



Kinguélé Aval Hydroelectric Development (34MW)

ENVIRONMENTAL AND SOCIAL IMPACT STUDY

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

ARTELIA / EDF / BIOTOPE

Dams, Hydraulic Engineering and Infrastructures

6, rue de Lorraine
38130 Echirolles



ARTELIA



EDF



biotope

DATE: 06 - 2020

REF: 8210771

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Prepared for:

Meridiam (registered under No. 483 579 389)

Prepared by:

ARTELIA & EDF Group**Represented by ARTELIA Eau & Environnement (SIRET N°. 503 646 572 00019)**

6, Rue de Lorraine, 38100 Echirolles - France

ARTELIA Water and Environment- Ref. No.: 8 210 771					
<i>Revision</i>	<i>Status</i>	<i>Drafted by</i>	<i>Checked by</i>	<i>Authorized by</i>	<i>Date</i>
0.0	Partial draft for proofreading	Marjorie BREMOND Lucie ALAZARD Jean René MALAVOI Vincent CHANUDET Fabien NATHAN Renald BOULNOIS Frédéric MATHIEU	Bernard YON Frédéric MATHIEU Sandrine LE CLERC	Guillaume PRUDENT-RICHARD	20/12/2017
0.1	Full draft for proofreading	Marjorie BREMOND Lucie ALAZARD Jean René MALAVOI Vincent CHANUDET Fabien NATHAN Renald BOULNOIS Frédéric MATHIEU	Bernard YON Frédéric MATHIEU Sandrine LE CLERC Guillaume PRUDENT-RICHARD	Guillaume PRUDENT-RICHARD	06/04/2018
1	Provisional version for submission to the authorities	Marjorie BREMOND Lucie ALAZARD Jean René MALAVOI Vincent CHANUDET Fabien NATHAN Renald BOULNOIS Frédéric MATHIEU	Bernard YON Frédéric MATHIEU Sandrine LE CLERC Guillaume PRUDENT-RICHARD	Guillaume PRUDENT-RICHARD	06/08/2018
1.1	Review at the request of the lenders	Marjorie BREMOND Lucie ALAZARD Jean René MALAVOI Vincent CHANUDET Fabien NATHAN Renald BOULNOIS Frédéric MATHIEU	Bernard YON Frédéric MATHIEU Sandrine LE CLERC Guillaume PRUDENT-RICHARD	Guillaume PRUDENT-RICHARD	05/05/2020

CONTENTS

1. NON-TECHNICAL SUMMARY	5
1.1. INTRODUCTION	5
1.2. PROJECT DESCRIPTION	5
1.2.1. PROJECT OBJECTIVES AND RATIONALE	5
1.2.2. PROJECT STATUS	6
1.2.3. PROJECT FEATURES	9
1.2.4. ANALYSIS OF ALTERNATIVES	14
1.2.5. PROJECT AREA OF INFLUENCE	16
1.2.5.1. DIRECT IMPACT AREA	16
1.2.5.2. EXTENDED IMPACT ZONE	18
1.3. ENVIRONMENTAL AND SOCIAL BASELINE	19
1.3.1. PHYSICAL ENVIRONMENT	19
1.3.2. NATURAL ENVIRONMENT	24
1.3.3. HUMAN ENVIRONMENT	33
1.4. INSTITUTIONAL AND LEGAL CONTEXT	38
1.4.1. INSTITUTIONAL FRAMEWORK	38
1.4.2. LEGAL FRAMEWORK FOR ESIAS	39
1.4.3. ESIA PROCES	40
1.4.4. INTERNATIONAL STANDARDS	41
1.4.4.1. IFC STANDARDS	41
1.4.4.2. REFERENTIAL OF THE AFRICAN DEVELOPMENT BANK	42
1.5. IMPACTS AND MEASURES	43
1.5.1. PHYSICAL ENVIRONMENT	43
1.5.1.1. Impact on hydrology	43
1.5.1.2. Impact on water quality	44
1.5.1.3. erosion- and sedimentation-related IMPACTS	44
1.5.1.4. Estimation of greenhouse gas (GG) emissions	45
1.5.2. NATURAL ENVIRONMENT	45
1.5.2.1. Impact on the monts de cristal national park	45
1.5.2.2. loss of natural and critical Habitats	46
1.5.2.3. loss of floristic ecological richness	51
1.5.2.4. loss of faunistic ecological richness (excluding fish)	51
1.5.2.5. Impact on fish biodiversity	53
1.5.2.6. biodiversity conservation meAsures	54
1.5.3. HUMAN ENVIRONMENT	56
1.6. PUBLIC CONSULTATIONS	57
1.6.1. ACTIVITIES	57
1.6.2. CONCERNS AND WISHES	59
1.7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)	60
1.7.1. AIM OF THE ESMP	60
1.7.2. ORGANIZATION	60
1.7.3. PROCEDURES AND ACTION PLANS	61
1.7.4. ENVIRONMENTAL PERFORMANCE INDICATORS	63

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

1.7.5.	GRIEVANCE REDRESS MECHANISM	67
1.7.6.	ESMP BUDGET	68

1. NON-TECHNICAL SUMMARY

1.1. INTRODUCTION

This section forms a non-technical summary of the environmental and social impact assessment (ESIA) for the construction and operation of the Kingulé Aval hydroelectric power plant. It presents a summary of the environmental and social impact assessment results for the project, which has been the subject of several preparatory studies over a period of more than 20 years; the first dating back to 1988.

The planning context surrounding Gabon's energy needs aims to provide a response to both growing demand in terms of energy needs and stabilization of the national grid through sufficient installed power capacity. It is within this framework that Meridiam and FGIS wish to upgrade national electricity production through implementation of the Kingulé Aval project, which is designed to generate 34 MW with a hydroelectric power plant on the River Mbé. The site of the dam and its reservoir is located across both the buffer zone and the heartland of the Monts de Cristal National Park, downstream of two existing installations (Kinguélé and Tchimbélé) operated by SEEG. Construction of the Kingulé Aval facility is scheduled to begin in the 3rd quarter of 2020 and its commissioning is scheduled for 2024..

The Kingulé Aval hydropower project is being developed by a consortium made up of:

- **FGIS**, the Gabonese Fund for Strategic Investments: created in 2012 to replace the former Sovereign wealth fund (SWF), the Gabonese Fund for Strategic Investments (FGIS) is a Gabonese sovereign fund created to help the country developing new projects that generate enough income to replace those of the petroleum sector - 53% of 2013 GDP. FGIS wishes to actively participate t the development of projects in Gabon and / or in Africa by investing up to 500 billion FCFA (762 million euros) by 2022.
- **MERIDIAM**: is an independent investment company specializing in the development, financing and management of long-term sustainable public infrastructure projects. Its model is based on the conviction that the alignment of interests between the public and private sectors can provide essential solutions to the needs of the community. With offices in Paris, New York, Toronto, Luxembourg, Istanbul, Vienna, Addis Ababa and Dakar, Meridiam manages 6.2 billion euros in assets and has more than 65 projects in development, construction or operation in 2018. Meridiam is an actor committed to the implementation of rules of good governance and respect for the environment. The company has aligned its environmental and social investment policy with that of international financial institutions, in particular Parparco, the European Investment Bank, the International Finance Corporation (IFC), etc.



The consortium selected a design office (BE) through an international tender to carry out the environmental and social impact study (ESIA) of the project. The BE in charge of the ESIA of the project is the grouping made up of ARTELIA (representative of the grouping) and EDF, as well as BIOTOPE, subcontractor, in charge of biodiversity aspects.

1.2. PROJECT DESCRIPTION

1.2.1. Project objectives and rationale

The Kingulé Aval hydropower project is a major feature for the implementation of the Emerging Gabon Strategic Plan, aiming at promote economic development while promoting sustainable development principles.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

The Gabonese Republic ambitions to meet growing demand for electricity by using renewable and affordable energy based on its natural resources, in particular through the construction of several hydropower projects.

In the regard, the Government is willing to to develop a sustainable, diversified and affordable electricity supply for all. This action should bring the Gabon power generation capacities to 1200 MW by 2025. The Independent Production program, based on Public Private Partnership contracts, is currently transforming the electricity sector in Gabon.

The stakes are also economic: the project, and other similar projects, will place Gabon as a first class destination for the energy made available. It will also support the diversification of the economy and the creation of stable and sustainable jobs.

The Kingulé Aval hydropower project, feasible on the short run, is a key component of the larger plan to foster economic development of Libreville region. The need for an increased generation capacity in Gabon and especially in Libreville is pressing. Indeed, the country faces a structural deficit in electricity capacity creating chronic load shedding and requiring the country to purchase of expensive back-up capacities. Currently, production just meets demand, and no reserve margin is available because the generation from renewable sources is just on demand. Several development projects are impacted and delayed. The growth in electricity consumption has been sustained for several years, with annual growth rates between 4.5 and 6% (smoothness above 5%) on average. There is an immediate risk of shortage.

