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Environmental and Social Impact Assessment of the CBG Mine Extension Project

Chapter 1 – Background

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ABBREVIATIONS AND ACRONYMS

(Note: Text in square brackets [] is a translation of a French term for which there is no official English version.)

°C: Degrees Celsius

AFD Agence Française de Développement [French development agency]

AIDS: Acquired immune deficiency syndrome

AIP: Annual investment plan

AMC: Alliance Mining Commodities Ltd.

ANAÏM: Agence Nationale d'Aménagement des Infrastructures Minières [national agency for mining infrastructure development]

APA: Laboratoire Archéologie et Peuplement de l'Afrique [African archeology and settlement laboratory]

APAÉ: Association des parents et amis d'élèves [parents and friends of students]

ARV: Antiretroviral

BAP: Biodiversity action plan

BEPC: *Brevet d'études du premier cycle du second degré* [middle-school leaving certificate]

BGÉÉE: Bureau Guinéen d'Études et d'Évaluation Environnementale [Guinean bureau of environmental studies and assessment]

BM: Banque Mondiale / World Bank (WB)

BPII: *Bonnes pratiques industrielles internationales* / Industrial international best practices

C/P: Frontline fishing camps and ports

CA: *Chiffre d'affaires* [revenues]

CBG: Compagnie des Bauxites de Guinée

CCME: Canadian Council of Ministers of the Environment

CCNUCC: *Convention-cadre des Nations Unies sur le changement climatique* / World Bank United Nations Framework Convention on Climate Change (UNFCCC**)**

CDD: *Contrat de durée déterminée* [contract of defined length]

CDI: *Contrat de durée indéterminée* [contract of indefinite length]

CÉCI: *Centre d'études et de coopération internationale* / Centre for international Studies and Cooperation

CECIDE: Centre du Commerce International pour le Développement [international trade center for development]

CEDEAO: Communauté économique des États de l'Afrique de l'Ouest / United Nations Economic Commission for Africa (UNECA)

CFB: Chemin de Fer de Boké [Boké railroad]

CITES: Convention on International Trade in Endangered Species

CMG: Chambre des Mines de Guinée [Guinean chamber of mines]

COD: Chemical oxygen demand

COPC: Contaminant of potential concern

CoPSAM: Comité Préfectoral de Suivi des Activités des Miniers [prefectoral mining activity monitoring committee]

CPC: *Contaminant potentiellement préoccupant* / contaminant of potential concern (COPC)

CPD: Comité Préfectoral de Développement [prefectoral development committee]

CPÉ: *Consultation et participation éclairées* / informed prior consent (IPC)

CR: *Commune rurale* [rural commune]

CRD: *Commune rurale de développement* [rural development commune]

CSA: Centre de santé amélioré [improved health center]

CSO: Civil society organizations

CSR: Corporate social responsibility

CU: *Commune urbaine* [urban commune]

CVÉ: *Composante valorisée de l'écosystème* / valued ecosystem component (VEC)

dB: Decibel

dBA: A-weighted decibel

dBZ: Decibel relative to Z

DEP Direction Préfectorale de l'Éducation [prefectoral directorate for education]

DPUHC: Direction préfectorale de l'urbanisme de l'habitat et de la construction [prefectoral directorate for housing and construction]

DUDH: *Déclaration universelle des droits de l'homme* / Universal Declaration of Human Rights (UDHR)

ÉDG: Électricité de Guinée

EIA: Environmental impact assessment

ÉIE: *Étude d'impact environnemental* / environmental impact assessment

ÉIS: *Étude d'impact social* / social impact assessment

EITI: Extractive Industries Transparency Initiative

EPA: Environmental Protection Agency (United States)

EPI: Extended Program on Immunization

EPT: Ephemeroptera, Plecoptera and Trichoptera (types of aquatic insects)

ESCOMB: *Enquête de surveillance comportementale et biologique sur le VIH/SIDA* [HIV/AIDS behavioral and biological surveillance survey]

ESIA: Environmental and social impact assessment

ESMP: Environmental and social management plan

ETAE: *Eaux tropicales de l'Atlantique Est* [tropical waters of the Eastern Atlantic]

FEL 1: Front-end loading – preliminary economic assessment

FEL 2: Front-end loading – prefeasibility study

FEL 3: Front-end loading – detailed engineering study

FPIC: Free prior and informed consent

GAC: Guinea Alumina Corporation

GdG: *Gouvernement de la Guinée* / Government of Guinea (GoG)

GDP: Gross domestic product

GES: *Gaz à effet de serre* / greenhouse gas (GHG)

GHG: Greenhouse gas

GIEC: Groupe d'experts intergouvernemental sur l'évolution du climat / Intergovernmental Panel on Climate Change (IPCC)

GIS: Geographic information system

GNF: Guinean franc

GoG: Government of Guinea

GPS: Global positioning system

GRI: Global Reporting Initiative

GTP: Ground truth point methodology

Ha: Hectare

HAP: *Hydrocarbure aromatique polycyclique* / polycyclic aromatic hydrocarbon (PAH)

HFO: Heavy fuel oil

HP: Horsepower

HSE: Health, safety and environment

IBA: Important bird area

ICCPR: International Covenant on Civil and Political Rights

ICESCR: International Covenant on Economic, Social and Cultural Rights

ICMM: International Council on Mining and Metals / Conseil International des Mines et des Métaux

IFC: International Finance Corporation / *Société Financière Internationale* (SFI)

IFI: International finance institutions / *institutions financières internationales*

ILO: International Labor Organization

IPCC: Intergovernmental Panel on Climate Change

ISQG: CCME Interim Sediment Quality Guideline

IST: *Infections sexuellement transmissibles* / sexually transmitted infections (STIs)

ITIE: Initiative pour la Transparence des Industries Extractives / Extractive Industries Transparency Initiative (EITI)

IUCN: International Union for Conservation of Nature / Union internationale pour la conservation de la nature (UICN)

km: Kilometer

km^2: Square kilometer

LA_{eq}: Equivalent sound level (dBA)

LDIQS: CCME Interim Sediment Quality Guideline

L_{eq}: Equivalent sound level (dB)

m: Meter

m^2: Square meter

m^3: Cubic meter

m^3/h: Cubic meters per hour

MDDEP: Ministère du Développement durable, de l'Environnement et des Parcs du Québec, now called the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques [Quebec ministry of sustainable development, environment and parks, now called the ministry of sustainable development, environment and the fight against climate change]

MDT: *Matières dissoutes totales* / total dissolved solids (TDS)

ml: Milliliter

mm: Millimeter

MME: Ministère des Mines et de l'Énergie / Ministry of Mines and Energy

MTPA: Million tonnes per annum

MW: Megawatt

N/A: Not applicable

NEP: *Niveau d'effet probable du CCME* / CCME probable effects level (PEL)

NGO: Nongovernmental organization

NP: *Norme de performance de la SFI* / IFC Performance Standard (PS)

NSP: *Ne s'applique pas* / not applicable (N/A)

OAU: Organization of African Unity

OCDE: Organisation de Coopération et de Développement Économique / Organization for Economic Cooperation and Development (OECD)

OECD: Organization for Economic Cooperation and Development

OIT: Organisation internationale du Travail / International Labor Organization (ILO)

OMS: Organisation mondiale de la Santé / World Health Organization

ONG: *Organisme non-gouvernemental* / nongovernmental organization

ONU: Organisation des Nations-Unies / United Nations

OSC: *Organisations de la société civile* / civil society organizations

OUA: Organisation de l'unité africaine / Organization of African Unity

OWINFS: Our World Is Not for Sale

PACV: *Programme d'appui aux organisations villageoises* [village support program]

PAH Polycyclic aromatic hydrocarbon

PAI: *Plan annuel d'investissement* / annual investment plan

PARC: *Plan d'action de réinstallation et de compensation* / resettlement and compensation action plan (RAP)

PCB: *Plan de conservation de la biodiversité* / biodiversity action plan (BAP)

PCS: *Partenaires contre le SIDA* [AIDS prevention group]

PDL: *Plan de développement local* [local development plan]

PEL: CCME probable effects level

PEPP: *Plan d'engagement des parties prenantes* / stakeholder engagement plan (SEP)

PÉV: *Programme élargi de vaccination* / Expanded Programme on Immunization (EPI)

PGES: *Plan de gestion environnementale et sociale* / environmental and social management plan (ESMP)

PIB: *Produit intérieur brut* / gross domestic product (GDP)

PIDCP: *Pacte international relatif aux droits civiles et politiques* / International Covenant on Civil and Political Rights (ICCPR)

PIDESC: *Pacte international relatif aux droits économiques, sociaux et culturels* / International Covenant on Economic, Social and Cultural Rights (ICESCR)

PK: Point kilométrique / kilometer point

PM_{10}: Particulate matter in air up to 10 micrometers in size

$PM_{2.5}$: Particulate matter in air up to 2.5 micrometers in size

PMH: *Pompe à motricité humaine* / manually operated pump

PNUD: Programme des Nations-Unies pour le Développement / United Nations Development Program (UNDP)

PP: *Parties prenantes* / stakeholders

PPV: Peak particle velocity

PRCB: Projet de renforcement des capacités de Boké [Boké rural community development project]

PS: IFC Performance Standard

QSE: Quality, safety and environment

RAP: Resettlement and compensation action plan

RAP: Rapid assessment program / rapid biological assessment

RSE: *Responsabilité sociale des entreprises* / corporate social responsibility (CSR)

RTA: Rio Tinto Alcan

SAG: Société Aurifère de Guinée [Guinea gold corporation]

SDT: *Solides dissous totaux* / total dissolved solids (TDS)

SEG: Société des Eaux de Guinée [Guinea water corporation]

SEP: Stakeholder engagement plan

SFI: Société Financière Internationale / International Finance Corporation (IFC)

SIA: Social impact assessment

SIDA: *Syndrome d'immunodéficience acquise* / acquired immune deficiency syndrome (AIDS)

SIG: *Système d'information géographique* / geographic information system (GIS)

SNAPE: Service national des points d'eau [national water supply points service]

SO_x: Sulphur oxides

SP: *Sous-préfecture* [subprefecture]

SSC: Species Survival Commission

SSE: *Santé, sécurité, environnement* / health, safety and environment (HSE)

SST: *Solides en suspension totaux* / total suspended solids (TSS)

STI: Sexually transmitted infections

TDR: *Termes de référence* / terms of reference (TOR)

TDS: Total dissolved solids

TOR: Terms of reference

TPE: *Très petite entreprise* / very small business

TPH: Tonnes per hour

TSP: Total suspended particulates

TSS: Total suspended solids

UDHR: Universal Declaration of Human Rights

UICN: Union internationale pour la conservation de la nature / International Union for Conservation of Nature (IUCN)

UN: United Nations

UNDP: United Nations Development Program

UNECA: United Nations Economic Commission for Africa

UNESCO: United Nations Organization for Education, Science and Culture / Organisation des Nations unies pour l'éducation, la science et la culture

UNFCC: United Nations Framework Convention on Climate Change

UniGE: Université de Genève / University of Geneva

UTM: Universal Transverse Mercator

VEC: Valued ecosystem component

VIH: *Virus de l'immunodéficience humaine* / human immunodeficiency virus (HIV)

WB: World Bank / Banque Mondiale (BM)

WHO: World Health Organization / Organisation mondiale de la Santé (OMS)

ZÉE: *Zone économique exclusive de la Guinée* [Guinea economic exclusive zone]

ZICO: *Zone importante pour la conservation des oiseaux* / important bird area (IBA)

CHAPTER 1 - BACKGROUND

1.1 Introduction

1.1.1 Background

The mining of bauxite—Guinea's leading mineral resource—is an economic pursuit that is steadily growing, with help from the country's Mining Code and economic policies. The Compagnie des Bauxites de Guinée (CBG) is a mining company belonging jointly to the Government of Guinea and Halco Mining (Alcoa, Rio Tinto Alcan and Dadco). CBG is currently considering increasing its bauxite production by 9 million tonnes per annum (MTPA) of shipped material, for a production capacity of 22.5 MTPA (at 3% moisture content) by the last quarter of 2017, with another 5-MTPA expansion around 2022, for a total production capacity of 27.5 MTPA. An intermediate step is planned at 18.5 MTPA. The CBG Extension Project (the Project) involves increasing the rate of bauxite extraction, transport and processing, as well as building new infrastructure and making modifications to CBG's facilities, equipment and operations.

This study identifies the Project's potential impacts on the environment (physical and biological) and the communities in the Project area. It also includes an Environmental and Social Management Plan (ESMP) to ensure that impacts will be mitigated and adequately managed and that the company's operations comply with applicable national and international standards and regulations on environmental and social management for the mining industry.

1.1.2 The study team

ÉEM is an environmental and sustainable development consulting company based in Montréal, Québec, Canada. Its three main spheres of competence are environmental management, community relations and sustainable development strategies. Since its inception in 1993, ÉEM has worked with the world's largest mining companies, including Alcoa, Rio Tinto (aluminum, iron ore, titanium, diamonds), BHP Billiton, Glencore (copper, zinc, nickel), DeBeers, Cliffs Natural Resources, and Potash

Corporation, as well as many Aboriginal organizations representing stakeholders affected by mining and mineral processing operations.

ÉEM has extensive experience in managing projects for its clients. It offers high-quality environmental management and community relations services in its spheres of competence, partnering with other experts where needed to round out its service offering.

In order to conduct the CBG Extension Project ESIA and participate as a consultant in the feasibility study, ÉEM assembled a group of experts in environmental and social aspects, with appropriate knowledge of Guinea's geography, government structure and environmental legal framework, to form an optimal team for the studies.

The members of the team, with their areas of expertise, are shown in the figure below:

Figure 1-1 Structure of the study team

Table 1-1 identifies the firms responsible for the write-up of the various chapters of the ESIA. Following the table is a profile of each firm.

Table 1-1 Responsibilities for the writing of the chapters of the ESIA

Section of the report	Author(s)
1. Context of the ESIA	ÉEM / CBG
2. Physical environment	ÉEM / CBG / SENES Consultants
3. Biology baseline	ÉEM / SYLVATROP Consulting
4. Evaluation of biological impacts	ÉEM
5. Socioeconomic baseline	INSUCO
6. Stakeholder consultations	ÉEM / INSUCO
7. Evaluation of social impacts	ÉEM / INSUCO
8. Human rights	INSUCO
9. Evaluation of cumulative impacts	ÉEM
10. Environmental and Social Management Plan (ESMP)	CBG
Evaluation of human health risks	CBG

1.1.2.1 INSUCO Guinée

INSUCO is a consulting firm that provides specialized social science and engineering services for extractive, infrastructure and institutional projects in Africa and Latin America. Its effective, operational and pragmatic approaches are based on its in-depth understanding of the client's priorities and the local context. Its teams are multidisciplinary and intercultural. INSUCO has developed a high level of expertise in baseline studies, impact assessments, stakeholder engagement plans, social management plans, and resettlement and compensation plans. Its history of involvement in Guinea makes INSUCO one of the most highly invested consulting firms in the country.

1.1.2.2 SENES

SENES is a consulting firm specializing in energy, nuclear and environmental sciences, with eight offices in Canada and the U.S. Since its inception in 1980, the company has participated in over 5,000 projects in North and South America, the Caribbean, Africa, Australia, Europe, Asia, the Middle East and the Far East. Its technical expertise covers several branches of engineering, natural and physical sciences, mathematics, statistics and computer science. This concentration of technical expertise is favorably perceived by other consulting firms.

1.1.2.3 Sylvatrop Consulting

Sylvatrop Consulting is an environmental consulting firm based in the Republic of Guinea, with an office in Senegal. It is a spinoff of SYLVATROP, a French NGO active since 1999 in the protection, conservation, and sustainable and participative management of tropical biodiversity in West Africa. Working with both the public and private sectors, it addresses the environmental problems (ecology and communities) faced by its partners as part of their projects—mines, port facilities, roads, impoundments for hydropower, agricultural or drinking water purposes, airports, railroads, or development projects in agriculture, forestry, livestock or fishing.

