This is an example of environmental responsibility).

6. Periodically the prepared list of different types of waste that are estimated should be reconciled with the list of the actual generated waste that was legally disposed of by SGSOC through the Waste Management Contractors. This is required for record purposes and proof that it was legally and environmentally correctly disposed of.

7. Management should take personal interest (through an appointed member of a Senior Management) to ensure that the system is working correctly. Inspections by the Senior Manager should be done once per month and detailed audit once every six months to ensure that the system is working.

8. All Waste Manifest forms should be kept for record purposes. (The Waste Manifest forms are also proof of disposal for which payment has been made).

The Waste Manifest should be issued in 4 copies.

- ✓ Copy 1,2,3,4 initiated by SGSOC and signed (SGSOC keeps Copy 1 for record of issue)
- ✓ Copy 2,3,4 are taken by the Transport contractor who signs them and keeps Copy 2 for himself for record after having delivered the waste to the Collector who signs all the 3 copies that he received the waste in full.
- ✓ Copy 3,4 are retained by the Waste Collector and signed by him indicating how the waste has been destroyed or treated. On completion of the treatment he signs the two copies and submits Copy 4 with the invoice for the treatment to SGSOC, the initiator of the waste. He keeps Copy 3 for his record.

The Waste Manifest is designed to enable anyone to determine as to who is responsible for the waste at any time. This is particularly important in the case of Hazardous Waste.

Management should take active interest in the Waste Management. It should also establish a budget to enable the Waste to be rationally and legally handled.

It should be noted that Waste handling is a legal obligation, clearly outlined in the Framework of Environmental Legislation Law 96/12 of 5/8/96 and should therefore, be taken as a point of Law.

9.4.3. Structure of a Waste Management Plan

1. List SGSOC potential wastes and classify them into Hazardous **H** or Non Hazardous **NH**

For example:

Type of waste	H / NH
Acid / caustic solutions	H
Batteries, elements of batteries	H
Debris from painting	H
Expired, not used, additives and chemicals	H
Household Trash	NH
Medical, hospital waste	H
Scrap iron	NH
Used engine oil, grease and lubricants	H
Used oil filters	H
Various solvents	H
Water contaminated by hydrocarbons	H

2. Responsibility for waste handling
3. Procedures to follow
4. Specific waste handling instructions

Two (02) examples are given below:

- 1 **H** Waste: Water contaminated by hydrocarbons, oils and fuels
- 1 **NH** Waste: Domestic waste

WATER CONTAMINATED BY HYDROCARBONS, OILS AND FUELS (CODE W-HYCO) (H)

Description and definition

This is water containing relatively small quantities of oils or fuels, resulting from the contact with mechanical equipment or accidental fuel spill in the workshops or the installations.

For example water from car washing or engine washing, mixed water and oils resulting the dripping of pluvial waters around engines, and accidental fuels spills during the refueling.

Options opened for the reduction of this form of contamination water

Insure that the conception of workshops is such that it separates rain waters and does not allow it to be contaminated by oil or fuels.

Safety measures to observe during handling

Avoid all contact with the skin and the eyes

Method of treatment by preferential order

Mechanical workshops and industrial installations are frequently constructed with an oil separator. The oil separator is the first stage of treatment of this form of pollution and it is essential. Oil is therefore separated of oily waters that enter the separator and are recuperated thereafter.

The remaining water in the separator, considering that it was in contact with oil or fuels, contain small quantities of dissolved oil and has to be treated before it is discharged into the municipal drainage system or into nature.