Therefore, the project takes place in a context of power shortage and urgent investment planning to preserve and promote the country's development perspectives. The project has two objectives over 5 years:

- To supply renewable energy from hydropower of around 34 MW for 200 GWh, in response to growing energy needs;
- To increase the share of hydropower energy within the energy mix of the country and thus, to decrease the share of electricity generated from hydrocarbon fuel, while stabilizing the power supply, thanks to sufficient installed power.

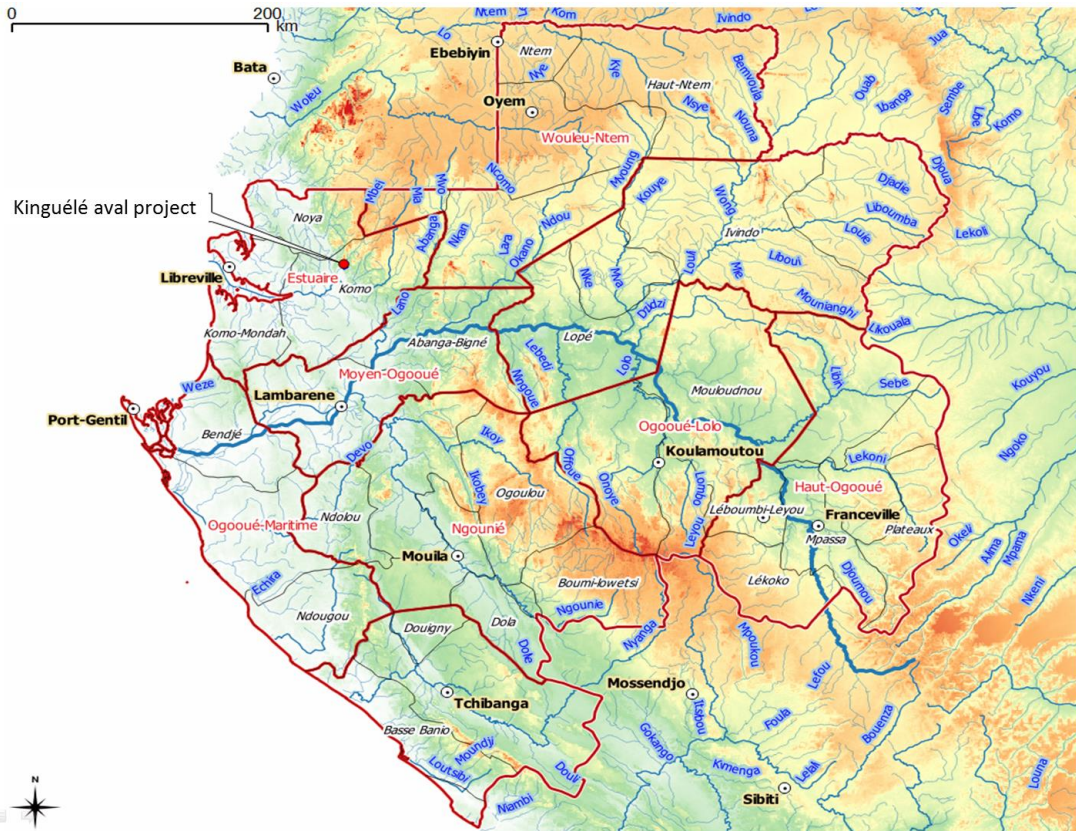
1.2.2. Project status

The project is located in the department of Komo, in the Estuary province, approximately 90 km east of Libreville. It is the most downstream element in the Mbé Hydropower power network, which already includes the Tchimbélé hydropower project (50 km upstream) and Kingulé hydropower project (10 km upstream). The reservoir spreads between the Monts de Cristal National Park (PNMC) and in its buffer zone. The dam itself and the construction site are in the buffer zone. The base is located outside the PNMC and its buffer zone.

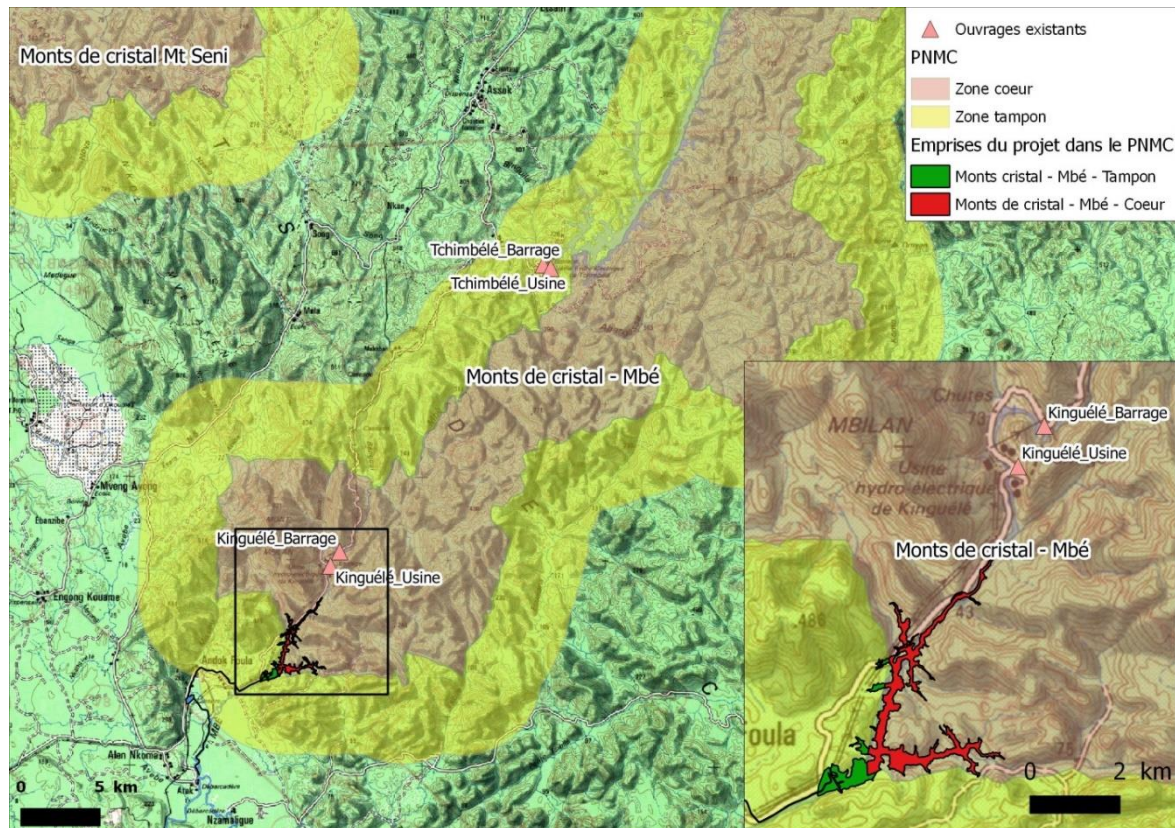
Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Project location