1.1.3 Report structure

This report is divided into 10 chapters covering the entire scope of the ESIA:

1. Background

2. Physical Environment Study

3. Biological Baseline Study

4. Biological Impact Assessment

5. Socioeconomic Baseline Study

6. Stakeholder Consultation

7. Social Impact Assessment

8. Report on Potential Impacts on Human Rights

9. Cumulative Impact Assessment

10. Environmental and Social Management Plan (ESMP)

1.1.4 Upcoming stages

A number of stages and studies must still be completed before the ESIA can be finalized.

1.1.4.1 Key stages in ESIA finalization

Stages to be completed:

- validation by the Government and financial institutions;
- presentation of the impact assessment by the BGÉÉE in the Study Area (CBG undertakes to present the report to at least the six communities targeted for the December 2013 public consultation; see Chapter 6, Stakeholder Consultation; and
- approval of the impact assessment.

1.1.4.2 Studies to be conducted

The ESMP is a cornerstone of the strategy for managing the environmental and social impacts of the Extension Project. The ESMP identifies a number of studies and activities that must be completed before construction can start, while other plans are required under Guinean law, specifically the 2011 Mining Code.

1.1.4.3 Cumulative impacts

Because of the lack of data about nearby projects, the cumulative impacts (Chapter 9) can only be stated in fairly general terms. A central conclusion can nevertheless be put forth: namely that, at a practical level, the management of the effects of numerous mining operations in the region must devolve to the local and national governments. Only comprehensive planning can be effective in reducing the cumulative impacts of these projects. For example, efforts to protect biodiversity, natural resources and fishing in the Rio Nuñez Estuary must be guided by an integrated vision and a plan to ensure a port and channel for all users.

it is strongly recommended that the Government of Guinea undertake a strategic study on the environmental and social impacts of developing the mining industry in the region, and that it work with mining companies, authorities and the local population to draw up a regional development plan. The objectives of the plan could include:

- ensuring regulation of the mining industry during its expansion;
- maximizing positive impacts for the local population and for the nation as a whole; and
- protecting the nation’s rich cultural and environmental heritage.

1.1.4.4 Missing information

At this stage, we are missing certain information we would need to predict all the impacts. Some of the gaps have to do with engineering aspects that will not be ironed out until the detailed engineering stage (FEL 3). Others depend on studies that should take place later in the process (for example, just before land clearing). The missing information includes:

- a detail plan of mine roads; and
- a dredging plan for the Rio Nuñez Estuary.

These gaps are documented in various chapters of the ESIA and ESMP, and measures for addressing them are suggested. The impacts and mitigation measures related to the missing information are documented in the ESMP along with the corresponding solutions, which could include additional studies and consultations with the stakeholders in question.

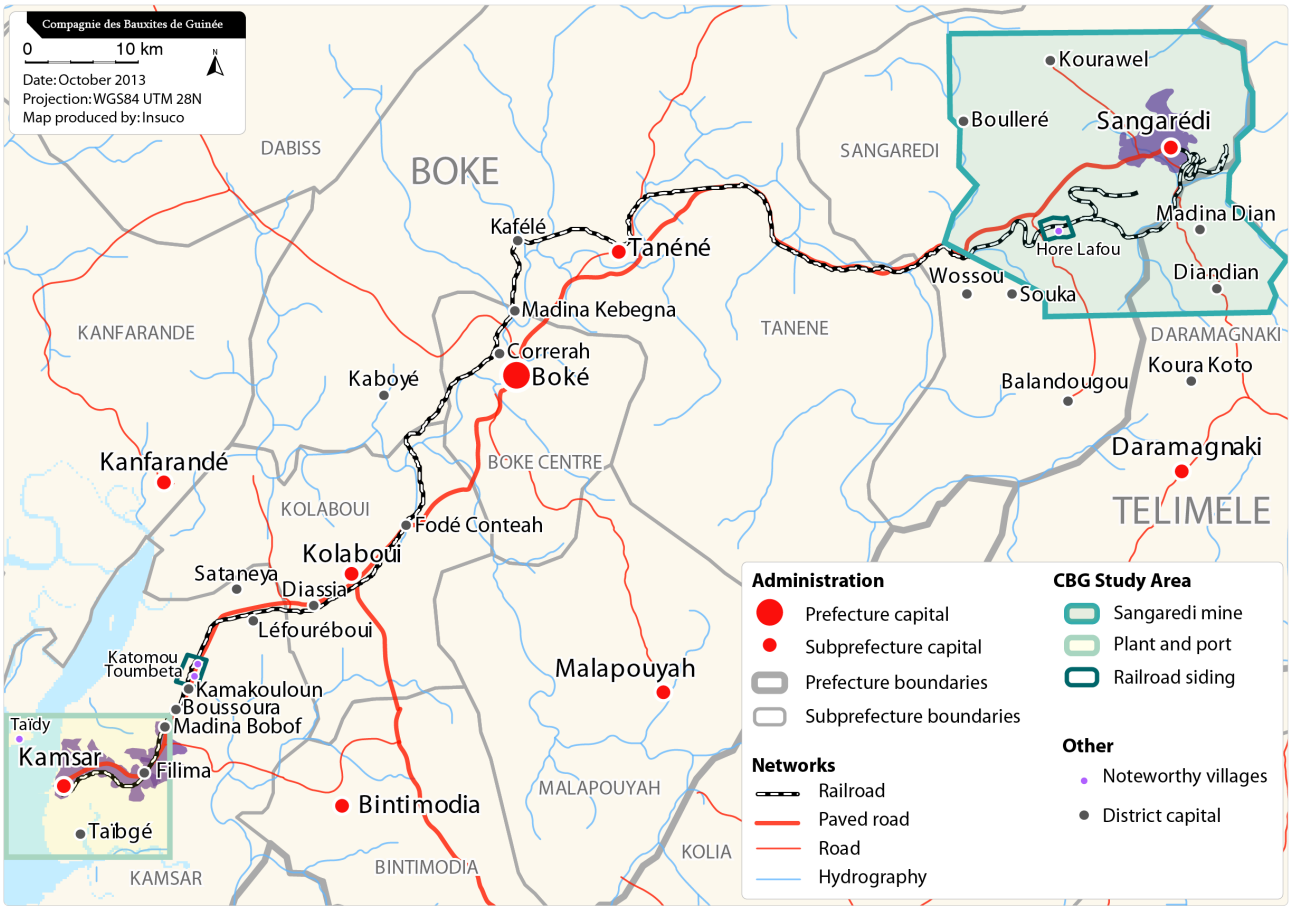
1.2 CBG Extension Project

1.2.1 General description

CBG is a mining company owned jointly by the Government of Guinea and Halco Mining (Alcoa, Rio Tinto Alcan and Dadco).

At present, CBG extracts, transports by rail, processes and ships some 13.5 MTPA (plant nameplate capacity) of 3% moisture content bauxite from its facilities, located in Kamsar and Sangarédi in northwestern Guinea (Map 1-1). CBG was created in 1963 and its facilities have been in operation since 1973.

Map 1-1 Map of project area and CBG facilities



(Source: ÉEM. *Environmental and Social Impact Assessment of the CBG Mine Extension Project*)

CBG is currently considering increasing its bauxite production by 9 MTPA of shipped material, for a production capacity of 22.5 MTPA (at 3% moisture content) by the last quarter of 2017, with another 5 MTPA expansion around 2022, for a total production capacity of 27.5 MTPA. An intermediate step is planned at 18.5 MTPA.

The first scenario therefore consists in raising production to 22.5 MTPA in 2017 or later. Works and investments in this scenario include a new rail yard (Parawi), extension of the siding at PK 72, and the purchase of new railcars.

Phase I has an intermediate stage, which consists in raising production to 18.5 MTPA. A series of works and investments must be made in order to achieve this

increase in ore production, processing and shipping—such as the purchase of new rolling stock (railcars, locomotives), a new rail yard at Kamsar, extension of the existing quay (south) and dredging of part of the port.

Phase II of the Extension Project will raise production to 27.5 MTPA by 2022. Works and investments for this phase include construction of shops at the N'Dangara mine and construction of railroad sidings at PK14 and PK118.

The next sections will describe the Project components for each of the three sites operated or occupied by CBG. The sites are:

- the Sangarédi mining area (N'Dangara, Sangarédi, Boundou Wandé, Bidikoum, Parawi and Silidara plateaus);
- the railroad network (new sidings); and
- the Kamsar plant (including the port).

1.2.1.1 Sangarédi mining area

At present, most of the bauxite is extracted from the Sangarédi, N'Dangara, Bidikoum, Silidara and Boundou Wandé plateaus.

The scope of this ESIA is based on a mining plan initially submitted for the period up to 2027 (Figure 1-2). Extension of the mining areas—and therefore extension of the railroad, or construction of a road capable of handling land trains—was studied as part of the 2014–2042 Long-Term Mining Plan (June 2014), but was not included in this ESIA, since operations will not be moved to the North Cogon until 2027. An additional study will be needed for that extension.

At the mine site, the Extension Project will mainly consist in acquiring equipment (loaders, trucks, bulldozers, water tanks) and hiring people to operate it. The use of surface miners will also be studied for ore extraction on some of the plateaus.

With the addition of new heavy machinery, the existing shops will no longer be adequate, and new facilities will be built (Figure 1-3). Construction of the new rail and stockpiling yard at Parawi and the associated infrastructure (road, bridges, railroad)—already planned by CBG for the move to the north side of the national highway—will be accelerated. The stockpiling area will be expanded over the Parawi

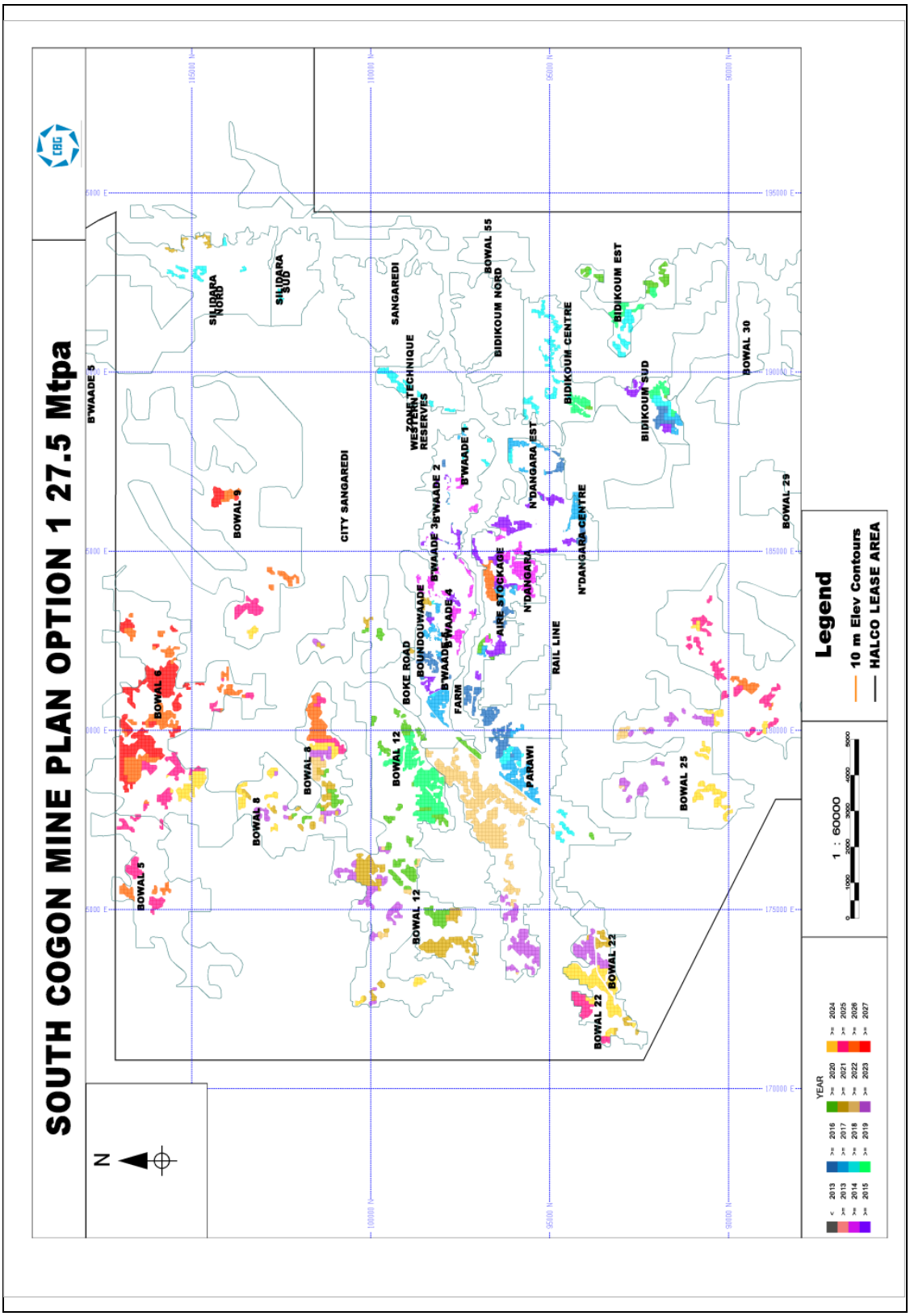
plateau toward the villages of Hamdallaye and Fassaly Foutabhé, and will cross the national highway. An overpass will be built to allow road traffic over it (Figure 1-4).

Generally speaking, very little overburden will need to be stripped before reaching the ore zone, since bauxite ore is usually close to the surface. The overburden will be set aside and used to cover the area during rehabilitation. Once the ore zone has been reached, drilling and extraction will proceed, then the ore will be loaded onto trucks and taken to the main stockpiling area, near the railroad.

There, bulldozers will spread the ore into layers corresponding to the original deposits. Loaders will then load it onto railcars, working vertically to mix the different horizontal layers.

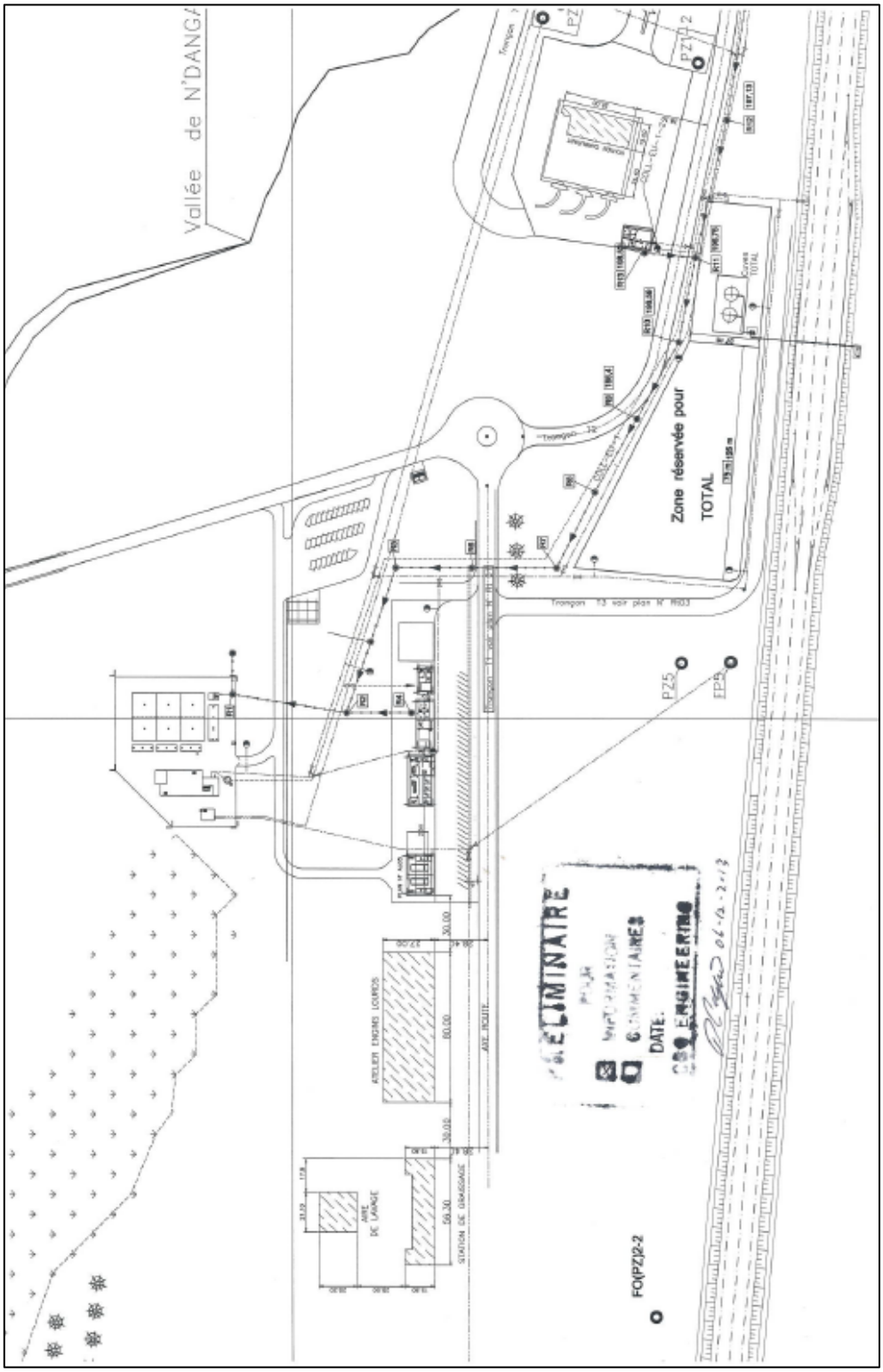
Blasting will be done on a regular basis. A blasting management program will ensure that all the necessary safety measures are taken to reduce the impact on the local population. Only properly trained personnel will be authorized to handle explosives.