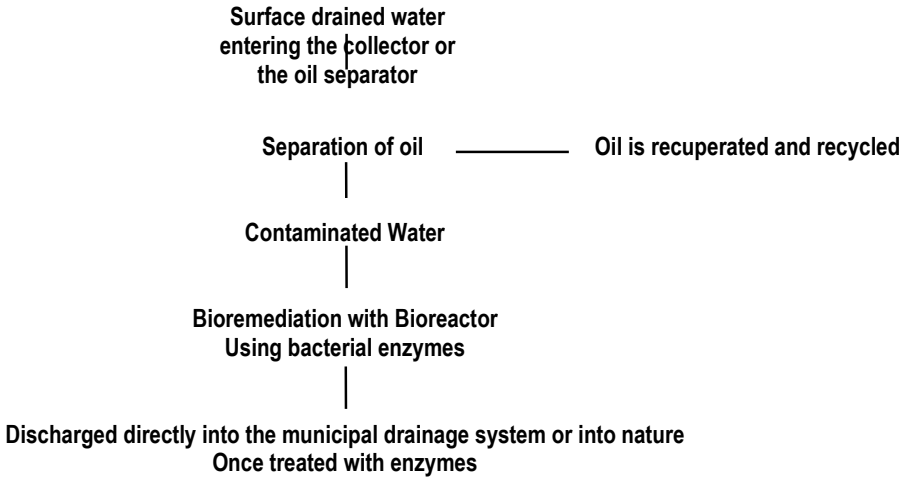
The recommended treatment system is the system of bioremediation with the enzymes.

Using the bacterial enzymes, the treatment can be done in a short period of time and the contaminated water, which is now free of contaminants, can be then discharged into the municipal drainage system.

The installation in the oil separator or in a water collector of an **"Enzyme Bioreactor"** can insure immediate degradation of contaminants such as oils and fuels.

Different enzymes are used to degrade different fuels and oils.

The enzymes or complex of enzymes have to be determined beforehand for each mechanical workshop or industrial installation as the type of enzymes required depend on the hydrocarbons that require to be degraded.



Note: If a Bio-reactor is not available, water exiting from the separator has to be recuperated and bio-degraded in a treatment tanks by natural bioremediation before it is discharged.

DOMESTIC WASTE (CODE TRSH) (NH)

Description and definition

This waste consists of office waste (paper), kitchen wastes, table remains, wrappings of all sorts, aluminum or iron cans, cartons, paper, disposable plates, plastic bags, etc.

Options for the reduction of the production of this type of waste

- Reduce printing.
- Use reusable articles rather than disposable ones such as paper plates, plastic knives, etc.
- Effect food economy by preparing just sufficient food for all persons and not more.
- Before throwing garbage away remove all items of:
    - Glasses
    - Metals
    - Plastic
    - Paper

These items can be recycled (**see Law 96/12 Article 42, 43).**

Safety measures to be observe when handling

None

Method of treatment by preferential order

Temporary Storage:

In garbage bags.

Option I

Allow collection by city garbage collectors for disposal in the municipal dump.

Option II

On the spot burying (in locations without municipal dumps)
(After sorting recyclable items).

Option III

Burn on the spot in a combustion pit (in locations without municipal dumps)
(After removing plastic containers and bags).

Note: DO NOT BURN PLASTIC CONTAINERS AND BAGS; THESE CAN BE SOURCES OF DIOXINE WHEN BURNT.

9.5. Monitoring

9.5.1. Introduction

SGSOC will implement an Environmental Monitoring Program in and around their concession area. In the absence of Cameroonian standards for environmental discharges and emissions, the standards set out in the World Bank Pollution Prevention and Abatement Handbook (1998) and the IFC – HSE Guidelines (April 30, 1997) will be used.

Monitoring results will help judge the success of mitigation measures in protecting the environment. They will be also used to ensure compliance with national and international environmental standards.

As previously indicated the intention of the Environmental Monitoring Program is to follow closely the effectiveness of the Environmental and Social Management Plan by verifying its conformity with reference to:

- ✓ the frequency and location of sampling that may be required is respected;
- ✓ the Impact Indicators as specified here are respected;
- ✓ the proposed procedures, such as Waste Management for example, are being followed; and
- ✓ that written documentation is available for future reference and guidance in the future

In order to achieve the aims of the Monitoring Program the use of Environmental Management Indicators will be followed, which is a tool to facilitate effectiveness of the monitoring process and the indicators used are listed below:

<u>AIR (ambient+ emissions) :</u>

Carbon Dioxide	CO_2
Carbon Monoxide	CO
Sulphur Dioxide	SO_2
Nitrogen Oxides	NO_X
Methane	CH4
Particulate	PM_{10}

<u>SOIL + WATER:</u>

Tot. Pet. Hydrocarbons	TPH
Biological Oxygen demand	BOD
Chemical Oxygen Demand	COD

Total Suspended Solids	TSS
Agrochemicals	N, P, K, Mg

NOISE:

Noise level measurements

QUANTITY OF WATER PRODUCED:

Monitoring of effluent discharged

HAZARDOUS AND DOMESTIC WASTE PRODUCED:

Monitoring of Waste Management Plan

The frequency of sample monitoring is to be suggested by Legislation proposed in the World Bank manual "Pollution Prevention and Abatement Handbook" 1998 or that generally followed in Internationally accepted Good Environmental Practices.