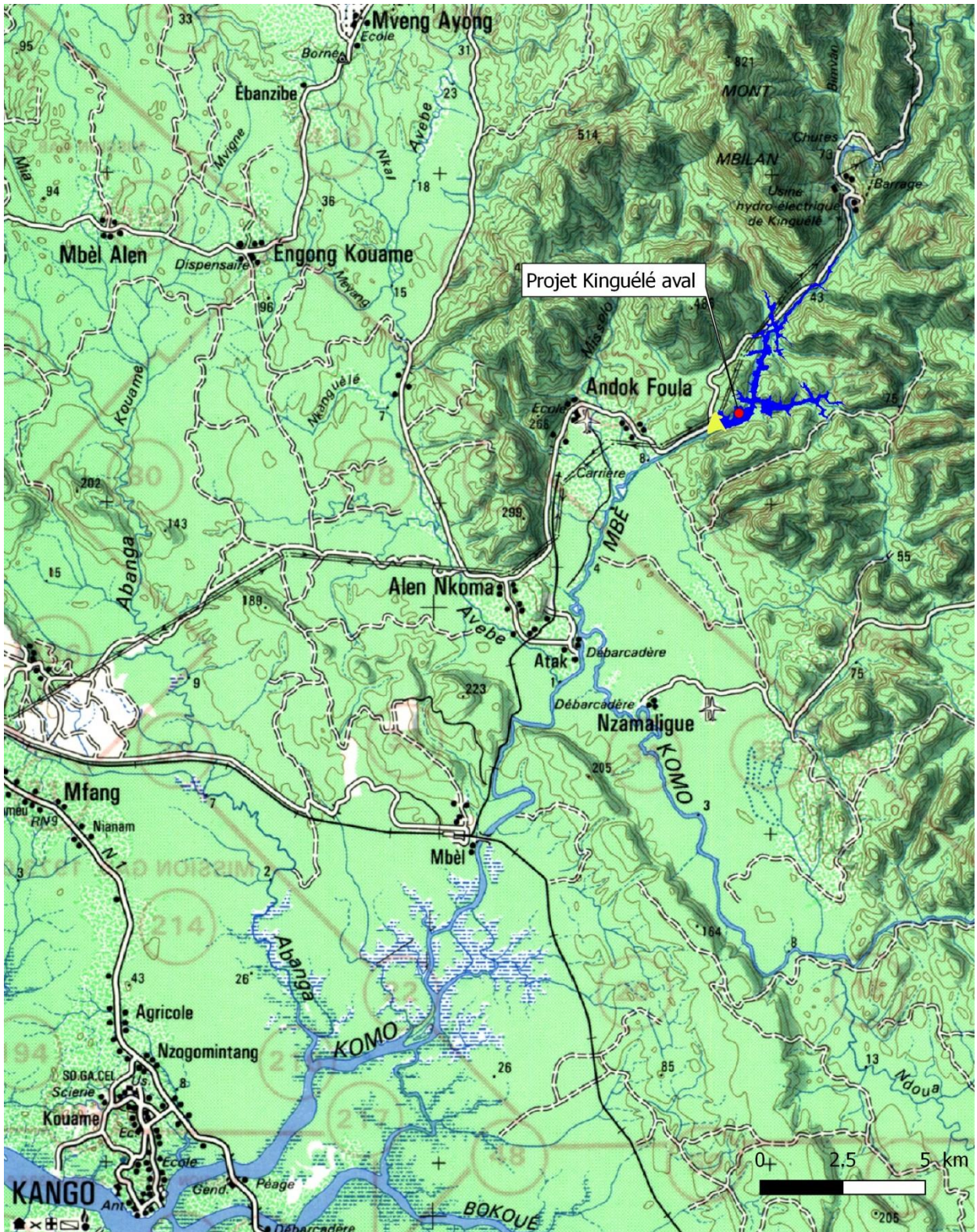


Situation of the project in relation to the Monts de Cristal National Park

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Project location in relation to the nearest village (Andock foula)

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

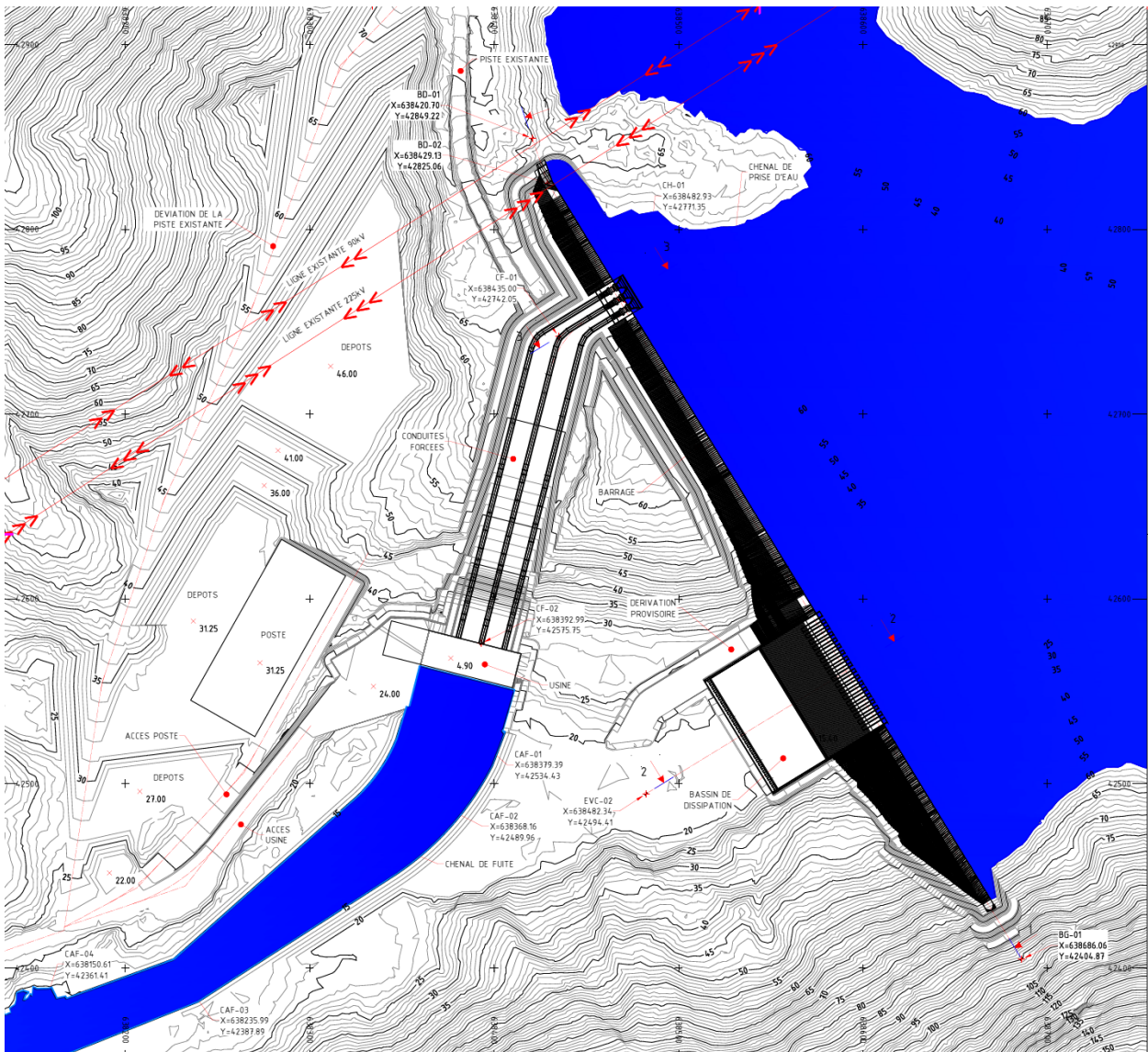
NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

1.2.3. Project features

The Kingulé Aval scheme is a run-of-river facility; in other words, it does not intend to regulate the river flows. There will be no significant change in seasonal flows downstream of the outlet point, as all the inflows in the reservoir will be immediately transferred downstream through the turbines. The reservoir is not designed for storage; all the water passes through the power plant. A spillway ensures the release by overflow in the event of excess water during high water and floods.

As the existing Kingulé road is located within the land take of the future penstocks, a minor realignment of the road nearby the Kingulé Aval structures is therefore planned. A thalweg close to the powerhouse could be filled for this purpose.

The figure below illustrates the main facilities of Kingulé Aval hydropower scheme.