Figure 1-2 Long-term mining plan for the area south of the Cogon



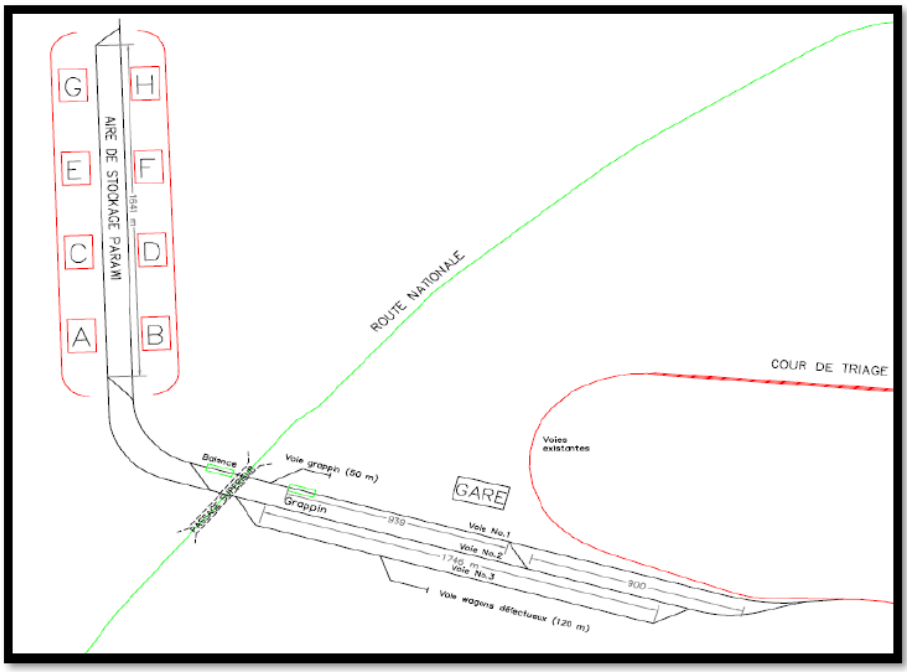
(Source: MineSight. Plan Minier Long Terme 25 ans)

Figure 1-3 Location of new shops at N'Dangara mine



(Source: CBG. 2D31 Preliminary engineering packages)

Figure 1-4 Implantation of planned infrastructure – Parawi



(Source: CANARAIL. Ingénierie FEL 2 - Volet ferroviaire)

As for the haulage roads, they will be maintained by graders. To control dust during the dry season, water from one of the following sources will be used: a pumping station on the Cogon, about 13 km from the N'Dangara plateau (90%), and a basin formed by a road culvert serving as a dike (10%).

1.2.1.2 Railroad network

From the mine, the bauxite is hauled to the Kamsar plant via a railroad line conceded to CBG by the Government of Guinea (ANAÏM). At present, an average of five 120-car trains loaded with ore leaves the Sangarédi mine every day for Kamsar. Each car contains some 82 tonnes of bauxite. In order to increase the production rate, the train runs will be modified and improved: instead of two to three locomotives and 120 cars, they will have three locomotives and 130 cars. Besides increasing the number of cars in each train, the addition of locomotives will make it

possible to maintain a rhythm of up to nine trains a day to Kamsar, seven days a week.

To optimize the train runs, new sidings will have to be built between the mine and Kamsar, at kilometers 14 and 118, to allow the trains to pass each other. The siding at PK 118, 2.5 km long, will be built on the north side of the existing tracks. For PK 14, the running line will be converted into a siding from km 13.4 to km 15.5 by a system of counter-curves, and the new section built will become the running line, so that the siding will be on the same side as the national highway.

The Tanéné (PK 72.7) and Boké (PK 54.7) sidings, already in place, will be lengthened. The Boké siding will not require any major work, while the Tanéné siding will be lengthened by 600 meters.

1.2.1.3 Kamsar plant

Figure 1-5 gives an overview of the bauxite treatment process at the Kamsar plant.

Rail yard – Discharging station

The Extension Project will require the construction of a new car dumper and, consequently, modifications to the tracks in the rail yard at the plant entrance. All the necessary equipment will be built within CBG's existing property (zoned industrial).

After several different options for increasing the plant capacity were analyzed, the one selected was the abandonment of the existing discharging station and construction of a new car dumper that will enable the total plant capacity to be reached (27.5 MTPA). The discharging station is 40 years old and in need of extensive repairs; moreover, the new dumper will ensure safer unloading operations.

This option therefore involves building a rotary car dumper at the surface and installing a primary sizer in the hopper (Figure 1-7). The hopper will be equipped with a ventilation system. This structure will be completely closed to reduce dust and noise emissions. A dust suppression system will be installed at the discharging point to contain emissions. The transfer chutes will be equipped with fogging nozzles (probably with two fluids, water and air) to suppress dust. Curtains will be

installed at the entrance and exit, and all openings will be closed to contain dust emissions. Additional design details will become available during FEL 3.

Completion of the hopper and a discharging line is planned for the preliminary 18.5 MTPA scenario. A second discharging line will be added during finalization of the first expansion to 22.5 MTPA.

Crushers

The impact crushers now in use will be replaced by a two-stage crushing system capable of processing the equivalent of 27.5 MTPA, or the total plant capacity. A primary crusher will reduce the product size to 300 millimeters, then a secondary crusher will reduce it to 100 millimeters (maximum size). The crushers will be installed at the same time as the dumper lines, and will be two-stage:

- The ore will be discharged directly into the primary crusher, located in the dumper hopper. This setup was chosen to avoid having belt conveyors carrying large pieces of ore. A rock breaker will also have to be installed, to break up the blocks that are too big for the primary crusher.
- The output from the primary crusher will be carried by a new conveyor, C301, to the secondary sizing structure.

The feed and discharge chutes on the primary crusher will be completely closed to prevent dust emissions, and will be equipped with fogging nozzles (probably with two fluids, water and air). From the secondary crusher structure, another new conveyor, C303, will carry the ore to transfer station TA301. Conveyor C304 will then transport it to the modified TA1 transfer tower. No modifications will be made to the existing stacking and reclaim systems.

Drying

For the bauxite ore to be shippable, its moisture content must be reduced to 6.7% through a drying process. Two new dryers will be needed to dry all of the ore extracted (Figure 1-8). At present, the dryer has an exhaust system comprising a cyclone, a venturi scrubber and an exhaust fan. This system has a capacity of 510,000 m^3/h. Each of the new dryers will come with its own gas scrubber, and there will also be a new shed for stockpiling the dried bauxite. The new shed will be built right behind the existing one.

The effluent from the wet scrubbers is currently being discharged into a settling pond. The solids at the bottom of the pond (mainly bauxite) are removed, dried and returned to the process as raw material. Based on the current sludge production rate, the quantity of sludge produced by the wet scrubbers after the Extension Project will be about 68,000 tonnes a year. A study has shown that the sludge drying capacity will be sufficient to process the annual sludge production.

Conveyors

As part of the Extension Project, new conveyors will be installed and some of the existing ones will be modified to improve ore transport and adapt it to the new equipment. The new conveyors, all of them covered, will be as follows:

- two new conveyors (C301 & C302) between the new crushing station and the new secondary crushers;
- a new conveyor (C303) between the secondary crushers and transfer tower TA301;
- a new conveyor (C304) between transfer towers TA301 and TA1;
- new conveyors for the new dryers (C80, C305, C306 & C307) and for shipping (C110, C120, T10, T20).

Existing conveyors C2, C3, C4, C5, C6, C8, C9, C10, C11, C16, C20 and C30 will have their capacity increased to 5,400 TPH while conveyors C12, T1 and T2 will be increased to 6,000 TPH.

Dust control will be ensured at all chutes and transfer points. Dust will be controlled by suppression in the wet plant and by collection in the dry plant. Detailed design of these systems will be carried out during FEL3.

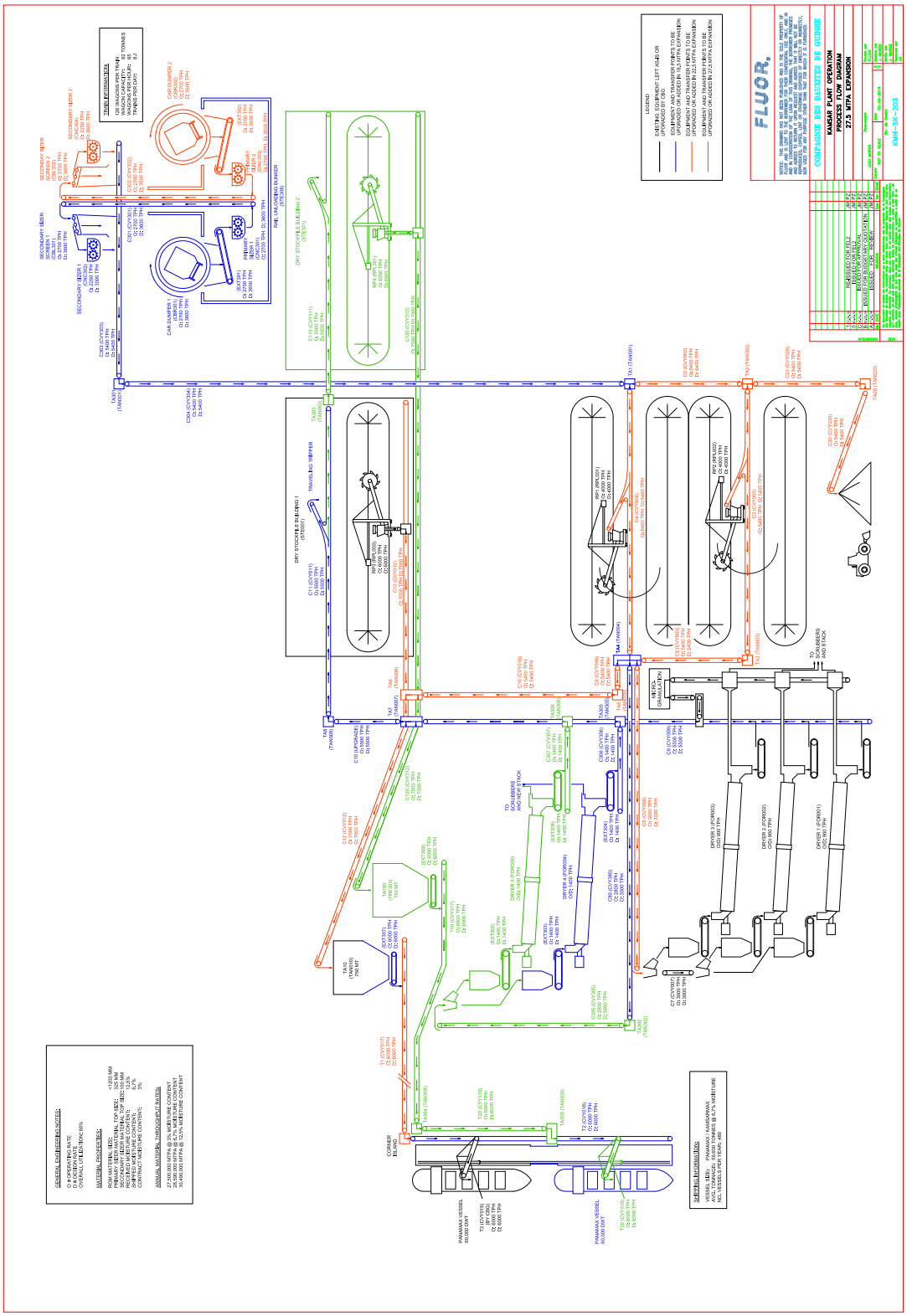
Power generation

Because the Project will increase power demand by 28.35 MW, four additional generators will be needed at Kamsar, two of which are planned for the 18.5 MTPA scenario (Figure 1-9). The generators are similar to the ones being installed for the existing power plant upgrade, and will be added to that same power plant. An additional generator is also needed at Sangarédi and will be installed in the new power plant. Like all of the generators at CBG, the new ones will run on diesel and heavy fuel oil (HFO).

According to the FEL2 Studies, the current level of operation requires five HFO deliveries a year. This will rise to seven for the 22.5 MTPA scenario and nine for the 27.5 MTPA scenario. CBG now has three 10,000 m^3 HFO tanks. The option is to build a new 10,000-m^3 tank during the 27.5 MTPA scenario to reduce the frequency of deliveries to four, five and seven a year, respectively. This capacity will fuel the dryers, the boilers and the electrical generators. A 3,000-m^3 diesel tank is also planned for this scenario (Figure 1-10).