Records must be kept of all monitoring for future reference and guidance.

The Environmental Monitoring Program will cover the following:

- General environment
- Air emissions
- Biodiversity
- Surface water and groundwater
- Soil
- Noise and dust emissions
- Social monitoring

9.6.2. General Environment

SGSOC should create the position of HSE coordinator to ensure that the mitigation measures and other requirements set forth in the Environmental and Social Management Plan are adhered to. It is recommended that SGSOC appoint a HSE coordinator during the plantation development and the Palm Oil Mill construction phase of the project.

The following guidelines apply to the functions of a HSE coordinator:

- The HSE coordinator should have the ability to understand the contents of the Environmental and Social Management Plan and explain it to the different contractors, the site staff, the supervisors and any other relevant personnel.
- The HSE coordinator would have to be on site to supervise environmental actions associated with plantation development and construction activities.
- The HSE coordinator should be able to understand, interpret, monitor, audit and implement the EMP. He must give feedback to his hierarchy in the form of a written report.

9.6.3. Main monitoring objectives

Air quality

- To measure emissions of particulate matter, SO_2 and NOx on an annual basis to confirm if emissions from the Palm Oil Mill are within the guideline limit set by the World Bank.
- To measure concentrations of dust and gaseous emissions at selected locations surrounding the project area, so that the results can be assessed in relation to international air quality standard (see World Bank standards).

Biodiversity

- To document terrestrial flora and fauna prior to land clearing for each planting phase.

Surface water and groundwater

Some groundwater monitoring is performed in accordance with permit requirements.

- To evaluate compliance of water quality with the standards set by the permit.
- During the palm oil mill operations, to monitor surface water on a monthly basis at the main discharge points from the drainage systems.
- To assess the effectiveness of environmental management actions designed to minimize surface water contamination.
- To document changes in surface water flow if they occur.

Soil

- To assess the effectiveness of environmental protection measures aimed to:
  - Minimize erosion;
  - Maximize sediment retention in surface runoff; and to
  - Minimize suspended solid loads downstream of disturbed areas.

(See Agrinexus Implementation Plan).

Noise

- Noise levels have to be taken on a monthly basis.
- To ensure that noise levels produced by operation of the Palm Oil Mill machinery and equipment do not exceed the applicable World Bank standards.

Transportation

- To document disturbances to local villagers due to equipments or product transportation if they occur.
- To avoid traffic accidents by respecting road signalization.
- To mitigate nuisance of increased traffic due to increased noise level.

Social Monitoring

- To anticipate impacts potentially caused by incoming workforce.
- To evaluate the effectiveness of recruitment policy to give preference to local villagers.
- To identify community concerns so that they can be addressed before they develop into serious community relations issues.
- To ensure that grievances are resolved and do not escalate into conflict.
- To evaluate local community perception towards the project during plantation development and operation stage.
- To support government (Ministry of Public Health) and local communities to prevent and to combat diseases.
- To ensure that the opportunity for the spread of disease between the non-local workforce and local residents is kept to a minimum by multiple sensitization meetings.
- Avoid any deterioration in public health and environmental sanitation as a result of the project.