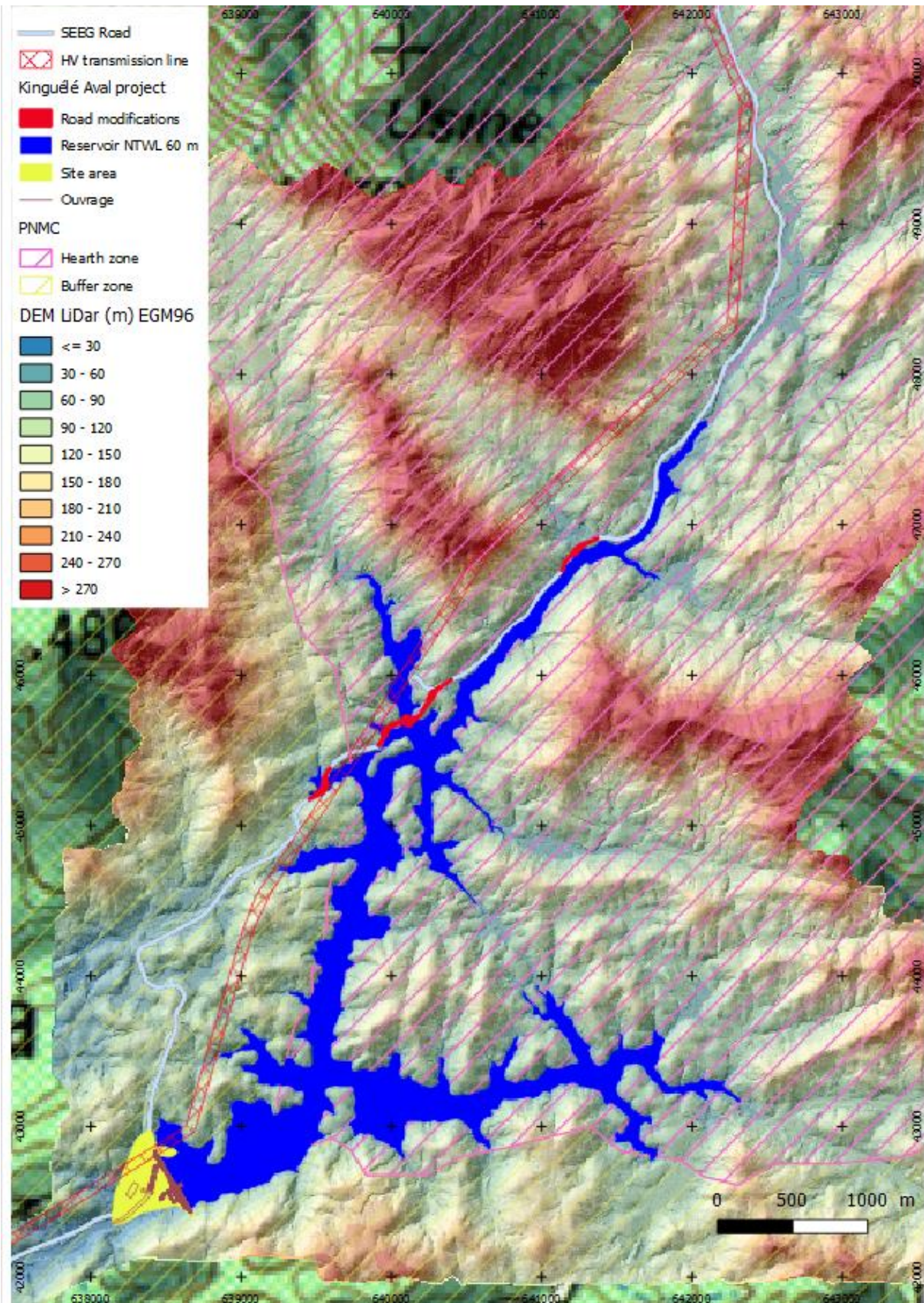


Visual of the layout

Kingulé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

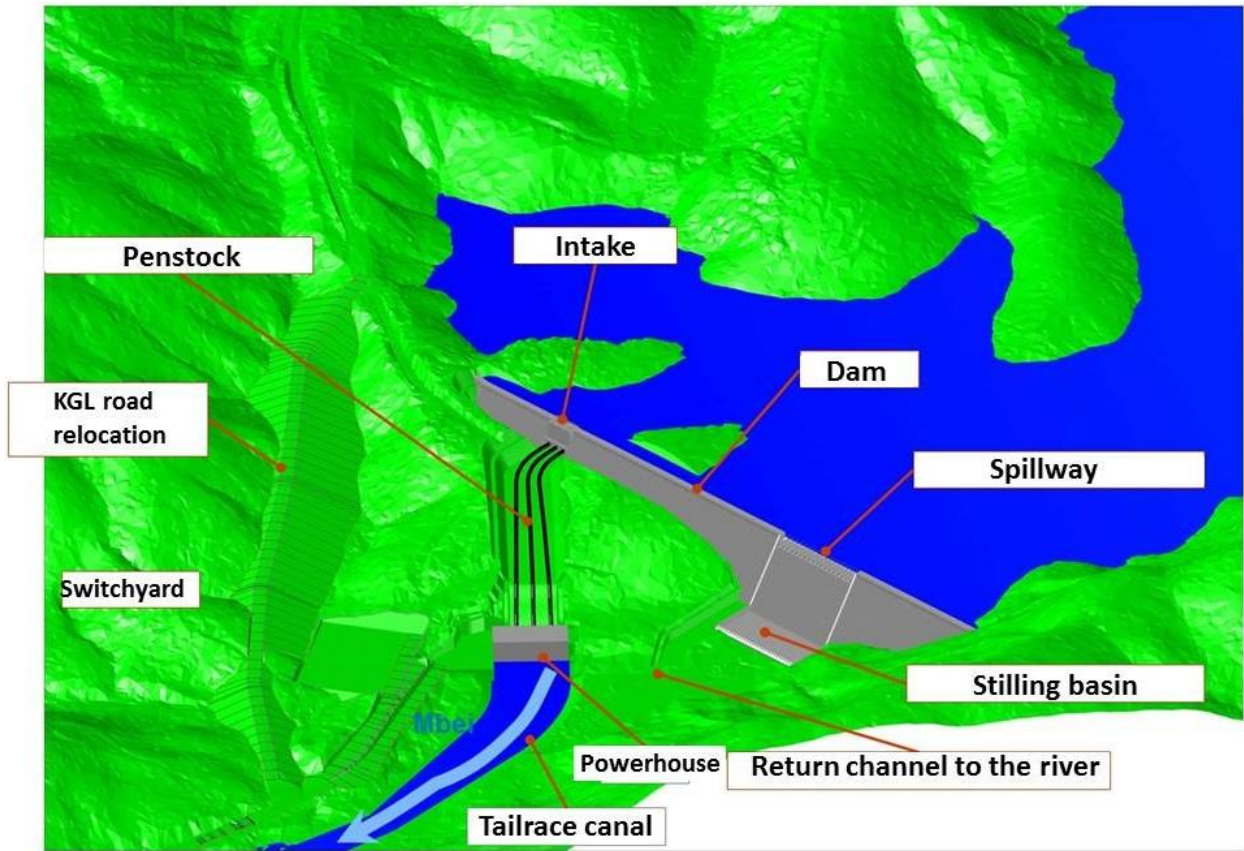


Reservoir land take

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Perspective view of dam, penstocks, powerhouse and downstream outlet

Summary of Kingulé Aval Development characteristics

Power and Production	
Available power (at transformer terminals)	34.3 MW
Average annual production	200 GWh
Installation design flow	90 m ³ /s
Average volume / year through turbines	1,885 Mm ³
Hydrology	
Interannual flow rate	65 m ³ /s
Design flood (Q ₁₀₀₀) ¹	1040 m ³ /s
Extreme – safety flood (Q ₁₀₀₀₀) ²	1300 m ³ /s
Construction flood – Q ₁₀	190 m ³ /s

¹ The **design flood** is the flood used for the hydraulic design of the facility structures. The flood spillway structures, with all valves open, must allow the reservoir level to be kept at maximum water level (MWL). The design flood is the flood that must be discharged without any damage to the structures and their immediate downstream area, while ensuring dam safety at all times. For the Kingulé Aval project, a 1,000-year return period flood (**Q1000**) has been chosen: the structures are concrete.

² The **safety flood** is the extreme flood that can be discharged by providing a minimum freeboard with respect to the structural crest level without failure of the structures at their ultimate strength. The spillway structures must allow the safety flood to be discharged at extreme high water level (EHWL). For the Kingulé Aval project, a 10,000-year return period flood (Q10000) has been chosen for this.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Reservoir	
Normal top water level (NTWL)	60.0 NGG ³
Maximum water level (MWL)	62.0 NGG
Maximum extreme water level (MEWL)	62.5 NGG
Minimum operating level (MOL)	58.0 NGG
Active capacity (between NTWL and MOL)	4.2 hm ³
Reservoir area at normal top water level	234 ha
Reservoir area at MWL	267 ha
Dam	
Type of dam	RCC
Crest level	63.5 NGG
Foundation level (low point)	15.4 NGG
Foundation type	RCC dam founded on rock. Foundation integrates an impervious cut-off and a drainage curtain. Foundation of right bank abutment integrates an impervious cut-off (diaphragm wall or secant piles)
Crest length	470 m
Crest width	5.0 m
Maximum height above foundation	48.1 m
Upstream slope	Vertical face
Downstream slope	0.8 H / 1 V
RCC volume	170,000 m ³
Temporary diversion	
Number of openings	2 openings
Opening cross section (L x H)	3.5 x 5.0 m
Top-of-raft level (upstream end)	21.20 NGG
Longitudinal slope of opening	1.2 %
Bottom outlet (installed in a temporary diversion opening)	
Type of valves	Segment valve (downstream end) Gate valve (upstream end)
Segment valve dimensions (L x H)	2.5 x 3.0 m
Gate valve dimensions (L x H)	2.5 x 4.0 m
Armor-plating cross section (L x H)	2.5 x 4.0 m
Discharge under NTWL	100 m ³ /s
Spillway	
Sill	
Type of sill	Piano key weir (PKW)
Sill level	60.10 NGG
Overspill width	Crest length 70 m Sill developed length 210 m

³ The project description uses the Gabonese national survey (Nivellement Général Gabonais - NGG) reference frame. In other sections of the ESIA, the EGM08 worldwide survey may be taken as reference frame, e.g. for the LIDAR topography, in which Elevation_NGG = Elevation_LIDAR + 10 m.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Downstream Fall	
Type	Stepped chute (downstream face of RCC dam)
Total height	43.4 m
Step height	0.6 m
Height of side "training" walls	2.0 m
Stilling basin	
Top-of-raft level	16.6 NGG
Width (bank-bank)	70 m
Length (upstream-downstream)	35 m
Collecting works	
Intake	
Type of valves (for each of 3 openings)	Gate valve + steel bulkhead gates
Equipment	Trash rack + rake gantry
Sill level	47 NGG
Total width	22.5 m
Number of openings	3
Width of openings	2.8m
Trash rack inclination (to the vertical)	15 °
Penstock	
Penstock material	Glass Reinforced Polyester (GRP)
Type of penstock	External penstocks laid in trenches
Number of penstocks	3
Maximum velocity in penstocks	5 m/s
Penstock diameter	2.8 m
Penstock length	210 m
Average longitudinal gradient	15%
Water level upstream of penstock (intake)	47 NGG
Water level downstream of penstock (powerhouse connection)	12.6 NGG
Powerhouse	
Characteristics of the Civil Engineering Building	
Type	External powerhouse (semi-buried)
Superstructure dimensions (above access platform)	
Height	12.6 m
Width (bank-bank)	72.5 m
Length (upstream-downstream)	51.5 m
Infrastructure dimensions (below access platform)	
Height	19.1 m
Width (bank-bank)	51.5 m
Length (upstream-downstream)	19.0 m
Transformer area	19 x 8 m
Generator c/c distance	12.8 m