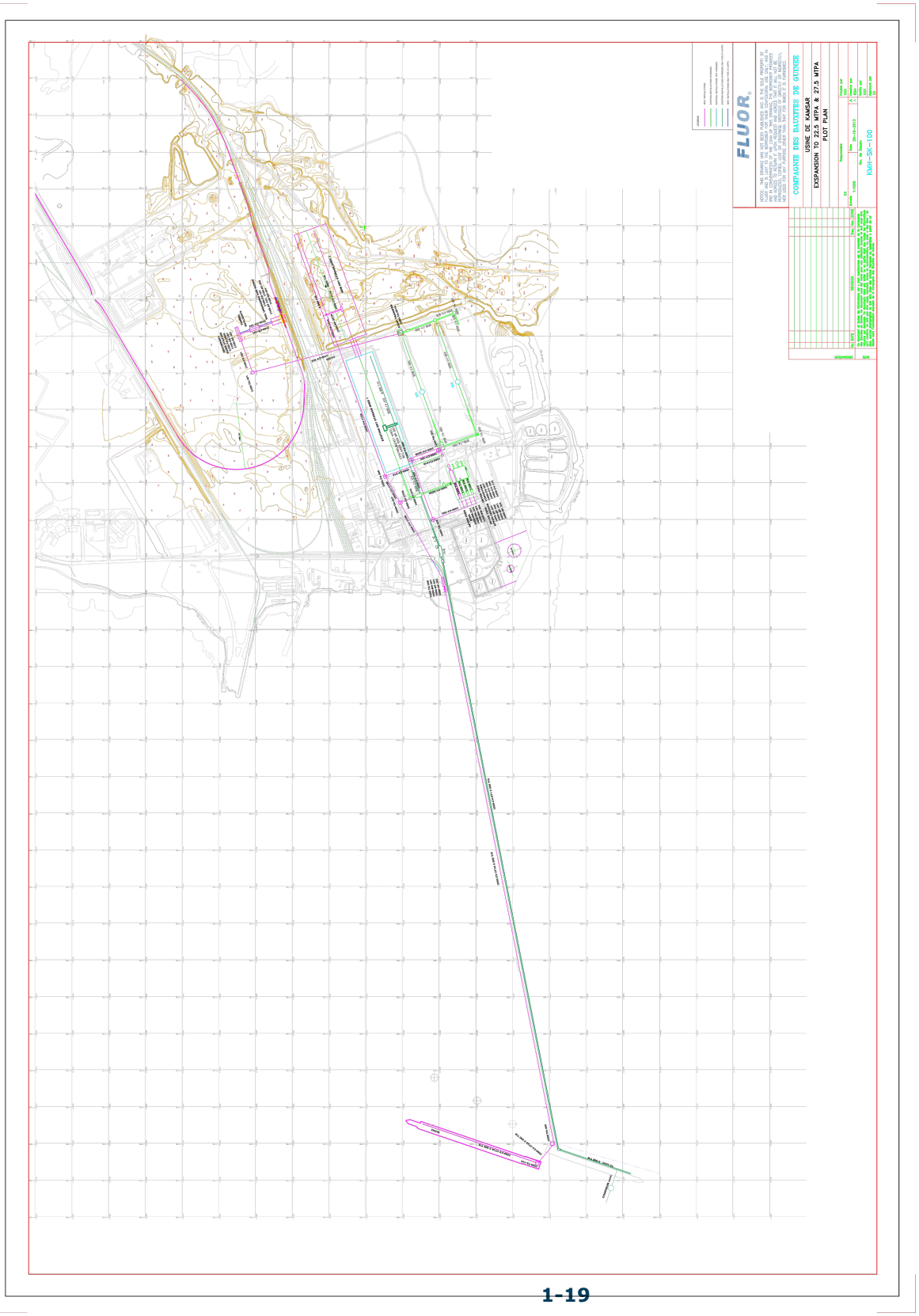
Lastly, the compressed-air and steam capacities must also be increased. Additional compressors are needed for plant services and utilities, as well as for operating the new rotary dryers. An additional boiler will be installed during the 18.5 MTPA scenario.

Figure 1-5 Process flow diagram (18.5, 22.5 and 27.5 MTPA)



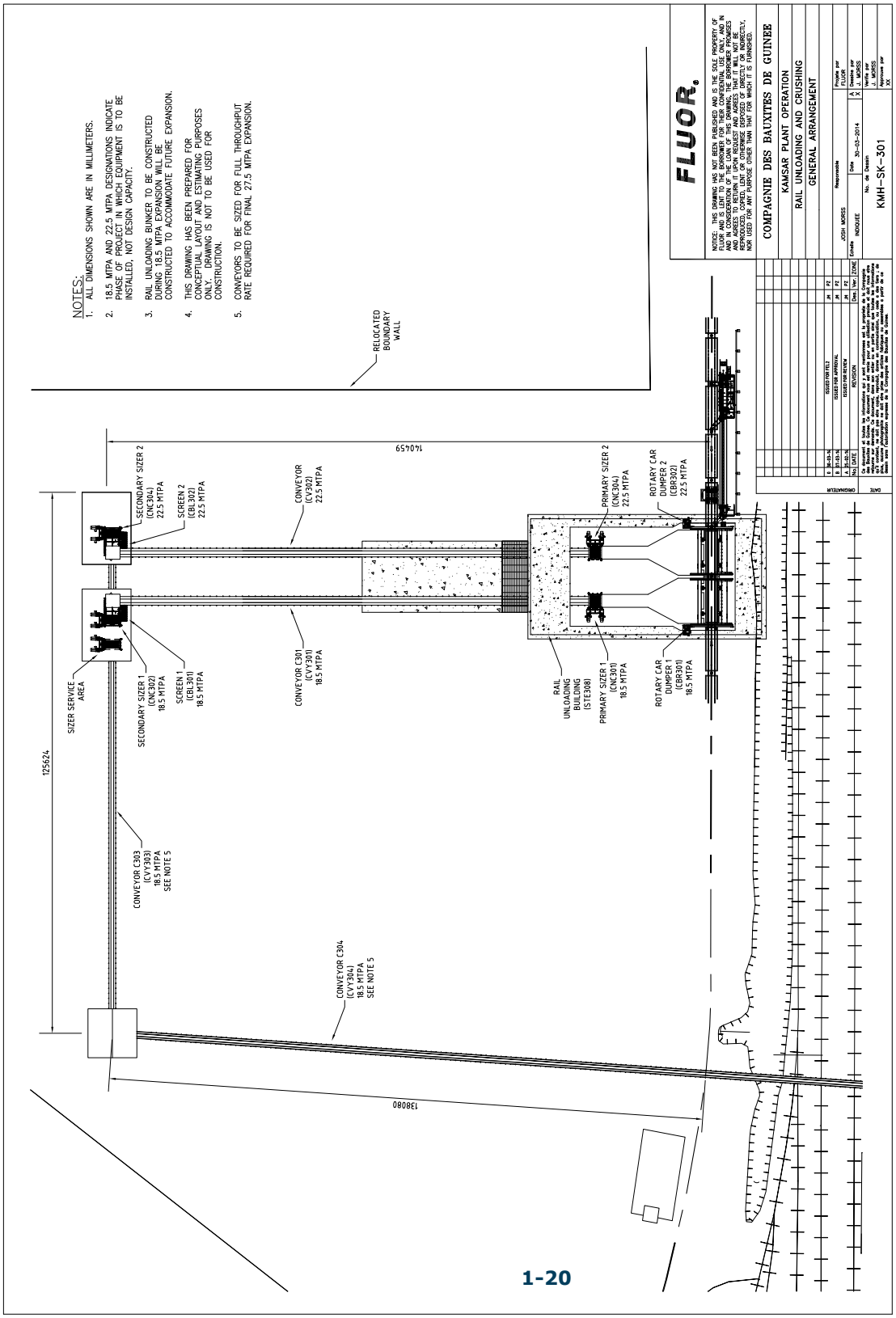
(Source: CBG. 2D31 Preliminary engineering packages)

Figure 1-6 Kamsar plant expansion overview



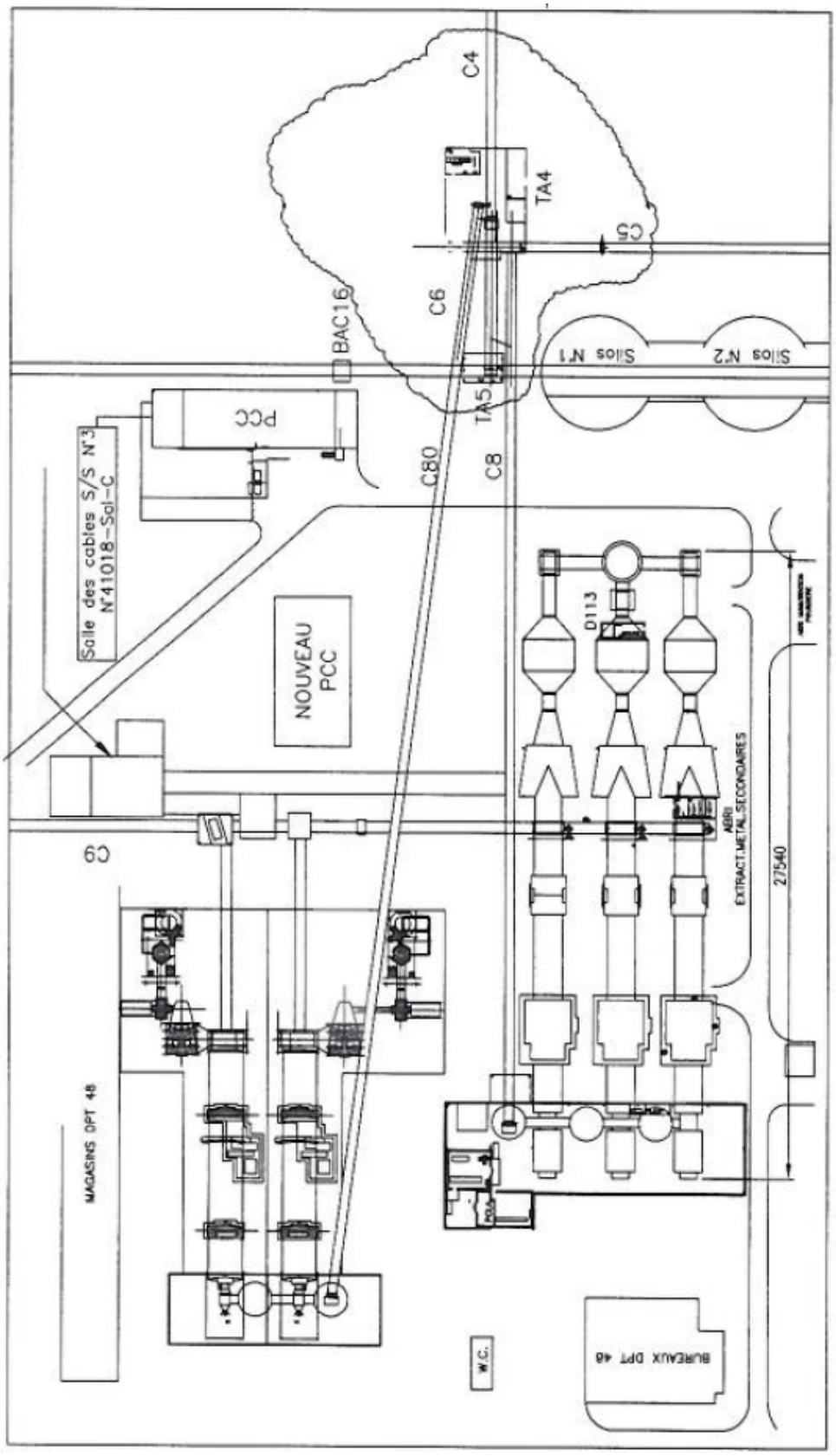
(Source: CBG. 2D31 Preliminary engineering packages)

Figure 1-7 Car dumper and crushing station



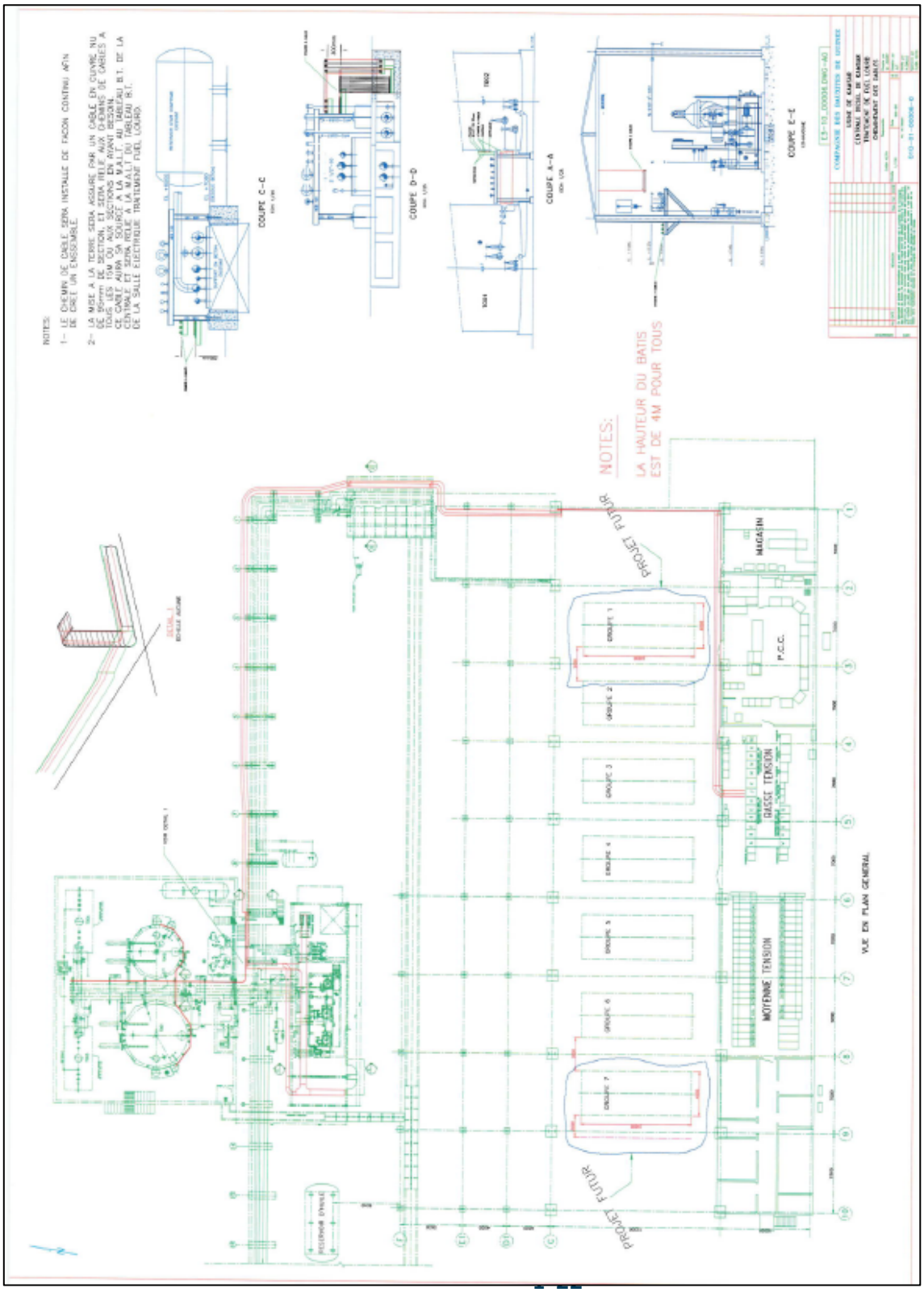
(Source: CBG. 2D31 Preliminary engineering packages)

Figure 1-8 Location of two new dryers connected to conveyor C80



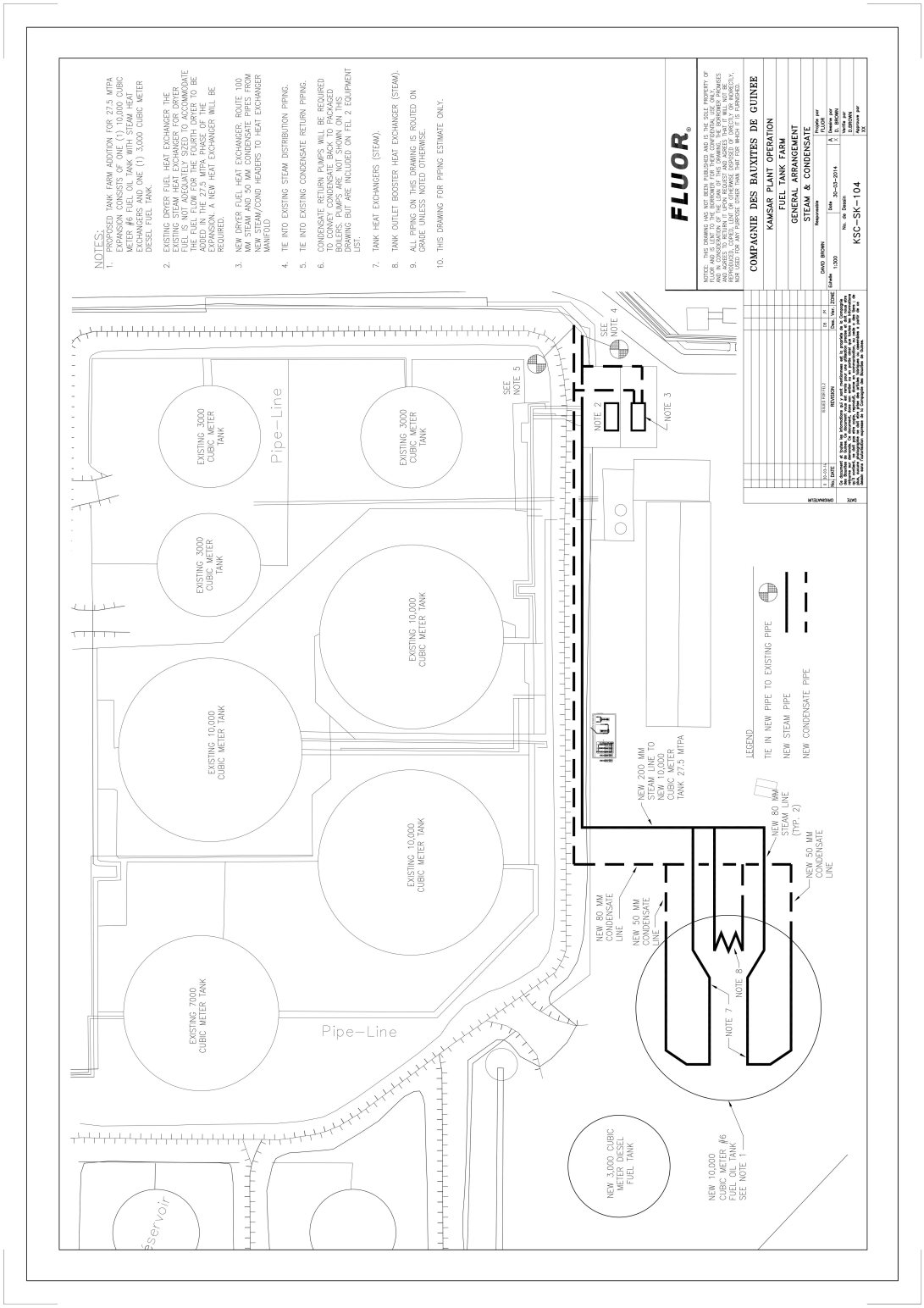
(Source: CBG. 2D31 Preliminary engineering packages)