9.6. Cost of implementation of attenuation and ESAP

Table 21: Environmental and Social Action Plan

Project Phase	Activity/Source of Impacts	Medium affected	Effects of the impacts	Importance of the impact	Mitigations of the impacts	Mitigation responsibility	Cost	Monitoring	Indicator / Performance criteria
Nursery Establishment (15 hectares)	Site clearing	Biodiversity	Loss of habitat (Fauna and Flora)	Major	The nursery sites are very small (15 ha). The animals will migrate to a close by location. Being a secondary forest, the sites do not contain endangered vegetations.				
		Water	Flood incidents downstream	Moderate	Make boundaries around the nursery sites.				
			Turbidity of the water	Minor					
		Soil	Soil erosion - Loss of arable soil in the area	Moderate					
	Open burning of the biomass	Air	Elevated particles in the air - atmospheric pollution + Climate change	Moderate	Practice zero burning.				
	Construction of the base camp	Visual impact	Land use	Minor	Use of local material such as wood to build the base camp.				
	Traffic	Air	Dust and noise	Moderate	Speed limitation signals.				
	Degradation of the biomass	Soil	Pest infestation	Minor	Use of pesticide and insecticide to control the infestation.				
	Use of agrochemicals	Water and soil	Pollution of the soil and water courses	Major	The use of agrochemicals should follow strictly the plant requirements. Fuel dispensers have to be used by a well trained person to prevent accidental spillage.				
	Use of petrochemicals			Major					
	Sewage from workers			Moderate	Toilets with septic tank should be constructed.				
	Waste from the nursery: - Domestic waste	Waste management	Soil pollution	Moderate	Domestic waste should be collected and disposed of in a proper manner.				
	Waste from the nursery: - Hazardous waste (Used oils, empty chemical products containers, used polybags)	Waste management	Soil pollution	Moderate	All empty containers (agrochemicals or petrochemicals) have to be collected for proper disposal. The used oil has to be stored carefully for reuse or disposal (it can be recuperated by a recycling company). The used polybags should be collected for proper disposal.				
				Major	Do not cut down primary forest to develop an oil palm monoculture.				
					A three (03) kilometers buffer				

Plantation Development	Site clearing, construction of roads, and establishment of the base camp	Biodiversity (Habitat)	Loss of habitats / Loss of species	Major	zone should be left between the Korup National Park and the SGSOC concession.				
					Mbu river acts as a natural boundary between the Bayang Mbo Wildlife Sanctuary and the SGSOC concession, however, an additional 500 meters buffer zone between the BMWS and the SGSOC concession should be incorporated.				
					Corridors should be left out to help the evacuation of the animals.				
					Some part of the forest can be fragmented as patches and remain undisturbed to save some tree species.				
					SGSOC should plan its development every year over a large period of time by clearing smaller blocks (250 to 500 hectares). Phasing out of the plantation development.				
					SGSOC should also work closely with the KNP and the BMWS managements.				
			Loss of Non-Timber Forest Products (NTFPs) (Ex. country onion, bush pepper, bush mango, bitter kola, red cola, monkey cola, Njabe, and many other spice species)	Major	Leave some forest area in the plantation; this forest can also act as a buffer zone and can be used as a shelter for the animals that are going to be used for pest control.				
			Limited natural resources for the villagers and the new migrants (foods, wood as fuel for cooking, etc.)	Major	A ranch should be created by SGSOC to provide its workers and the villagers with meat (cows, sheep, poultry, etc.…) The waste (fiber + nut shelves) from the POME can be compacted into briquettes and distributed to the villagers.				
			Human – elephant conflict with destruction of the plantations near the Bayang Mbo Wildlife Sanctuary	Minor	The human – elephant conflict should be resolve by using the WWF Better Management Practice (leave a buffer zone, leave a corridor, install electrified fences, build trenches, use repellents, guard the plantation).				