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Level 0 level (powerhouse access, assembly hall)	24 NGG
Manifold axis level	14 NGG
Level of draft tube low point (invert)	7.2 m
Level of underside of power plant raft	4.9 NGG
Electromechanical equipment characteristics	
Number of turbine sets	3
Type of turbine sets	Francis
Wheel/runner diameter (mm)	1.98 m
Turbine set mechanical power	12.2 MW
Rotational speed	272.73 rpm
Nominal net head	43 m
Maximum flow/unit	30 m ³ /s
Maximum electrical power	
Q _{min} installation	15 m ³ /s
Powerhouse downstream outlet level – maximum (MWL)	23 NGG
Powerhouse downstream outlet level – nominal (at 90 m ³ /s)	15.2 NGG
Powerhouse downstream outlet level – minimum (at 20 m ³ /s)	14.1 NGG
Overhead travelling crane capacity	40 tonnes
Tailrace canal	
Concrete part – Bottom width	51.5 m
Concrete part – Length	23 m
Concrete part – Upslope (upstream-downstream)	2.5 H / 1 V
Part excavated in rock – Bottom width	~70 m (river bed width)
Part excavated in rock – Length	300 m
Part excavated in rock – maximum over-excavation depth	~3 m
Switchyard and connecting transmission lines (225 kV)	
Connecting transmission line length (from powerhouse)	200 m
Switchyard area	70 x 80 m
Switchyard platform level	27 NGG
Existing road diversion	
Road near powerhouse - Length	600 m
Road near powerhouse - Gradient	9.2%
Road near powerhouse – Pavement	Concrete (steep slope)

1.2.4. Analysis of alternatives

Different project configurations were considered during design studies before opting for the solution retained and previously presented. These configurations are as follows:

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

- **Zero project alternative:** this is the reference situation involving no project execution, i.e. the environment would continue to evolve in the way in which it is evolving today. The river would not be disturbed and high and low water conditions would continue to alternate at the same rhythm. If the project is not executed, the forest areas in the Monts de Cristal buffer zone would not be reduced by a water reservoir and would be generally preserved from increased usage of timber products thanks to the country's clear-cut commitment to conserving its natural environment. Finally, the energy sector is characterized by a strong dependence on imports associated with vastly under-exploited hydroelectric power. Hence, without the Kinguéle development, Gabon will remain in a situation of under-production with ever greater consequences on (i), energy security (more frequent power cuts) and (ii), the overall kWh price through more intense usage of thermal power plants.
- **Energy sector alternative:** three sectors can be envisaged, namely thermal energy, solar energy and wind energy. Building and operating a hydroelectric plant rather than a thermal facility of the same capacity is more advantageous and less impacting in terms of greenhouse gas emission and air quality. With regard to solar energy, the productivity remains much less than that of a hydroelectric dam despite Gabon's sufficient sunshine, and this renders the solar sector uncompetitive with respect to hydroelectric production. Moreover, a solar power project alone is incompatible with a stable, basic energy supply to a national grid that is already well developed. Finally, resorting to a wind power alternative does not appear to be appropriate, again for productivity reasons.
- **Location, installation and environmental optimization alternatives.** The location of the Kinguéle Aval project, downstream of two existing hydropower schemes on the Mbé River (Kinguélé and Tchimbélé, operated by the Gabonese Electricity and Water Company (SEEG)), provides enabling conditions for its development: water management system of upstream projects, existing transmission lines, and the long standing presence of the SEEG with necessary structures for operation and maintenance. In addition, the Kinguéle Aval project maximizes the investments made for the Tchimbélé reservoir and for all access and electricity transmission structures. The project retained ensures other particular characteristics that minimize the environmental and social impacts, more specifically:
 - Land neither occupied nor used by the population
 - Less than 200 m of HV line to be installed (connection to Tchimbélé/Kinguélé power transmission lines, which run past the Kinguéle Aval powerhouse)
 - Less road (km) to be built (project site very near to access road to Kinguéle/Tchimbélé facilities)
 - Site installations on existing industrial wasteland (old quarry operation housing)
 - No quarry to be opened in the project area (limiting noise pollution) and use of an active quarry near the site (contributing to local economic life).
- **Axis position, water level height and design alternative:** Between 2016 and 2017, around 15 alternatives were analyzed according to a set of criteria of profitability, operability and environmental and social risks, in particular the impact on the PNMC. The alternative retained (34 MW, NTWL at 60 m NGG, MWL at 62 m NGG and installation design flow of 90 m³/s) not only optimizes efficiency, but also and above all curtails land take in the National Park (234 ha). Its specific design features also minimize environmental and social impacts, in particular:
 - Reducing volumes of RCC used during the construction significantly lowers the costs of building the structure and of the MWh generation;
 - Minor impacts on the access road. Only few sections of the access road to Kinguéle will be elevated without any major deviation, while options of NTWL at 72 mNGG would require to rebuild several kilometers of roads in the PNMC;
 - Locating the powerhouse at the base of the dam avoids the creation of a short-circuited sections, while other alternatives required a short-circuited section of 1.2 km;
 - Minimum impact in the Monts Cristal National Park: (i) unlike the upstream axis, the downstream axis and the works are not located in the park area and (ii) the reservoir is

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

reduced to 234 Ha (at the NTWL dimension) against 485 to 540 Ha for the alternative with the NTWL 72 mNGG;

Location and design features drastically lower impacts on population and biodiversity to the minimum extent possible.

1.2.5. Project area of influence

Defining the area of influence of the project is an iterative process, starting with a preliminary analysis (the study area) of impacts a priori, to be strengthened by the analysis of the impacts itself that considers the extent of impacts. It is usual for the study area to be much larger than the actual project impact area, especially regarding the social aspects.

1.2.5.1. DIRECT IMPACT AREA

The direct impact zone includes the majority of direct impacts, i.e. those generally caused by the physical impact of the project on its environment.

The footprint areas and their respective surfaces are presented in the figure and the table below.

Areas affected by project component

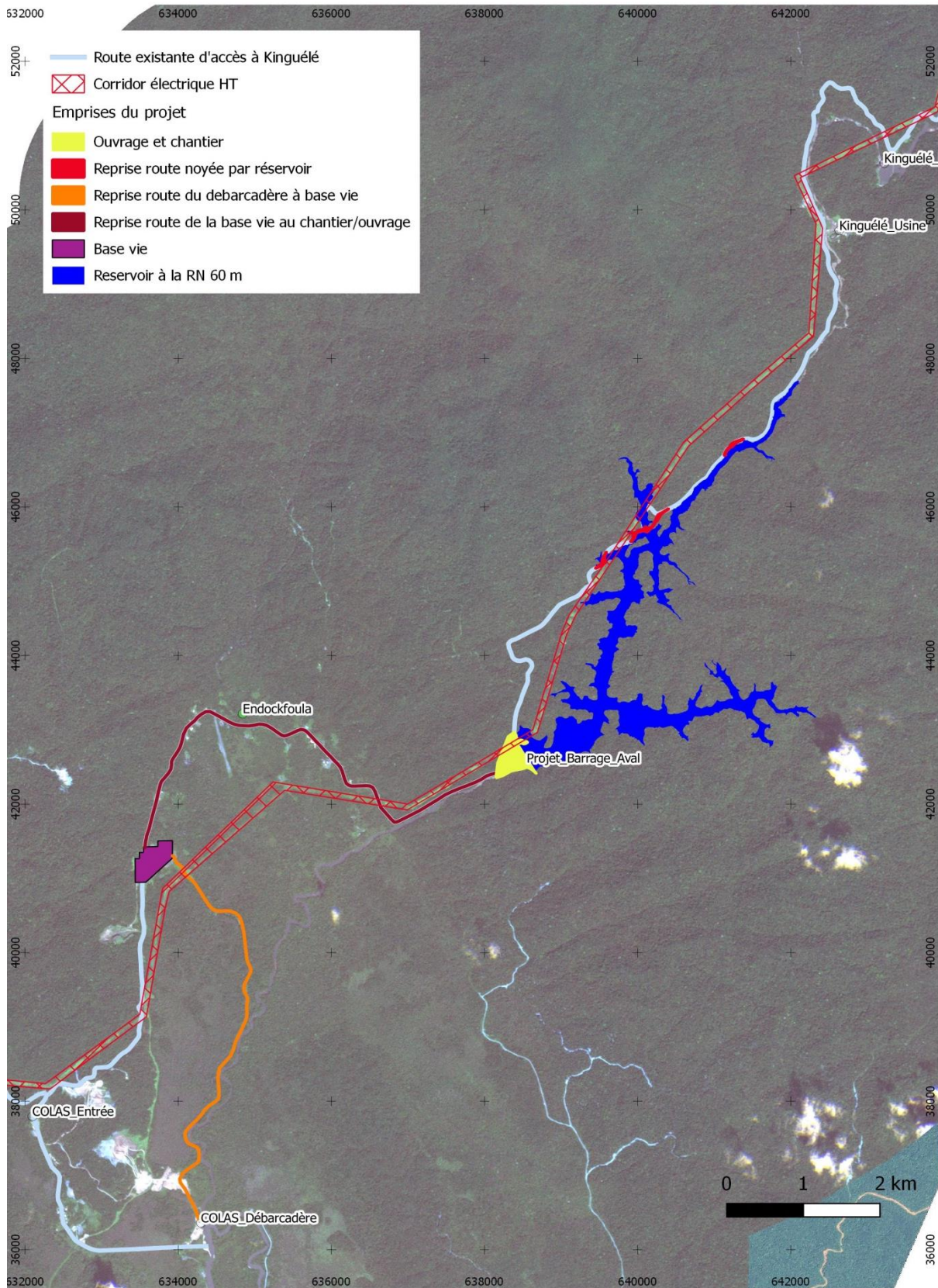
PROJECT COMPONENTS	AREA (HA)
The Footprint of structures represents 7 ha of the site area <i>The project footprint includes the dam, the water intake device, the power lines, the turbine and alternator plant, the restitution channel and the technical annexes (transformers, control rooms, wheels of 'access...)</i>	18.2
Reservoir at NTWL 60 NGG (excluding road recovery)	231.3
Road from the base camp to the facilities and construction site. This existing road will be improved for transportation to site	10.2
Road from the base camp to the dock. This existing road will be improved to support the transit of elements transported by the river.	8.9
Base camp on the former SOCO BTP area (approximate surface)	17.9
Resumption in zone 1 of the road work from the construction area towards the site of Kinguélé (operating city of the SEEG). Existing section of road embedded in the reservoir.	0.7
Resumption in zone 2 of the road work from the construction towards the Kinguélé site (SEEG operating city). Existing section of road embedded in the reservoir.	1.7
Resumption in zone 3 of the road work from the construction towards the Kinguélé site (SEEG operating city). Existing section of road embedded in the reservoir.	0.8
Total	289.7