Figure 1-9 Location of new generators in existing Kamsar power plant (18.5 MTPA)



(Source: CBG. 2D31 Preliminary engineering packages)

Figure 1-10 Addition of HFO and diesel tanks to Tank Farm (27.5 MTPA)

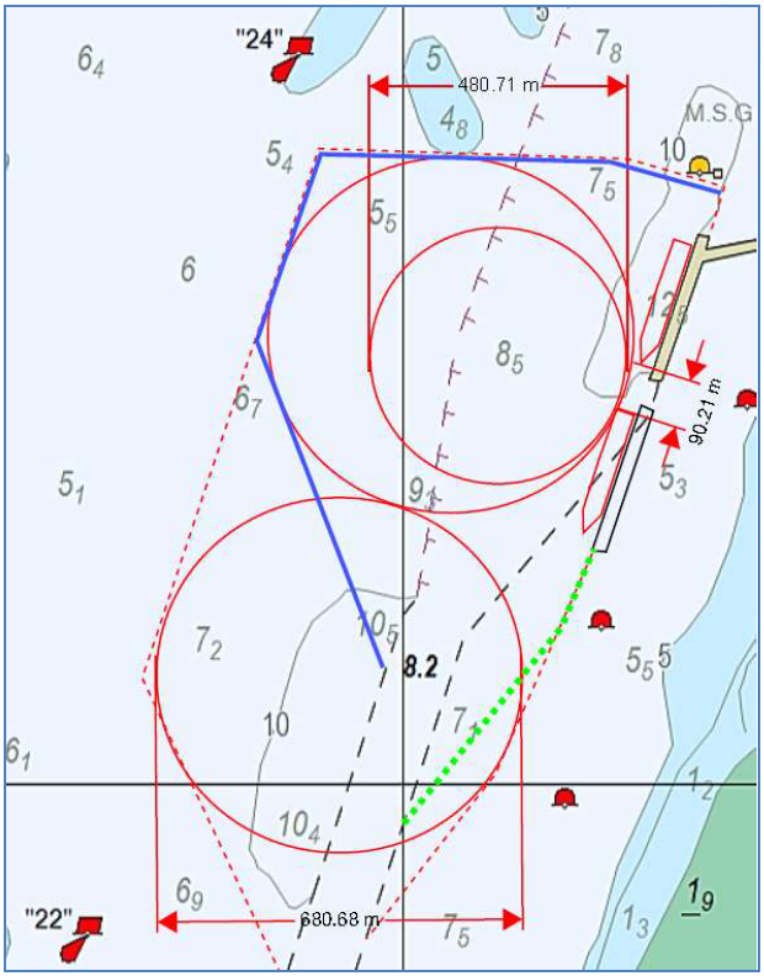


(Source: CBG. 2D31 Preliminary engineering packages)

Port facilities

The expansion of ore production will necessitate modifications to the ship loading quay. Now 275 m long, the quay will be extended by 301 meters so that two Kamsar Max type carriers can be docked at the same time, thereby allowing continuous loading. It will be extendable to accommodate two Cape Size type carriers in the future, if need be. Lengthening of the quay and expansion of the turning basins will require dredging in the estuary. However, the dredging has been reduced to a minimum, with a total volume of 419,000 m^3 (Figure 1-11).

Figure 1-11 Configuration of turning basins and anchoring areas

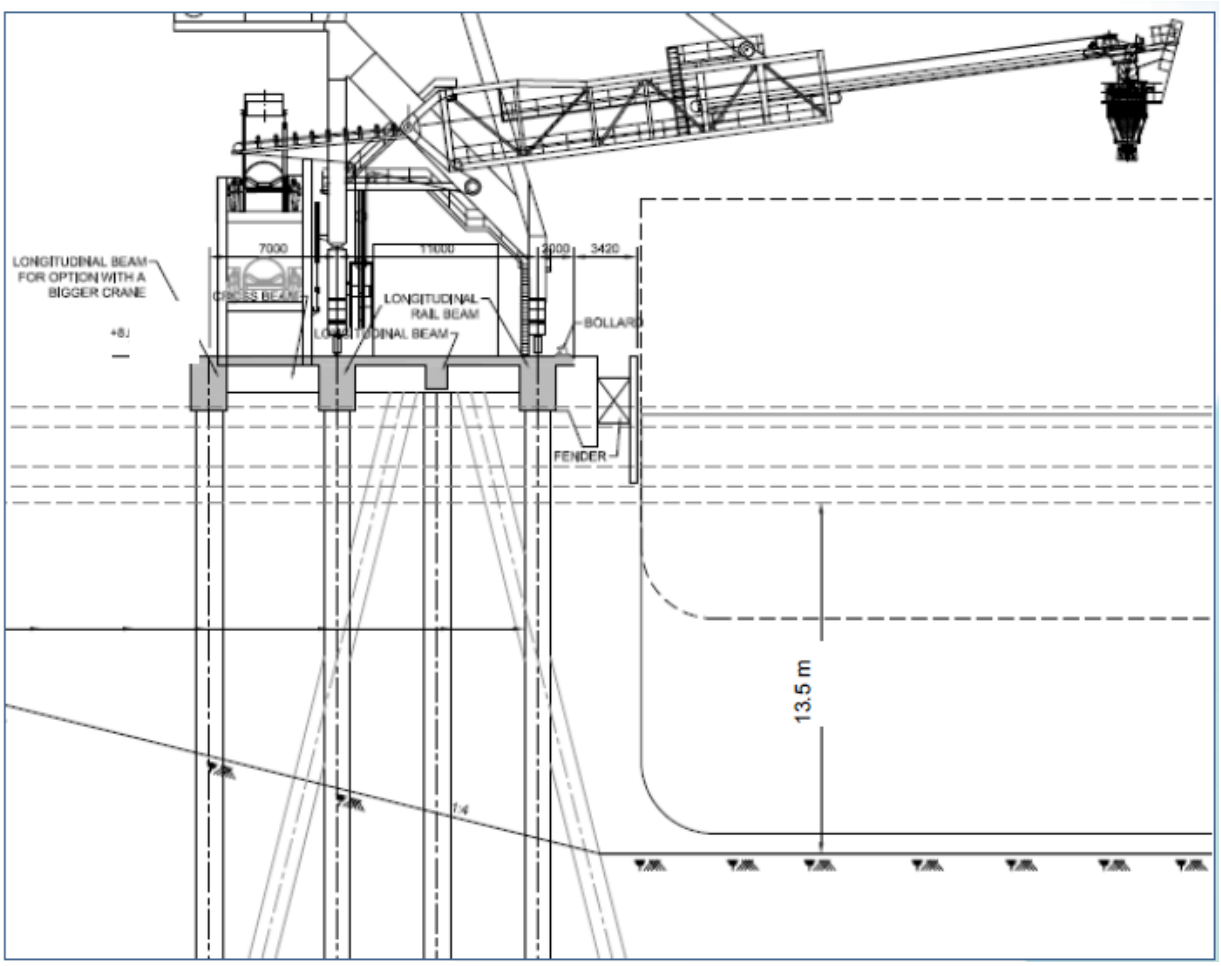


(Source: Royal HaskoningDHV. *Quay Structures – Pre-Feasibility Study* – Dredging zone indicated by red dotted line)

Only one turning basin is required for the 18.5 MTPA scenario. A second one is planned for the 22.5 MTPA scenario.

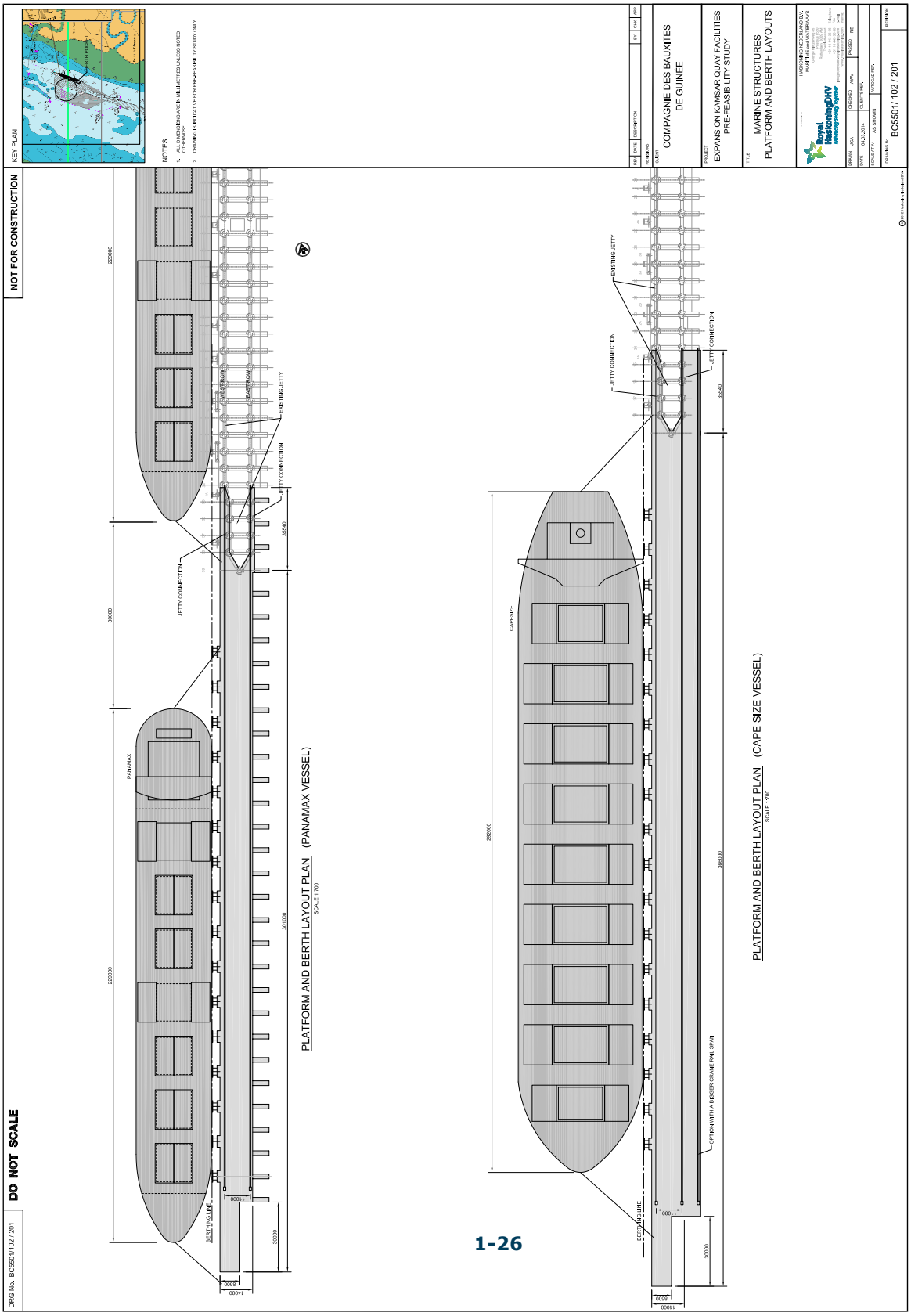
CBG has already undertaken the replacement of its ship loader. The new one will be able to move along the existing quay and its extension in order to load two carriers consecutively (Figure 1-12). A second ship loader will be installed so that two carriers can be loaded at the same time in order to handle plant capacity at the 27.5 MTPA scenario. The new loading capacity will increase the ore transfer rate from 4,500 to 5,750 tonnes per hour. The conveyor motor (C12) will be replaced to increase belt speed. A dust control system will be included in the loader specifications.

Figure 1-12 Sectional view of future loading quay extension



(Source: Royal HaskoningDHV. *Quay Structures – Pre-Feasibility Study*)

Figure 1-13 Extension of loading quay for Kamsar Max and Cape Size carriers



(Source: Royal HaskoningDHV. *Quay Structures – Pre-Feasibility Study*)

1.2.1.4 Project schedule

Engineering

Detailed engineering study (FEL3 – 18.5 MTPA)	Oct. 2014 – Sept. 2015
Construction (18.5 MTPA)	Oct. 2015 – Oct. 2017

ESIA

Environmental approval	Jan. 2015 – March 2015
Public consultation	Feb. 2015
Resettlement and Compensation Action Plan	Nov. 2014 – Dec. 2015
Resettlement and compensation	Jan. 2016 – June 2017

1.3 Guinean legal and administrative framework

The CBG Extension Project must comply with all national legal and regulatory requirements. The following information about the laws and administrative procedures will provide some background that will be helpful in assessing the Project's environmental and social impacts.