Plantation Development		Biodiversity (Habitat)	The connectivity and biodiversity corridors will be impacted because the proximity with the Korup National Park and the Bayang Mbo Wildlife Sanctuary.	Major	A three (03) kilometers buffer zone between the KNP and the SGSOC concession. Mbu river acts as a natural boundary (BMWS and SGSOC), however, an additional 500 meters buffer zone between the BMWS and the SGSOC concession should be incorporated.				
			Increase in poaching by the population.	Major	SGSOC should have a no poaching policy.				
		Land	Loss of the villagers' farmland.	Major	SGSOC has giving its word in the MOU to not touch any farm or village plantations and to leave farmland for the future generation. Before the plantation development, there will be a "demarcation" exercise with a team composed of SGSOC, villagers, and the government.				
		Water	Increase in surface runoff due to the reduction of infiltration and soil erosion	Major	SGSOC should develop a Water Management Plan. SGSOC should leave a riparian reserve of a few meters around the rivers and streams.				
		Soil	Soil erosion	Major	Phasing out the development. Leguminous cover crops will be use to help minimize soil erosion by reducing the pressure from raindrops and act as an impediment to surface run-off.				
	Open burning of the biomass	Air	Massive atmospheric pollution with elevated ambient total suspended particulates.	Moderate	Practice zero burning.				
			The release CO_2 into the atmosphere will contribute to climate change.						
	Degradation of the biomass	Soil	Biomass will provide shelter for certain pests such as rodents	Minor					
	Usage and application of agro-chemicals (fertilizers, pesticides, fungicides, insecticides, etc…)	Water	"Euthrophication" in the surface water causing growth of vegetation and affecting aquatic life.	Major	Mulch from the decomposed biomass can be used as fertilizer as well as the Empty Fruit Bunch from the Palm Oil Mill. SGSOC will put in place an Integrated Pest Management Program. This program will use chemical, cultural, biological, and physical practices to control the infestations.				
			High levels of chemicals can affect the quality of water, the aquatic life and even the supply of freshwater.						

Plantation Development	Use of generators in the plantation for the water pump or the camp	Water and Soil	Pollution by hydrocarbons by spillage.	Major	Put in place an oil/water separator next to the workshop drainage system. Train workers on how to handle these products. SGSOC has to put in place a "Spill Response Plan".				
	Sewage generated in the base camp	Water	An increase in the level of COD, BOD, and microbiological contents in the water system. It will lead to a bad odor and breeding of mosquitoes and flies.	Moderate	Toilets with septic tank have to be built and maintained.				
	The plantations will allow a certain type of pest infestation		Leaf-Eating Caterpillars – Nettle Caterpillars and Bagworms.	Moderate	They can be kept under control by various insect predators. To promote and sustain high predator population, beneficial host plants e.g. *Cassia cobanensis*, *Euphorbia heterophylla* and *Antigonon leptosus* should be planted in the field for the beneficial insects.				
			Mammalian Pests – Rats (vertebrate pest).	Moderate	An integrated approach of rat control should be practiced using the barn owl (*Tyto alba*) as a biological control agent and the use of rat baits.				
			Insect Pests – Rhinoceros Beetle.	Moderate	To prevent beetle population build-up, good ground covers such as *Mucuna bracteata* and *Pueraria javanica* should be established rapidly to reduce breeding sites in Oil Palm fields.				
	Transportation of the Fresh Fruit Bunch (FFB) to the palm oil mills and of the oil palm to the port.	Air	Dust and noise pollution.	Minor	The installation of traffic signage, speed limitation, and installation of speed bumps.				
	Waste	Soil	Soil pollution by empty containers (agrochemicals, hydrocarbon substances such as oil, grease, lubricant, etc…), dirty towels, etc…	Moderate	SGSOC has to put in place a "Waste Management Plan".				
	Plantation development	Population	Loss of land and NTFP (such as "bush meat", medicinal plants, and wood for cooking).	Major	There will be some buzzer zones left as patches. For the fire wood, SGSOC should make fire briquettes from the left over fibers and shells to distribute them to its workers and the population.				
			Destruction of community-based economy.	Major					
			Exposure to health risks (Malaria, HIV AIDS, STD, etc…).	Major	SGSOC should work closely with the Health Districts of the Ministry of Public health and promote sensitization campaigns.				