The footprint of facilities and directly affected areas represents over 290 ha, mostly forest areas.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Mapping of direct impact areas

1.2.5.2. EXTENDED IMPACT ZONE

The extended impact zone, as opposed to the direct impact zone, includes a set of zones in which the project can have potential impacts. It includes:

- Downstream area. In the downstream portion of the river (Mbé / Komo), the variation of liquid and solid flows can have indirect effects on natural environment (mainly banks and associated stands) and human environment (mainly water usage including fishery and safety). Impacts could go up to the mouth of the river, however analysis have shown that they should not spread further than the h, but analysis has shown that it is limited to the confluence between Mbé and Komo rivers.
- Upstream area. Project impacts could be felt upstream as dam represents a physical obstacle inducing an ecological discontinuity that could affect the upper part of the watershed. The Tchimbélé dam can be considered as the upstream limit of the influence potential of the project. However, the impact analysis has shown no impacts on physical and human environments upstream.
- Enlarged areas around fixed footprints (facilities) can induce effects varying distance from a few hundreds meters (noise, dust, wildlife) to few kilometers (demographic influx, inflation and other features of human environnement).

1.3. ENVIRONMENTAL AND SOCIAL BASELINE

1.3.1. Physical environment

Climate

The climate is equatorial, in other words hot and damp. Temperatures vary little throughout the year and there are alternating dry and rainy seasons; during the latter, rainfall is abundant and represents the determining climatic factor for human activities. A short rainy season (February - May) is distinguished from a long rainy season (September - December), similarly a short dry season (December - January) is distinguished from a long dry season (June - August).

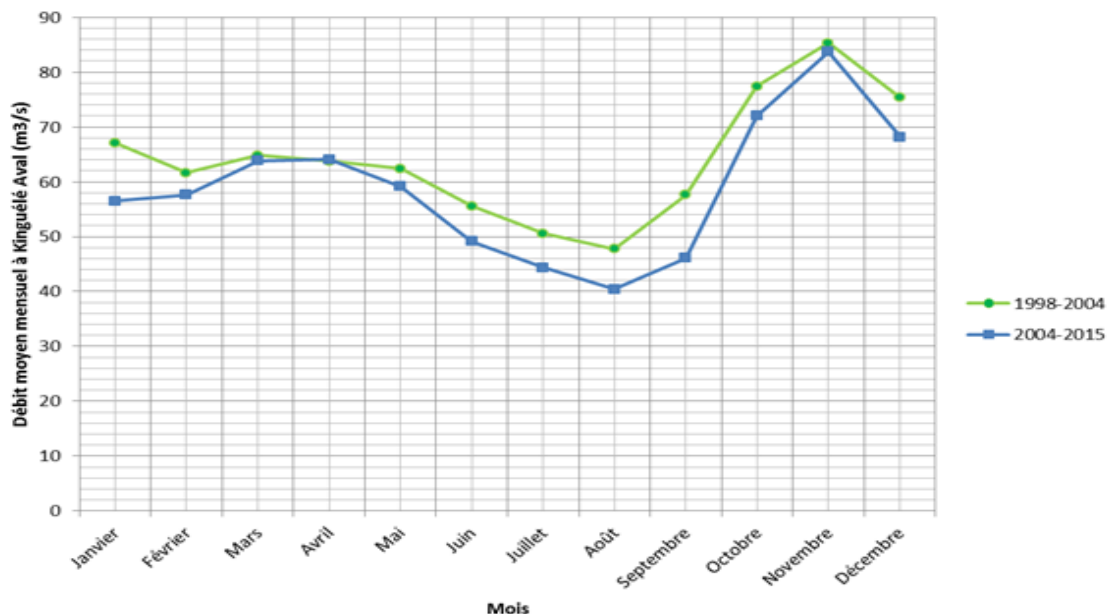
Hydrology

The region's dual seasonality embraces a period of major hydrological contributions and floods (October - December) and a period of more limited contributions (March - May). Low water conditions are very pronounced from July to September during the long dry season (cf. figure of next page).

The currently observed water contributions at the Kingulé Aval dam site are strongly influenced by the two dams located upstream. The Tchimbélé dam effectively reduces contributions to the Kingulé Aval site during the rainy season and allows them to be increased during the dry season. The Kingulé dam operates under daily hydropeaking with varying flows, which depend on the releases from Tchimbélé. The presence of the two upstream dams also produces a certain smoothing of the peak floods.

The study by ISL estimates the interannual flow rate at the Kingulé Aval site to be 61 m³/s.

- The 1998-2004 period was marked by high runoff involving very high annual contributions (64.1 m³/s average). 2002 was the wettest year with an average annual inflow of 71.0 m³/s. 2004 was the driest year with an average annual inflow of 59.6 m³/s.
- The 2004-2015 period was marked by a lower runoff with an interannual average inflow of 58.7 m³/s, which represents an 8% reduction in annual contributions with respect to the preceding period. 2009 was the wettest year with an average annual flow of 66.0 m³/s and 2005 was the driest year with an average annual flow of 49.3 m³/s.



Seasonal variability of contributions based on hydraulicity

The classified flow curves allow characterization of the daily variability of contributions based on their average probability of not being exceeded during a year.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Classified inflows at the Kingulé Aval site (1998-2015)

EXCEEDING FREQUENCY (%)	10	20	30	40	50	60	70	80	90
Inflow (m ³ /s)	77.1	71.8	69.3	67.9	60.3	54	52.3	42.5	37.2

Source: EDF

During a study conducted by ISL, the low water flows were estimated at the Kingulé Aval dam site based on data recorded after commissioning of the Tchimbélé dam:

- The monthly low water flow (QMNA) was estimated at 41.9 m³/s
- The minimum monthly flow with a 1/5 probability of not being exceeded for a given year (QMNA5) was estimated at 36.2 m³/s.

Hence, it can be seen that the annual daily minimum flows vary between 21.1 m³/s (2005) and 37 m³/s. This "brutal" variation from one year to another can be explained by the method of operating the Tchimbélé and Kingulé facilities. With its installation design flow, Kingulé operates under daily hydropeaking between 20 and 60 m³/s. The maximum flow is used, if a large quantity of water is available and the reserves at Tchimbélé permit its usage. Operation of both Tchimbélé and Kingulé conditions the flow observed at the Kingulé Aval site.

Only the flow released at Tchimbélé (20 m³/s) effectively ensures a supply of water to the Kingulé Aval site during extreme droughts. It should be noted that, based on the classified inflow curve, this drought situation occurs less than 2% of the time on an annual scale.