1.3.1 Legal framework

The CBG Extension Project will have legal implications in terms of the national administrative procedures for major projects and the technical regulations governing community and environmental management. The Project and the ESIA must comply with these laws and regulations in order to ensure the efficient implementation of the Project. The main elements of the legal framework applicable to the Project are as follows:

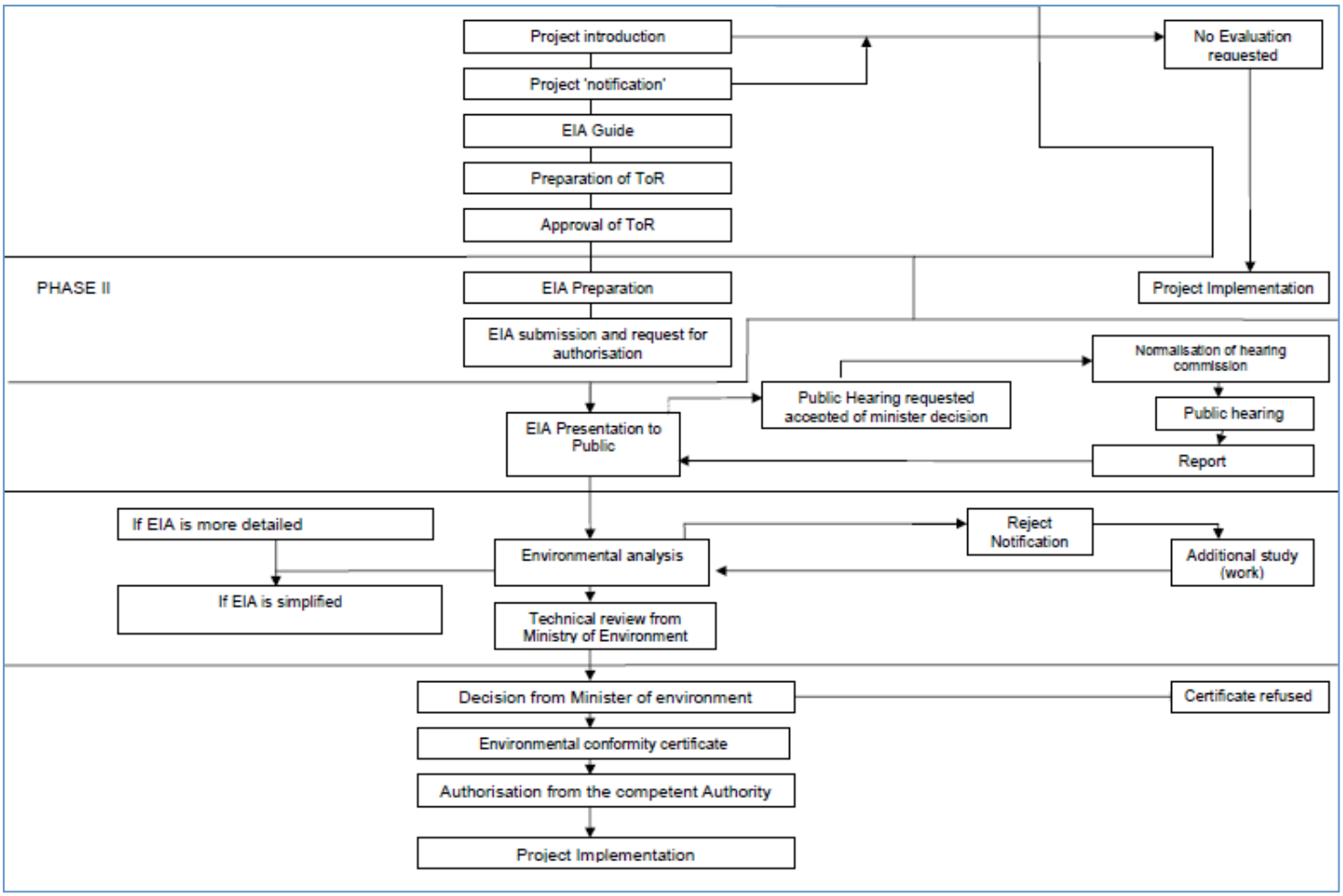
- *Code de la Protection et de la Mise en Valeur de l'Environnement* (or *Code de l'environnement*) – establishes the national framework for natural resource management and prescribes mechanisms, such as ESIAs, for minimizing negative environmental impacts;
- Loi L/96/010/An du 22 juillet 1996 portant sur la réglementation des taxes à la pollution applicables aux établissements classés;
- Décret présidentiel N° 199/PRG/SGG/89 codifiant les Études d'Impact sur l'Environnement (November 1989) – establishes that ESIAs must be conducted for certain types of projects, including ports, power stations, mines, etc.;
- Décret présidentiel N° 200/PRG/SGG/89 – establishes the project authorization and permitting process for construction and operation of a classified facility (Guinea has 79 classified facilities that constitute potential hazards to public health, agriculture, the environment, etc.);
- Décret 201/PRG/SGG/89 du 8 novembre 1989 portant sur la préservation du milieu marin;
- Arrêté conjoint N° 93/8993/PRG/SGG – specifies the nature of the classified facilities mentioned in Article 1 of Décret N° 200/PRG/SGG/89;
- Arrêté Nº 990/MRNE/SGG/90 – establishes the procedures and methodology for carrying out an ESIA. The following information is required:
    - a summary description of the project (justification, location, process, capital outlay and project schedule);
    - baseline data and surveys on the geology, hydrogeology, hydrology, wildlife, vegetation, topology of the various sites, noise, odors, air quality, traffic, infrastructure and socioeconomic activities;
    - an assessment of the project's impacts on the physical, ecological and social environment;
    - a study of other options (site and process) from an environmental standpoint, with a justification of the proposed choice; and
    - measures to eliminate, mitigate and, if need be, compensate for the project's harmful effects on the environment.

- Arrêté A/2008/4947/MDDE/CAB – establishes the terms for payment of the fees related to the examination of ESIA reports;

- Arrêté N° A/2013/474/MEEF/CAB portant sur l'adoption du *Guide général d'évaluation environnementale* – establishes the structure, content requirements and implementation sequences for ESIAs;
- Loi L/95/036/CTRN du 30 juin 1995, portant sur le *Code minier* de la République de Guinée – governs mining exploration, operations, commerce and processing in the mining industry, with reference to the Code de l'environnement;
- *Code de l'eau*, established under Loi L/94/005/CTRN – governs the management of water resources;
- *Code forestier* (Loi L/99/013/AN, 1999) – governs the management of forest resources;
- *Code foncier et domanial* (1992) – establishes the framework for rural and urban property ownership, recognizes customary law and governs expropriations and the associated compensations;
- *Code de protection de la faune sauvage et règlementation de la chasse* (Loi L/99/038/AN);
- *Code minier* (Loi L/2011/006/CNT);
- La loi-cadre sur les activités de la pêche en eau douce (L/96/067/AN du 22 juillet 1996);
- *Code pastoral* – establishes the conditions for using lands and resources as pasturage;
- *Code du travail* (1988) – establishes the framework for ensuring worker health and safety;
- *Code des investissements* (1995) – establishes a system of guarantees for investors, and requires that foreign investments accord hiring priority to Guinean nationals; and
- *Code des collectivités locales* (2006) – establishes the legal rights of local communities.

Figure 1-14 gives an overview of the overall ESIA and authorization process for projects subject to the Guinean impact assessment procedure.

Figure 1-14 Guinean ESIA and authorization process



1.3.1.1 National and local plans

A number of strategic action plans of the Government of Guinea must also be taken into account in the deployment of the Project. These plans constitute the primary administrative framework for ensuring that environmental priorities are observed throughout the territory. The plans whose strategic directions and objectives are relevant to the ESIA and the Project implementation include:

- *Plan d'action national pour l'Environnement*;
- *Plan d'action forestier national*; and
- *Plan directeur d'aménagement forestier des mangroves*.

In addition, the Project must take into account local plans such as:

- the *Plans de Développement Locau*x (PDLs) of rural and urban communes in Boké prefecture; and
- the *Plans Annuels d'Investissement* (PAIs) of those communes.

1.3.2 Administrative framework

1.3.2.1 National administrative framework

Many government bodies will be involved in the ESIA process for the Extension Project. Indeed, the Project touches on the jurisdictions of several ministries, which will participate in reviewing the ESIA report and applying the regulatory and administrative frameworks for which they are responsible. Here are the main government bodies involved in monitoring the Project deployment:

- Ministère délégué à l'environnement, aux eaux et forêts [environment, water and forests];
- Ministère d'État chargé des Travaux publics et des Transports [public works and transportation];
- Ministère de l'Habitat, de l'Urbanisme et la Construction [housing, urban planning and construction];
- Ministère de la Jeunesse et de l'Emploi des jeunes [youth and youth employment];
- Ministère de l'Industrie et des Petites et Moyennes Entreprises [industry and small and medium enterprise];
- Ministère de l'Élevage [animal farming];
- Ministère de l'Emploi, de l'Enseignement technique et de la Formation professionnelle [employment, technical education and vocational training];
- Ministère de l'Administration du Territoire et des Affaires politiques [territorial administration and political affairs];
- Ministère de l'Agriculture;
- Ministère de la Culture des Arts et du Patrimoine [culture, arts and heritage];
- Ministère de la Santé et de l'Hygiène publique [health and public hygiene];
- Ministère des Mines et de la Géologie;
- Ministère du Plan;
- Ministère de la Pêche et de l'Aquaculture [fishing and aquaculture];

- Ministère Délégué aux Affaires sociales, à la Promotion féminine et à l'Enfance [social affairs, status of women and child protection]; and
- Ministère Délégué aux Transports.

The ESIA process will be overseen by the Bureau Guinéen d'Études et d'Évaluation Environnementale (BGÉÉE), which will be charged with validating the ESIA deliverables. The *Guide général de réalisation des études d'impact environnemental et social* (BGÉÉE, Ministère de l'Environnement, des eaux et forêts, 2013) sets out specific requirements for ESIAs in terms of their content, structure and scope. The BGÉEE is also responsible for ensuring that the sequence of steps for conducting an ESIA in Guinea is followed.

1.3.2.2 Regional and local administrative framework

Guinea is divided into seven administrative regions: Boké, Faranah, Kankan, Kindia, Labé, Mamou and Nzérékoré, plus the city of Conakry. The regions are each headed by a Governor and subdivided into prefectures headed by prefects. Each prefecture is in turn divided into subprefectures, one of which is designated as an urban commune and prefecture capital.

The subprefectures are headed by subprefects, who are appointed by the Central Administration. As part of the decentralization of Guinea and the communalization of the territory, several rural subprefectures were designated as Communes Rurales de Développement (CRDs) [rural development communes] during the 1990s. CRDs are headed by elected presidents. Certain competencies related to public services devolve to the CRDs. In total, Guinea has 33 prefectures, 38 communes (including 5 in Conakry) and 303 rural subprefectures.

The districts are divided into sectors containing a number of villages. The three study areas (Kamsar, the railroad corridor and Sangarédi mine) are located within the Boké administrative region, although the mine extends slightly into Télimélé prefecture in the Kindia region.

However, for all intents and purposes, the Project is located in the Boké administrative region, which has five prefectures: Boké, Boffa, Fria, Gaoual and Koundara. The study areas are all located within Boké prefecture, which has 10 subprefectures: Bintimodia, Boké-Centre, Dabiss, Kamsar, Kanfarandé, Kolaboui,

Malapouya, Sangarédi, Sansalé and Tanéné. Only Boké-Centre has the status of urban commune. The three local study areas are located in:

- Kamsar subprefecture/CRD for the Kamsar industrial zone;
- Kamsar, Kolaboui, Boké-Centre, Tanéné and Sangarédi subprefectures/CRDs for the railroad (particular emphasis will be placed on the areas where sidings will be built, at PK 14 and 118); and
- Sangarédi subprefecture/CRD for the mining area around Sangarédi, with a slight overlap into Daramagnaki subprefecture.

1.3.3 International framework

1.3.3.1 International conventions

Following is a list of international conventions that have been ratified by Guinea and have direct implications for the Extension Project and its ESIA:

- United Nations Framework Convention on Climate Change (1992) and the Kyoto Protocol (1997);
- Vienna Convention for the Protection of the Ozone Layer (1985);
- Montreal Protocol on Substances that Deplete the Ozone Layer (1987);
- Convention on the Conservation of Migratory Species of Wild Animals (1979);
- Convention on Biological Diversity (1992);
- African Convention on the Conservation of Nature and Natural Resources (1968);
- Convention Concerning the Protection of the World Cultural and Natural Heritage (1979);
- Ramsar Convention on Wetlands (1993);
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1995, acceded to but not ratified);
- United Nations Convention on the Law of the Sea (1994);
- Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (1984);
- Convention to Combat Desertification (1994);
- Extractive Industries Transparency Initiative (Candidate status renewed in 2011);

- Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87) (ratified in 1959);
- Right to Organise and Collective Bargaining Convention, 1949 (No. 98) (ratified in 1959);
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111) (ratified in 1960);
- Worst Forms of Child Labour Convention, 1999 (No. 182) (ratified in 2003);
- Minimum Age Convention, 1973 (No. 138) (ratified in 2003).

1.3.3.2 Industry standards and good practice

Compliance with the *Performance Standards on Environmental and Social Sustainability* (January 1, 2012) of the International Finance Corporation (IFC), as well as with the Equator Principles for managing the environmental and social impacts of international investment projects.

The IFC Performance Standards establish essential criteria, in terms of social and environmental sustainability, for accessing international capital. The set of eight operational standards requires that environmental and social management systems be developed, implemented and followed in order to ensure that risks and impacts related to the basic themes of sustainable development are effectively and systematically managed throughout the life of a project. For each theme, particular methodology criteria, essential subjects and support principles are established to guide the process. The themes are as follows:

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

The Project will also be developed in compliance with the Equator Principles III (2011), a financial industry benchmark for taking social responsibilities and environmental management into account. The 10 basic principles are:

- Principle 1 – Review and categorization: The Equator Principles Financial Institution (EPFI) must categorize the project based on the magnitude of its potential risks and impacts. Such screening is based on the environmental and social criteria of the IFC;
- Principle 2 – Environmental and social assessment: The EPFI must require the client to conduct an assessment of the environmental and social impacts and to propose relevant management and mitigation measures for reducing the impacts to an acceptable level;
- Principle 3 – Applicable environmental and social standards: Social and environmental performance must be evaluated according to the IFC Performance Standards and the IFC/World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines), as well as the host country laws;
- Principle 4 – Environmental and Social Management System and Action Plan: The client must develop a plan for implementing the mitigation, remedial and follow-up measures needed to address the impacts and risks identified in the assessment process;
- Principle 5 – Stakeholder engagement: For projects with potentially significant adverse impacts on host communities, the client must conduct an informed consultation and participation process beforehand, facilitate the communities' informed participation, and make the assessment documents and action plan publicly available in a culturally appropriate manner;
- Principle 6 – Grievance mechanism: As part of the ESMS, the client must establish a grievance mechanism and inform the affected communities about it;
- Principle 7 – Independent review: An independent environmental and social consultant must carry out a review of the assessment, action plan and stakeholder engagement process in order to assess Equator Principles compliance;
- Principle 8 – Covenants: The client must covenant, in the financing documentation, to comply with the host country requirements, to implement the action plan, to provide periodic reports on the project's social and

environmental performance, and to decommission and dismantle the facilities where applicable;

- Principle 9 – Independent monitoring and reporting: Reports and monitoring information must be checked by an independent environmental and social consultant; and
- Principle 10 – Reporting and transparency: EPFIs must report annually on their Equator Principles implementation processes and experience.

Effective management of the Project risks and impacts requires a complete ESIA covering and assessing the potential risks and impacts of all operations and phases of the Project. According to the IFC Performance Standards, this process must use the best available tools and practices, and must encompass the Project's entire area of influence, including indirect effects and effects associated with the supply chain. The process must be documented and based on solid quantitative and qualitative scientific data; any gaps in important information must be identified and justified in collaboration with local and regional stakeholders, through stakeholder engagement and an informed consultation and participation process. The nature and methods of stakeholder engagement must be established at the planning stage, through a stakeholder engagement plan that must include a mechanism allowing participants to submit grievances.

The identification and assessment of risks and impacts must include the identification of possible mitigation measures in a specific hierarchy favoring the avoidance of impacts over minimization or compensation. The scope of the risks or impacts must also be defined in terms of the cumulative impacts of all projects—past, present and future—that could have combined effects on the natural, physical or human environment at an international or regional level. Once the risks and impacts have been assessed, disclosed and documented in a formal process, the ESIA must also provide information on the impacts or risks that will remain after implementation of the provisional mitigation measures.

The CBG Project team has assumed responsibility for verifying the ESIA report's compliance with the IFC Performance Standards, and will make sure the report complies with those standards before the final version is submitted.

1.4 Alternatives to the Extension Project

1.4.1 Hydrocarbon storage

During the prefeasibility study, the quantity of fuel needed to increase production was assessed and analyzed. The first analyses yielded a scenario of considerably increased oil tanker traffic at the mineral loading port. Because each fuel delivery adds to the risk of contamination, options were studied and it was decided to include, in the final prefeasibility study (FEL 2), an expansion of hydrocarbon storage capacity at Kamsar for the 27.5 MTPA scenario in order to reduce the number of deliveries. Consequently, the study provides for the addition of a 10,000-m^3 Bunker C tank and a 3,000-m^3 diesel tank, which would reduce the number of fuel deliveries by about 22%.

1.4.2 Mining

At the start of FEL 2, the long-term mining plan from the initial FEL 1 phase was still being used. Based on various recommendations from the ESIA coordinating team and other sources, a mandate was assigned to an outside firm to further develop and improve the mining plan in collaboration with the experts at Rio Tinto Alcan.