Plantation Development			Food security.	Major	SGSOC should have a cow ranch to provide meat to the workers and villagers.				
			Insecurity.	Major	SGSOC should have a security patrol to control the plantations and its installations.				
			Destruction of indigenous cultural values.	Major	No shrine or cultural site will be destroy by SGSOC.				
Palm Oil Mill Construction	Exhaust emission of CO, SO_2, NO, NO_2 and Particulate Matter PM_{10} which result from the combustion of the palm oil fiber and nut shell	Air	Air pollution	Major	There are two means of control for the attenuation of NO_x emission, namely: Combustion Control and Flue Gas Treatment. The FCD consists of using a scrubbing medium which rids the flue gases of Sulfur Dioxide SO_2 prior to exhausting them into the atmosphere.				
	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the combustion of the stand-by fossil fuel generators			Major	SGSOC took the initiative to manufacture biodiesel in the near future from the Crude Palm Oil, the standby generators should be operated using biodiesel and not fossil fuels.				
	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the transportation of the FFB to the Palm Oil Mill for processing from the plantation by trucks			Major	The approach here is FUEL – SWITCHING to biodiesel produced by SGSOC.				
	Exhaust emission of CO, CO_2, SO_2, NO, NO_2, HC and Particulate Matter which result from the transportation of Crude Palm Oil (CPO) for export or to the port by third party trucks			Major					
	Emission of Methane CH_4 from the shallow ponds as a result of digestion by anaerobic of the Palm Oil Mill Effluent (POME)			Major	Methane will be captured from the digesters and cleaned of sulphur and moisture before feeding it to the gas engine to generate electrical power.				
	Possible use of Ozone Depleting Substances (ODS)			Moderate	No CFCs or halon containing equipments should be imported. Use of solvents such as Carbon Tetrachloride and similar in cleaning operations should be avoided.				
	The discharge of untreated process effluent (POME) and other contaminated effluents	Water	Water pollution and eutrophication of water courses	Major	The Palm Oil Mill Effluent (POME) will be collected in anaerobic ponds which will help lower its COD, BOD and TSS numbers +				

Palm Oil Mill Construction					take up the pH.				
	Spill of hydrocarbon (or other hazardous substances)	Soil	Undesirable effects affecting underground water sources and human health	Major	Underground Fuel Storage tanks MUST BE DOUBLE WALLED. The mechanical workshops, garages, and similar areas must have their own INDEPENDENT drainage system. This drainage system must be enhanced with an Oil/Water separator. Elaboration of a “Spill Response Plan” for the SGSOC Site.				
	Generation of solid waste • Agri waste	Soil	Soil pollution	Moderate					
	Generation of solid waste • Office waste such as paper • Used oils, • Towels dirtied with oils, • Empty containers from the workshop and the garage, • Etc.…	Soil	Soil pollution	Moderate	Elaboration of a « Waste Management Plan » for the SGSOC Site.				

Table 22: Safety Action Plan

WORK RISK PREVENTION PLAN (Construction Phase)	Developed according to the attached model and have it signed by each operator prior to site access	HSE Officer
ENVIRONMENTAL/SAFETY POLICY	Prepare HSE Manual defining domains, responsibilities, clear objectives and all procedures	GM + HSE Officer + Consultant
SPECIFIC ORGANS	Appoint an HSE Officer and define his tasks; Create and operate a CHS and training its members	GM + HSE Officer + Consultant
DOCUMENTATION	Prepare HSE Manual and ensure emergency alert	HSE Officer
TRAINING	Educate and train all staff	HSE Officer and Consultant
PREVENTION AND EMERGENCY PLAN	To be developed according to attached models	HSE Officer and Consultant
OPERATIONS AND WORKS Risks associated with traffic accidents, processing work, mechanical, electrical repair and maintenance operations, handling, chemicals, decanting, welding and height works in plantations	Organize training in defensive driving and gestures and postures + specific work training; make the wearing of PPE mandatory	HSE Officer + External Training Consultant
HUMAN NEEDS	Form a medical team; appoint an HSE Officer and Assistant Officer as well as the Emergency Response Team Leader; train 10% of staff and firemen and guards in first aid	GM + HSE Officer + specialized service providers
ORGANIZATIONAL NEEDS	Create and organize HSC (Health and Safety Committee); train an emergency response team; develop and implement a prevention plan and an emergency plan; design and apply key HSE procedures; set up a medical centre	HSE Officer + specialized service providers
MATERIAL NEEDS	Identify fire and rescue equipment, provide appropriate PPE and make their wearing compulsory; ensure the protection of diesel storage area by paving the floor + earthing	HSE Officer + specialized service providers

10. IMPLEMENTATION OF THE ENVIRONMENTAL AND SOCIAL ACTION PLAN

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