The average value of the annual daily flows at the Kingulé Aval site is estimated at 25.1 m³/s for the 1998-2015 period.

Geology, soil and water quality

A geological fault explains the straightness of the River Mbé, but the seismic risk is considered low (similar to Zone 1 on the seismic zoning map of France).

In general, the area's geological materials tend to be of ferralitic-type composition due to its equatorial climate. These materials are of low chemical richness but their physical properties are acceptable, when their clay contents are sufficiently high. They have a low permeability and a good stability, specifically reinforced by the presence of dense forest cover throughout the whole catchment area.

There is little human activity in this area, most of which forms part of the Monts de Cristal National Park. The only industrial activities recorded are the Kingulé and Tchimbélé hydroelectric schemes; there are therefore relatively few pollution and erosion sources in the catchment area.

The quality of the River Mbé water is typical of a tropical river in a forest environment, flowing on granitic bedrock and little or not impacted by human activity. Its characteristics include a dark color characteristic of its humic compounds, a slightly acid pH, very low mineralization and nutrient (N and P) concentrations and no trace of bio-cumulable metal pollution.

Hydrosedimentary context

Sediment contributions at the project site mainly depend on those that can pass the Kingulé dam, itself probably mainly supplied by only 600 km² of catchment between Kingulé and Tchimbélé because the latter traps a large quantity of the sediments from upstream. Despite this, there is little silting up of the Tchimbélé reservoir, while the Kingulé reservoir is extensively silted up by mainly fine sediments. Moreover, the presence of the bedrock prevents or limits greatly the erosion processes. Conveyance of large and coarse solids appears modest and the streambed is mainly composed of large blocks and outcrops.

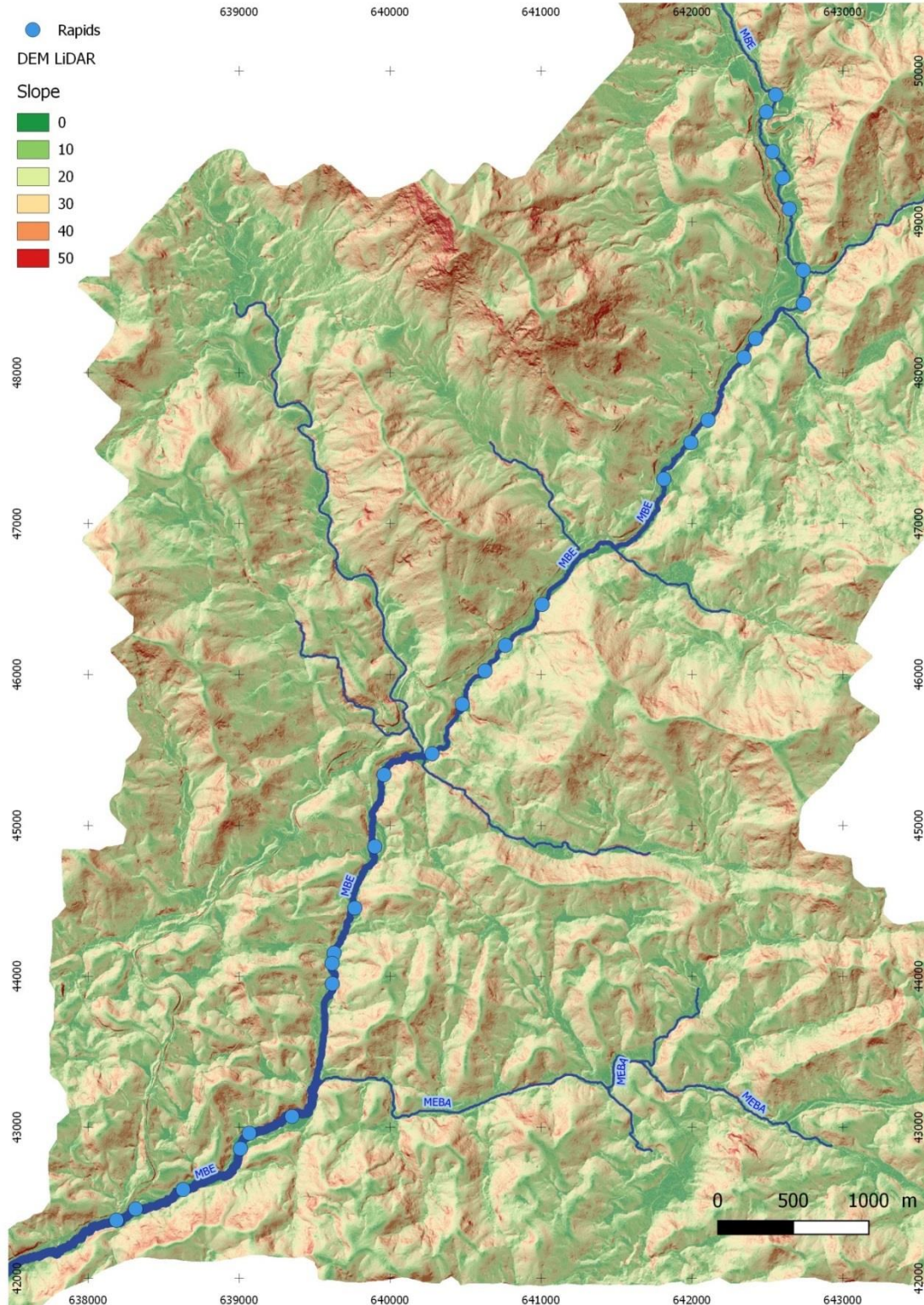
Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Topography

Downstream of the Kingulé Falls as far as Andock Foula (15 km), the River Mbé's steep gradient is punctuated by 20 or so rapids, each featuring a 1 - 5 m difference in level. This is the most steep-sided part of the valley and is at the origin of the project's hydro-energy potential (see map below).



Rapids between the project site and Kingulé

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Existing Tchimbélé and Kingulé installations

The two hydroelectric developments at Tchimbélé and Kingulé, respectively 50 and 10 km upstream of the project on the Mbé river, supply the Libreville electricity network with installed capacities of 68.4 MW and 57.6 MW respectively.

- Tchimbélé has the largest storage capacity with an initial total volume of 247 hm³
- Kingulé has a much smaller reservoir (0.45 hm³) without storage during the year, but the flows are regulated by the Tchimbélé dam located upstream.



Lake and Tchimbélé powerhouse (SEEG)

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Above: the three Kingulé power lines (3 x 20 m³ / s), below, Kingulé dam
Kinguélé plant and dam (SEEG)

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

The visit to the SEEG facilities provided a better understanding of the current arrangements for managing the Mbé water. The Tchimbélé dam regulates the flows downstream according to two temporalities:

- A seasonal temporality, the objective being to reach a maximum volume at the end of the rainy season towards the end of December and at the warning level of the low level of the reservoir at the end of the dry season towards the beginning of September.
- A daily time, more or less on demand depending on needs and peak hours. For this, 1 to 3 Francis turbines of 24 m³ / s are / are in operation, ie a flow between 24 and 72 m³ / s.

1.3.2. Natural environment

Biodiversity in the project and throughout this study has been taken into account by implementing the methodology provided by the International Finance Corporation's Performance Standard 6 (NP6). This methodology specifically sets out to identify possible "critical habitats" affected by the project and to then design suitable measures for guaranteeing a net conservation of biodiversity and even for generating a net increase in it during the life of the project by applying an alleviation hierarchy.

In this connection, a series of bibliographical studies and field surveys were therefore conducted during 2017 and early 2018 by Gabonese fauna and flora specialists. This work was coordinated by BIOTOPE Afrique Centrale, a company based in Libreville. The table below presents the work teams involved.

Work team and experts involved

TOPIC OR GROUP STUDIED	TEAMS INVOLVED
Terrestrial and aquatic flora	CENAREST / "Herbier National du Gabon" Gabonese team Missouri Botanical Garden (MBG) international team
Forest expert study	SYLVAFRICA Gabonese team
Fish	CENAREST / IRAF / "Laboratoire d'Hydrobiologie et d'Ichtyologie (LHI)" Gabonese team Expert study coordinated by AIMARA association attached to the Paris Natural History Museum
Amphibians	Expert study conducted by BIOTOPE Afrique Centrale
Birds	Expert study conducted by an independent Gabonese ornithologist
Mammals (meso-mammals and large fauna)	Expert study conducted by BIOTOPE Afrique Centrale
Other groups	Expert study conducted by BIOTOPE Afrique Centrale

The Kingulé Aval project involves the Mbé sector and part of the buffer zone of the Monts de Cristal National Park. The Agence Nationale des Parcs Nationaux (Gabonese national parks agency) is responsible for managing this park in line with its 2016 -2020 management plan.