Major changes were noted when the final document was submitted in June 2014. Although the footprint within the concession remains the same, the duration of mining in the various areas has been considerably reduced through the grouping of operations. This will minimize the impacts related to loss of land and disturbance of local populations. In some areas, for example (such as Bowal 22), mining presence went from nine years to four. The new mining plan also covers a longer period: up to 2042. Operations are to move to the North Cogon around 2027. For this phase, two options are also under study and will be discussed at greater length in upcoming studies. The first is to extend the railroad and set up new stockpiling and loading areas. The second is to haul the ore by road train. This ESIA covers only the period up to 2027, i.e., mining in the South Cogon.

As for the mining itself, various options were studied. At the beginning of FEL 2, the Project team analyzed whether the crushing operations should be located at Kamsar or at Sangarédi. A modeling of production and of the financial impacts demonstrated that it would be preferable and more economically viable, in the long term, to have

the crushers at Kamsar. If they were at Sangarédi, the positive effects would be short-term. The environmental impacts, too, have been lessened, since the crushing operations will stay where they already are, in the industrial zone. Had it been decided to move them to Sangarédi, there would have been a new element to consider in terms of noise and dust emissions in an area already severely impacted by CBG's operations.

Another attractive option, still under study, is the use of surface miners to reach deposits located near villages, roads or other structures. The Project team decided to push ahead with this option and develop it further during the detailed engineering phase (FEL 3). There are several arguments in favor of using this new technology. Environmentally, it would reduce noise, vibrations and dust emissions from blasting. It would make it possible to approach sensitive areas, i.e., less than 500 meters from structures (while maintaining the 100-meter minimum setback prescribed by the Mining Code). It has even been shown that surface miners could reduce annual fuel consumption by more than 2 million liters, with a corresponding reduction in greenhouse gas emissions.

Around 2017, operations are to be transferred to the northeast side of the national highway. The Project team therefore had to analyze options for crossing the road. The following options were discussed:

- level crossing with a stop sign;
- an overpass; and
- an underpass.

The underpass solution was selected, because it was also necessary to ensure that the train will be able to cross the road and get to the Parawi stockpiling and loading area.

A new rail yard was also needed for the railroad. Various options were analyzed, but only one was selected, based on the criteria of safety and quantity of excavation/fill. The route was drawn so as to optimize topography while ensuring that no train sorting operations will take place under the bridge. Expansion of the N'Dangara rail yard was rejected for reasons of safety (increased traffic, and railcars moving along several parallel tracks).

1.4.3 Port

During FEL 2, several options were studied for the port operations:

1. addition of a Capesize quay with all carrier loading dockside;
2. addition of a Capesize quay – Capesize carriers are partially loaded dockside, then loading is finished offshore with a Panamax (50,000 tonnes);
3. addition of a Capesize quay – Capesize carriers are partially loaded dockside, then loading is finished offshore with a Handymax (30,000 tonnes); and
4. addition of a Panamax quay – Capesize carriers are loaded offshore (in three trips).

Modeling was conducted by consulting firm Royal Haskoning to determine which type of quay would be the most economically viable in the long term. It was demonstrated that the most economical model also had the least environmental impact, since dredging is both the largest cost item in this part of the Project and the main source of environmental and social impacts.

Initially, option 3 had been recommended as being the one offering the best balance in terms of capital outlay and operating costs. It also reduced the extent of the dredging required in the estuary channel, since the Capesize carriers would be leaving the estuary with only part of their cargo (the remainder to be loaded offshore).

Following a review of the Project scope in the second phase of FEL 2, along with recommendations made by the ESIA coordinating team, the option of bringing Capesize carriers to the quay was rejected. The Project team even eliminated the option of offshore loading in favor of using only Panamax carriers, as is done at present. The location of the new quay was also reviewed. Initially, the consulting firm recommended a second quay a little further from the existing one, so that an additional jetty would have to be installed to reach it. In the scope review, the Project team requested an analysis of the possibility of simply extending the existing quay to accommodate two carriers. At the end of FEL 2, the option selected was to completely eliminate dredging in the channel while minimizing the footprint of operations in the port area.

1.4.4 Railroad

Consulting firm Canarail had a mandate to study the various railroad options. The locations of the additional sidings were chosen in collaboration with the ESIA coordinating team. Canarail had indicated that it would be technically preferable to install a siding near PK 116; however, a field verification revealed the presence of a village in the right-of-way there. CBG recommended keeping the siding at PK 118 to reduce the potential impact on local residents.

Several options were also studied with respect to railroad safety. A number of different systems were looked at, and then a final recommendation was made, according to the traffic anticipated during the different phases of production.

As for the Kamsar rail yard, the team studied two models: one with traffic going in the same direction as existing operations, and one with traffic going the opposite way. The latter would reduce the blocking of roads and accesses. It would also make it possible to set up a locomotive traffic configuration that would relieve congestion in the maintenance and repair shops.

1.4.5 Construction camps

During the first phase of FEL 2, the Project team had selected two locations outside the industrial zones for setting up the construction camps needed for the execution phase. After discussion and in light of certain recommendations based mainly on the security of residents and workers, it was decided to set up the camps within the industrial zones, both at Kamsar and at Sangarédi.

1.5 Study terms of reference

To identify the main host environment components to study for the ESIA, the ÉEM team conducted a scoping mission from October 3 to 24, 2013. Based on this field campaign, the team was able to validate the main elements to take into consideration for the impact study and to gain a much finer understanding of the local and regional environment likely to be affected by the mining facilities.

The scoping mission also made it possible to tailor specific methodologies for the studies on the physical, biological and social environments. This section will describe

the methodological approaches chosen for the baseline study and the study of the potential and residual impacts of the Project, as well as the main host environment components taken into account.

The Terms of Reference were approved by the Ministère de l'Environnement, des Eaux et forêts on November 8, 2013, and the final Scoping Report was submitted to the BGÉÉE on December 5, 2013. The Scoping Report is appended as Annexe 1-1.

1.5.1 Overview of documentation available

All of the ÉEM teams (physical, biological and social) went out of their way to obtain and consult all previous studies that could reduce or specify the scope and orientations of the fieldwork necessary. They kept in mind, however, that some of the data in baseline studies 3 to 11 years old (2003–2011) may be obsolete.

1.5.1.1 Key documents

Two major studies provided large amounts of data important to the present study. In 2011, AECOM produced an ESIA for CBG for a production increase from 13.5 MTPA to 16.5 MTPA (3% free moisture content). The ÉEM team incorporated the relevant baseline and other data collected and/or compiled for that study, to avoid duplicating the work.

The Guinea Alumina Corporation (GAC) is planning a bauxite mine in a region adjacent to the CBG mine and similar in terms of physical geography. It also has projects at Kamsar. GAC's studies (Knight Piésold and Co. 2008. Guinea Alumina Project – Social and Environmental Assessment) therefore offer useful data on Kamsar and the CBG mine region.

1.5.1.2 Documentation on the physical environment

Air quality baseline

Baseline conditions were determined using an atmospheric dispersion model, along with the baseline measurements collected by AECOM in January 2011 and the baseline monitoring for the present study done by CBG under the direction and supervision of ÉEM.

The ÉEM team examined the data from some of the meteorological stations in the region (Kamsar and Boké), and discovered that there was no surface observation station providing reliable hourly data with a total coverage that could be adapted to the atmospheric dispersion model. AECOM's 2011 ESIA had used five years of meteorological data produced by the MM5 model. MM5 is a medium-scale model that generally produces fairly low-resolution data (often 12 x 12 km). Such a resolution is not suitable for obtaining the coastal effects on the port. ÉEM developed five years of local meteorological data for each site (the mine, a site along the railroad, and Kamsar) for 2008–2012 at a resolution of 3 x 3 km, using an in-house meteorological forecasting and fine-tuning system called FReSH.

Noise baseline

Baseline conditions were determined using the baseline measurements collected by AECOM in early 2011 and the baseline monitoring done by CBG for the present study in 2014 under the direction and supervision of ÉEM.

Water and sediment quality baseline

As much as possible, the assessment made optimum use of information from previous reports and documents provided by the client, including but not limited to all relevant data available on surface water and groundwater resources inside the study areas. This was rounded out by an additional sampling conducted by CBG under the direction and supervision of ÉEM.

Examination of AECOM's 2011 ESIA and other relevant data sources showed that the following data were available; after analysis of their quality, they were used in the present study.

1. Hydrology

Data are available on the major rivers (Knight Piésold and Co. 2008).

2. Quality of surface water

AECOM's 2011 ESIA has data on the Kamsar site (two sites for Dougoufissa Creek and six sites for wastewater). The report for the Guinea Alumina Corporation project

(Knight Piésold, 2008) has data for Rio Nuñez and Dougoufissa Creek (2005–2007, four sites). CBG is conducting regular wastewater sampling (two sites) that includes measuring pH, suspended solids and hydrocarbons.

Data on the mine site are available in AECOM's 2011 ESIA (four sites in the Boundou Wandé and Thiapikouré rivers). CBG is also conducting regular sampling (six sites) that includes measuring nitrate, nitrite, suspended solids, hydrocarbons and fecal coliforms. Sampling has also been conducted since 2001 west of the CBG mine site for the Guinea Alumina project (Knight Piésold, 2008), and this could be useful for comparison purposes.

3. Sediment quality

Sediment samples were taken at Kamsar during AECOM's 2011 ESIA (10 sites) and for the Guinea Alumina project (Knight Piésold, 2008).

4. Groundwater quality

Data on the Kamsar region are available in AECOM's 2011 ESIA (four wells) and in the report for the Guinea Alumina project (Knight Piésold, 2008) (2006, five wells).

Groundwater levels and quality have been sampled since 2001 west of the CBG mine site for the Guinea Alumina project (Knight Piésold, 2008), and this could be useful for comparison purposes.

Geology and soil baseline

The general description of the regional geology and soils was largely based on the data in AECOM's 2011 ESIA and other recent studies, as well as additional data provided by CBG.

A number of local soil analyses were conducted:

- at Kamsar in 2011, where AECOM analyzed the soil at three locations and Golder Associates at six locations. In addition, four samples were subjected to leaching tests in 2011;
- at the mine site in 2011, where AECOM analyzed a composite soil sample.

1.5.1.3 Documentation on the biological environment

AECOM did not do systematic fieldwork in biology for the 2011 ESIA, relying instead on biological data from other studies, in particular the GAC 2008 ESIA (Guinea Alumina Corporation project).

In addition to the GAC 2008 ESIA, the following reports contain biological data:

EIA by BERCA-baara on the N'Dangara and Boundou Wandé mining plateaus

Preliminary version of a 2003 report commissioned by CBG and written by consulting firm BERCA-baara, titled "Étude d'impact sur l'environnement du Projet d'exploitation des gisements de N'Dangara et de Boundou Wandé".

Study of plateau vegetation by BERCA-baara

A 2003 report commissioned by CBG and written by consulting firm BERCA-baara, titled "Inventaire de la flore des plateaux miniers de Sangarédi, Bidikoum, Silidara et N'Dangara".

This study is useful and provides interesting data, particularly on ethnobotanical aspects and the use of certain species for revegetation.

RAP survey of Boké

The 2006 survey "A Rapid Biological Assessment (RAP) of Boké Préfecture, Northwestern Guinea" is a good assessment of selected sites in Boké prefecture: The RAP survey was carried out at several sites in Boké Préfecture along the coast of northwestern Guinea (Guinée Maritime): Sarabaya (Rio Kapatchez), Kamsar (including 5 subsites), and Boulléré.

The RAP survey provides highly useful data and has helped focus the biological fieldwork by indicating the species that may be present.

Nevertheless, as the above studies did not seem sufficient for the specific study areas, ÉEM proceeded to conduct biological fieldwork.

1.5.1.4 Documentation on the social environment

All existing data and reports (produced internally or externally) on the CBG Extension Project and on social and economic conditions in the Project area were studied.

The data to analyze were taken from various sources including scientific reference works, reports, development plans, aerial photographs and articles from international scientific journals. They were used to build a social database for the ESIA, complemented by fieldwork.

For an exhaustive list of the documents consulted for the social studies, please see the references in chapters 5, 7 and 8.

1.5.2 ESIA Study Areas

According to the description of the CBG Extension Project, its footprint can be divided into three separate zones (Map 1-1):

1. the bauxite mining area around Sangarédi;
2. the mouth of Rio Nuñez, an area that encompasses the CBG plant, the mineral loading port and the area used by the ships carrying the ore out to the estuary limit; and
3. a corridor along the railroad between Sangarédi and Kamsar, with particular emphasis on two sections where rail sidings are to be built.

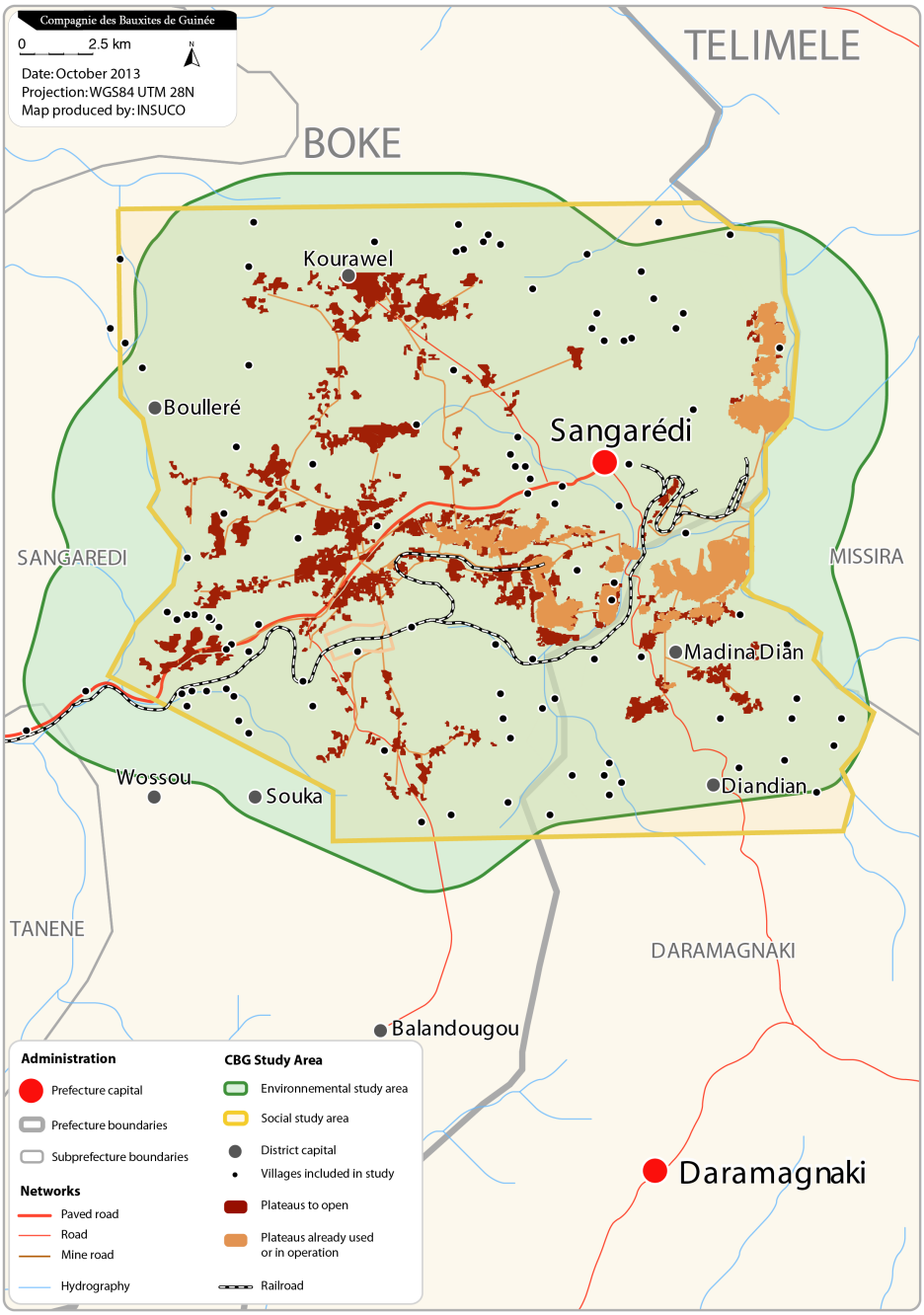
The mining area around Sangarédi (Zone 1) straddles two prefectures, Boké and Télimélé, located in the administrative regions of Boké and Kindia, respectively. It covers part of the subprefecture of Sangarédi (in Boké prefecture) and part of the subprefecture of Daramagnaki (in Télimélé prefecture).

The CBG plant and mineral loading port (Zone 2) are on the east bank of the mouth of Rio Nuñez, in Kamsar subprefecture, Boké prefecture. The west bank is actually an island also belonging to Kamsar subprefecture.

The railroad (Zone 3) crosses the subprefectures of Kamsar, Kolaboui, the Commune Urbaine de Boké and then the subprefectures of Tanéné and Sangarédi in Boké prefecture. It ends in Telimélé prefecture, at Daramagnaki subprefecture.

1.5.2.1 Zone 1

Map 1-2 Zone 1 Study Areas



Zone 1 Environmental Study Area

The boundaries of the Environmental Study Area for Zone 1 correspond to the perimeter of the areas that will be mined, plus an additional 3 km around the perimeter to take into account the effects of mining operations (noise, dust, etc.). This 3-km buffer seems reasonable given the size of the deposits and the relatively short period during which they will be mined. The fieldwork for establishing the baseline focused on reference sites and on the areas that will see changes due to the increase in the rate of bauxite extraction.

Zone 1 Socioeconomic Study Area

Based on the mining plan, all towns and villages liable to be impacted by the extension of the bauxite mining areas in the communes of Sangarédi and Daramagnaki in the coming years were identified and geolocated.

1.5.2.2 Zone 2

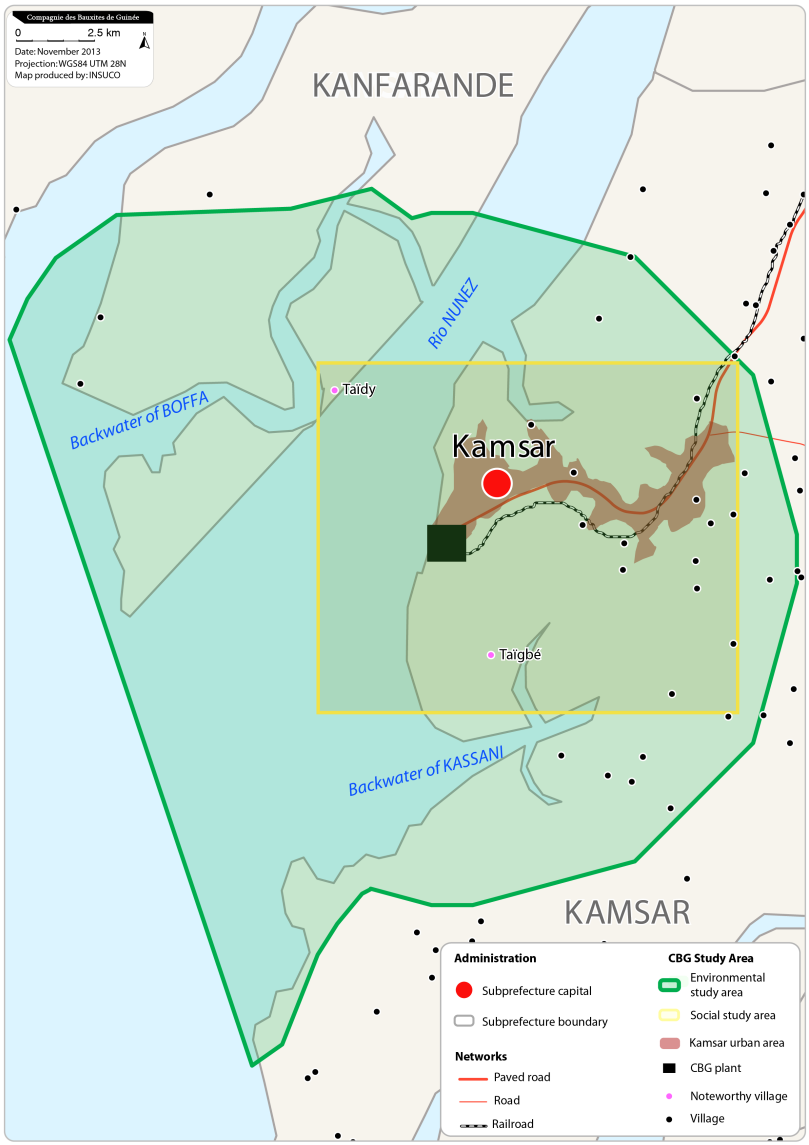
Zone 2 Environmental Study Area

The Environmental Study Area for Zone 2 was determined by superimposing two potential impact zones. The first is a 10-km area around the CBG plant and port; this is a conservative buffer for impacts related to air quality and noise. The second is a marine area likely to see impacts from the port facilities and increased marine traffic. This area covers the mouth of Rio Nuñez as well as certain important biological environments nearby.

Zone 2 Socioeconomic Study Area

The Socioeconomic Study Area for Zone 2 encompasses the area near the CBG plant and mineral loading port, where direct impacts (such as dust and noise) will be felt, as well as an extended area covering the agglomeration of Kamsar, where indirect impacts caused by population growth and increased local employment will be felt. Demographic growth will exert greater pressure on local and regional basic services and infrastructure. Two villages at the mouth of Rio Nuñez were also added to the Study Area, since they are liable to be impacted by increased maritime traffic as a result of the Extension Project. They are the villages of Taïdi, on the west side of the river mouth, and Taïgbé, south of Kamsar.

Map 1-3 Zone 2 Study Areas



1.5.2.3 Zone 3

The study area for the railroad is a corridor 2 km wide (1 km on either side of the railroad).

1.5.3 General methodology for impact assessment

Based on the host environment baseline studies and stakeholder consultations, a set of potential impacts on the physical, biological and social environments of the Project Study Area can be identified. The positive, negative, direct and indirect impacts are considered.

The initial assessment of the relative significance of the Project's environmental and social impacts on Valued Ecosystem Components (VECs) is based on an analysis using four criteria:

1. value of the component;
2. magnitude of the disturbance;
3. geographical scope; and
4. duration.

The following sections define the criteria and homogeneous assessment approaches for the Project as a whole. In order to maintain consistency in the assessment, a uniform approach was used for the physical, biological and social analyses. Any differences in the understanding of the criteria applied to the various VECs were specified and justified during the discussions on methodology for each impact. The impacts were assessed for two Project phases (construction and operation) and for the three zones: the plant and port in Kamsar, the railroad linking the mine to the plant, and the bauxite mine itself.

1.5.3.1 Component value

Valued ecosystem components (VECs) are typically defined as "Any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern." (Canadian Environmental Assessment Agency, "Cumulative Effects Assessment Practitioners' Guide", February 1999)

The "component value" criterion measures the component's importance in the functioning of the ecosystem and/or the socioeconomic system in the study area.

For the environmental assessment, the component value is mainly based on documented judgments by national and international organizations and experts, data on the conservation status of species and habitats (for example, IUCN species classifications) and the results of field studies conducted during the assessment.

For the socioeconomic assessment, the component value is mainly based on consultations conducted during the assessment. The components mentioned most frequently during the consultations are deemed to have a high value. For more information on the consultation analysis methodology, see Chapter 6 – Stakeholder Consultation. The expert's assessment also plays a role in the final determination of the component value.

Component value can be low, medium or high.

Table 1-2 Importance of components

Low	Medium	High
Plays a marginal role in the functioning of the ecosystem or socioeconomic system.	Important role in the functioning of the ecosystem or socioeconomic system.	Could not be impacted without compromising the functioning of the ecosystem or socioeconomic system.

The "component value" criterion makes up one third of the overall significance of an impact.

1.5.3.2 Magnitude of disturbance

This criterion measures the severity of the disturbance to the quality of the VEC or sub-component in question. The disturbance caused by an impact can be low, medium or high.

Table 1-3 Magnitude of disturbance

Low	Medium	High
Affects the quality of the VEC or sub-component, but does not significantly alter its characteristics or functions.	Affects certain aspects of the quality of the VEC or sub-component, without compromising its integrity.	Affects the integrity of the VEC or sub-component, or irreversibly alters its quality.

The "magnitude of disturbance" criterion makes up one third of the overall significance of an impact.

1.5.3.3 Geographical scope

This criterion addresses the potential geographical extent of the impact.

Table 1-4 Scope

Site	Local	Regional
Disturbs the VEC over a specific and circumscribed area around the activity site, smaller than the study area (e.g. in the vicinity of the facilities, perceptible by only a few people, etc.).	Disturbs the VEC beyond the footprint of the Project, within a 10-km radius (e.g., over the study area, perceptible by several groups of people, etc.).	Disturbs the VEC beyond the study area (e.g., affecting several communities, extending over several geographical units or territorial organizations, or affecting extended networks).

The "geographical scope" criterion makes up one sixth of the overall significance of an impact.

1.5.3.4 Duration

This criterion addresses the potential temporal extent of an impact.

Table 1-5 Duration

Short	Medium	Long
Affects VECs during the construction phase.	Affects VECs over a longer period than Project construction or rehabilitation, but not as long as the existing mining plan (2028).	Affects VECs for the duration of the existing mining plan (2028) or longer.

The "duration" criterion makes up one sixth of the overall significance of an impact.

1.5.3.5 Matrix for determining aggregate significance of impacts

The following tables illustrate the method used to determine the weighted significance of impacts.

Table 1-6 Matrix for calculating impact significance – Impacts of low significance

VEC value	Magnitude of disturbance	Scope	Duration	Significance of impact	
low	low	site	short	low	Low
low	low	site	medium	low	
low	low	local	short	low	
low	low	site	long	low	
low	low	local	medium	low	
low	low	regional	short	low	
low	medium	site	short	low	
medium	low	site	short	low	
low	low	regional	medium	low	
low	low	local	long	low	
low	medium	site	medium	low	
low	medium	local	short	low	
medium	low	site	medium	low	
medium	low	local	short	low	
low	low	regional	long	low	
low	medium	local	medium	low	
medium	low	local	medium	low	
low	medium	site	long	low	
low	medium	regional	short	low	
low	high	site	short	low	
medium	low	site	long	low	
medium	low	regional	short	low	
medium	medium	site	short	low	
high	low	site	short	low	

Table 1-7 Matrix for calculating impact significance – Impacts of medium significance

VEC value	Magnitude of disturbance	Scope	Duration	Significance of impact	
low	medium	local	long	medium	
low	medium	regional	medium	medium	
low	high	site	medium	medium	
low	high	local	short	medium	
medium	low	local	long	medium	
medium	low	regional	medium	medium	
medium	medium	site	medium	medium	
medium	medium	local	short	medium	
high	low	site	medium	medium	
high	low	local	short	medium	
low	high	local	medium	medium	
medium	medium	local	medium	medium	
high	low	local	medium	medium	
low	medium	regional	long	medium	
low	high	site	long	medium	
low	high	regional	short	medium	
medium	low	regional	long	medium	
medium	medium	site	long	medium	
medium	medium	regional	short	medium	
medium	high	site	short	medium	
high	low	site	long	medium	
high	low	regional	short	medium	
high	medium	site	short	medium	
low	high	local	long	medium	
low	high	regional	medium	medium	
medium	medium	local	long	medium	
medium	medium	regional	medium	medium	
medium	high	site	medium	medium	
medium	high	site	short	medium	
high	low	local	long	medium	
high	low	regional	medium	medium	
high	medium	site	medium	medium	
high	medium	local	short	medium	

Table 1-8 Matrix for calculating impact significance – Impacts of high significance

VEC value	Magnitude of disturbance	Scope	Duration	Significance of impact	
low	high	regional	long	high	High
medium	medium	regional	long	high	
medium	high	site	long	high	
medium	high	local	medium	high	
medium	high	regional	short	high	
high	low	regional	long	high	
high	medium	site	long	high	
high	medium	local	medium	high	
high	medium	regional	short	high	
high	high	site	short	high	
medium	high	local	long	high	
medium	high	regional	medium	high	
high	medium	local	long	high	
high	medium	regional	medium	high	
high	high	site	medium	high	
high	high	local	short	high	
medium	high	regional	long	high	
high	medium	regional	long	high	
high	high	site	long	high	
high	high	regional	short	high	
high	high	local	medium	high	
high	high	local	long	high	
high	high	regional	medium	high	
high	high	regional	long	high	

1.5.4 Impact mitigation and optimization measures

For all the impacts identified, measures are proposed for optimizing the Project's positive impacts and minimizing the negative ones. These mitigation measures are based on technical solutions envisaged by CBG in its Project planning, on the one hand, and on ÉEM team members' expertise and suggestions from the stakeholders consulted, on the other hand.

The following order of priority was followed:

1. Avoidance measures – Ways of preventing the impact are given top priority.

Example: changing the design of a facility or the choice of equipment, such as substituting a type of machine that does not produce atmospheric contaminants.

2. Reduction measures – If the impact cannot be avoided, ways of reducing its significance are considered.

Example: modifying equipment or implementing a mechanism such as a system for controlling contaminated runoff.

3. Restoration measures – If the impact cannot be avoided or reduced, ways of repairing the damage are considered.

Example: After the mine is shut down, restoring an ecosystem that was destroyed during construction or operation.

4. Compensation measures – If an impact cannot be avoided or reduced and it causes irreversible degradation of a VEC that cannot be restored, ways of substituting other resources or services with a similar use or function are considered.

Example: Substituting pasture lands to replace the ones lost.

1.5.4.1 Residual impacts

Based on the technical studies of the physical, biological and social environments in the Study Area, as well as consultation of Project stakeholders, a preliminary assessment was made of the Project's impacts on the host environment and potential mitigation and optimization measures were identified.

The residual impact assessment used the same methodology as the one used in the preliminary assessment of potential impacts. The mitigation measures identification process was repeated until the residual impacts were reduced to the lowest level possible. In assessing the residual impact levels, it was assumed that all the mitigation measures proposed for each discipline (summarized in the ESMP, Chapter 10) would be implemented steadily, according to an aggressive schedule and with the appropriate resources.

A fourth criterion was also applied to the assessment of residual impacts: their probability of occurrence. Although this criterion was not applied in the numerical

weighting of impacts, it allows more effective prioritization of the actions in the environmental and social management plans to be developed later.

Each impact was assigned a probability rating:

1. certain: occurrence of the impact is inevitable and confirmed;
2. probable: occurrence is not certain, but its stochastic probability can be scientifically determined; or
3. uncertain: based on the data gathered and team's expertise, it is not possible to state the impact's probability of occurrence. For example, impacts created by natural disasters or accidents not directly related to CBG's facilities would be in this category.

1.5.4.2 Cumulative impact assessment

The ESIA team analyzed the direct and indirect social and environmental impacts of the Extension Project. It then compiled a list of past, present and planned developments or activities in the Study Area in order to assess the cumulative impacts caused by interaction between the CBG Extension Project and other activities in the region. These impacts were assessed according to the CEAA guidelines (Canadian Environmental Assessment Agency, "Cumulative Effects Assessment Practitioners' Guide", February 1999) as well as other directives and regulations applicable to cumulative impact assessment in Guinea.

The IFC standards (International Financial Corporation, "Good Practice Note – Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets", 2012) were also followed. These standards require the cumulative impact assessment to take into account all data available from impact studies on other projects and all environmental and social baseline data for the defined study area. A process similar to the ESIA methodology must be applied to the cumulative impact analysis and must incorporate the risks and impacts left over from past projects as well as those arising from any probable or potential regional project. As in the ESIA, as much quantitative data as possible must be provided, and gaps in data must be understood and justified. Regional mitigation measures must be identified and developed in conjunction with regional stakeholders, government representatives and representatives of other projects located within the cumulative impact study area.

One of the main tasks in a cumulative impact assessment is to determine which of the many development activities near the study areas should be taken into account. Potential activities include RUSAL's alumina production facility at Dian-Dian, Alcoa/Rio Tinto Alcan's Kabata project, Guinea Alumina Corporation's alumina production facility, and SEMAFO's Poudaldé hydroelectric project on the Cogon River. The status of potential or planned developments must be the subject of in-depth discussions with CBG management and government representatives.