The Monts de Cristal form a unique group of dense evergreen forests within the Atlantic forests of Central Africa. Depending on rainfall, altitude and exposure to winds from the Atlantic, these forests vary over short distances because of the fractured and often steep relief. Today, the Monts de Cristal forests are the dampest forests in Gabon. This ancient situation has made them a refuge for fauna and flora during the cool, dry climatic periods, which have occurred throughout the last 2 million years and have encouraged development of a very rich variety of flora and entomology (insects) with a high level of endemism for these groups. These characteristics and their official recognition both nationally and internationally make the Monts de Cristal National Park a critical habitat as defined by IFC Performance Standard 6.

With regard to biodiversity, the project study area extends beyond the land take of the dam site and its reservoir lake to a peripheral distance of 500 m and includes a variety of typical Monts de Cristal environments. Natural habitats dominate this study area.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

The very dense hydrographic network extends around not only the River Mbé, a torrential river and major affluent of the River Komo, but also its main tributaries, the Sobéa and Missola rivers on the right bank and the Méba river on the left bank, which are all fed by a multitude of forest streams. The hydraulic regime and the hydromorphological characteristics of the network are considered as still being mainly natural despite the existence of two dams upstream.

A mosaic of natural aquatic, humid, herbaceous, shrubby and forest habitats continues to develop within and along the edge of these watercourses.

The terrestrial natural habitats occupy a major part of the study area. They comprise two distinguishable types of terra firma forest: one on hillsides and the other on ridges.

The villages and their surroundings, including a few extensive agriculture sectors, dirt roads, some disused quarries and the herbaceous vegetation regularly maintained along the transmission line that crosses the study area, represent the occasional altered habitats observed.

The table below provides a summary of the existing habitats and the associated fauna and flora species, which prompt the critical habitat.

Habitats in the project area and associated species prompting a critical habitat

HABITAT	FLORA SPECIES AT ORIGIN OF CRITICAL HABITAT	FAUNA SPECIES AT ORIGIN OF CRITICAL HABITAT
AQUATIC AND RIPARIAN HABITATS		
Wide torrential river (Mbé)	(no species directly linked to this habitat)	Fish <ul style="list-style-type: none"> • <i>Brachypetersius gabonensis</i> • <i>Chromidotilapia regani</i> • <i>Grasseichthys gabonensis</i> • <i>Plataplochilus sp. nov.</i> Reptiles <ul style="list-style-type: none"> • Slender-snouted crocodile (<i>Mecistops cataphractus</i>)
Intermediate torrential rivers (main affluents)		Fish <ul style="list-style-type: none"> • <i>Brachypetersius gabonensis</i> • <i>Chromidotilapia regani</i> • <i>Plataplochilus sp. nov.</i> Amphibians <ul style="list-style-type: none"> • Efulen water frog (<i>Petropedetes palmipes</i>)
Sub-forest streams		Fish <ul style="list-style-type: none"> • <i>Brachypetersius gabonensis</i> • <i>Plataplochilus sp. nov.</i> Amphibians <ul style="list-style-type: none"> • Stévar's egg frog (<i>Leptodactylodon stevarti</i>)
Rapids supporting Podostemaceae	3 species of Podostemaceae: <ul style="list-style-type: none"> • <i>Ledermanniella sanagaensis</i> • <i>L. letestui</i> • <i>L. linearifolia</i>. 	(no species directly linked to this habitat)
Meadows supporting <i>Anubias barteri</i>	(no species directly linked to this habitat)	
Rocky flooding riverbanks		
Marshy shallows supporting <i>Nelsonia smithii</i>	3 species: <ul style="list-style-type: none"> • <i>Phyllobotryon sp. nov.</i> • <i>Thaumatococcus flavus</i> • <i>Veyretella hetaerioides</i>. 	
Swampland supporting <i>Halopegia azurea</i>	(no species)	

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

HABITAT	FLORA SPECIES AT ORIGIN OF CRITICAL HABITAT	FAUNA SPECIES AT ORIGIN OF CRITICAL HABITAT
Riparian forests	3 species: <ul style="list-style-type: none"> • <i>Phyllobotryon sp. nov.</i> • <i>Palisota cristalensis sp. nov. ined.</i> • <i>Pauridiantha longistipula.</i> 	Forest butterflies <ul style="list-style-type: none"> • <i>Charaxes basquini</i> • <i>Bebearia faraveli</i> • <i>Euphaedra abri</i> Amphibians <ul style="list-style-type: none"> • Stévar't's egg frog (<i>Leptodactylodon stewarti</i>) • Efulen water frog (<i>Petropedetes palmipes</i>)
TERRESTRIAL HABITATS		
Forests on Monts de Cristal ridges	1 species: <i>Sirdavidia solananna</i>	Forest butterflies <ul style="list-style-type: none"> • <i>Charaxes basquini</i> • <i>Bebearia faraveli</i> • <i>Euphaedra abri</i> Reptiles <ul style="list-style-type: none"> • Forest hinge-back tortoise (<i>Kinixys erosa</i>) Birds <ul style="list-style-type: none"> • African grey parrot (<i>Psittacus erithacus</i>) Mammals <ul style="list-style-type: none"> • African forest elephant (<i>Loxodonta cyclotis</i>)
Forests on hillsides	2 species: <ul style="list-style-type: none"> • <i>Campylospermum klainei</i> • <i>Palisota cristalensis sp. nov. ined.</i> 	

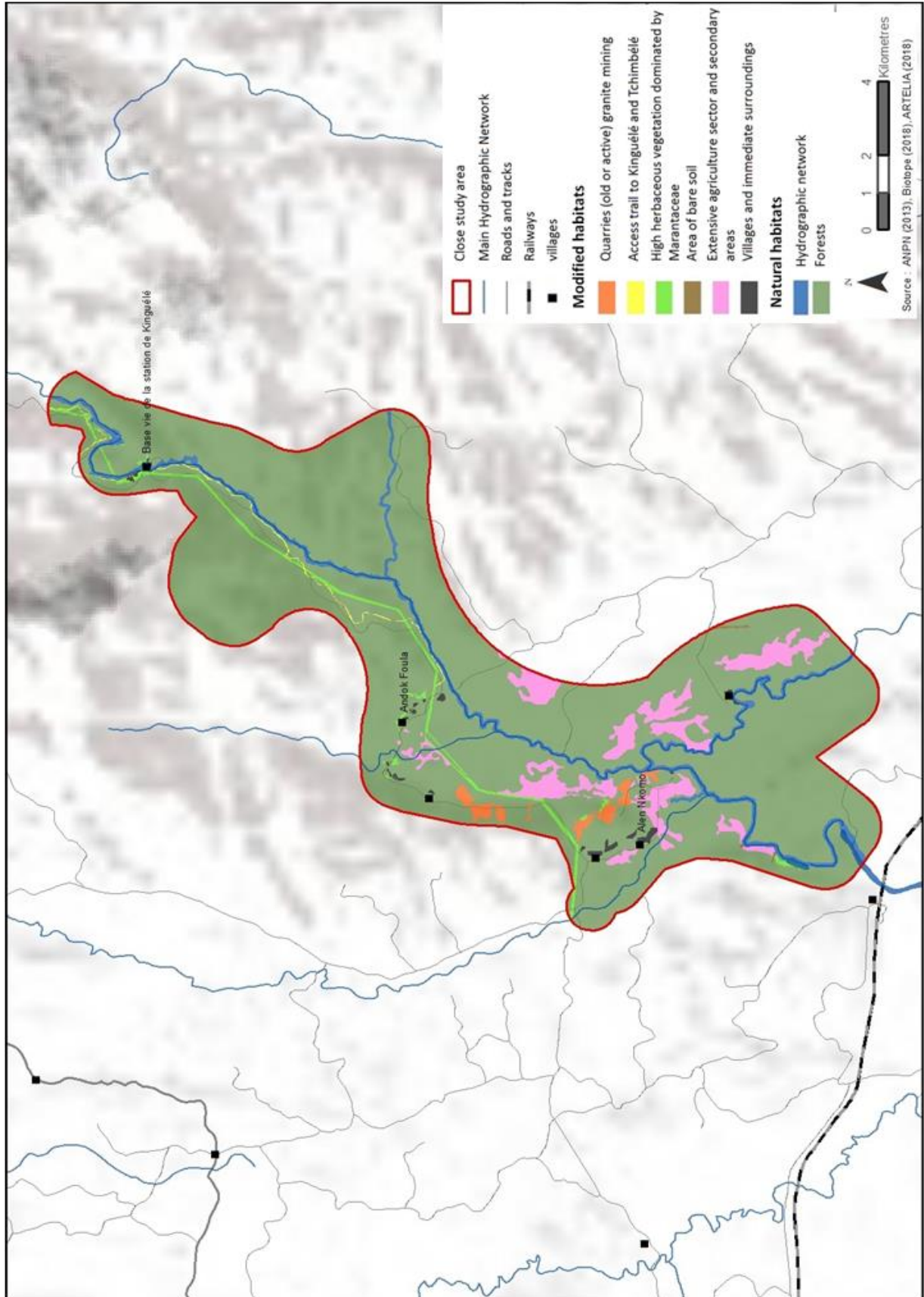


View of River Mbé and riparian forests in study area

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

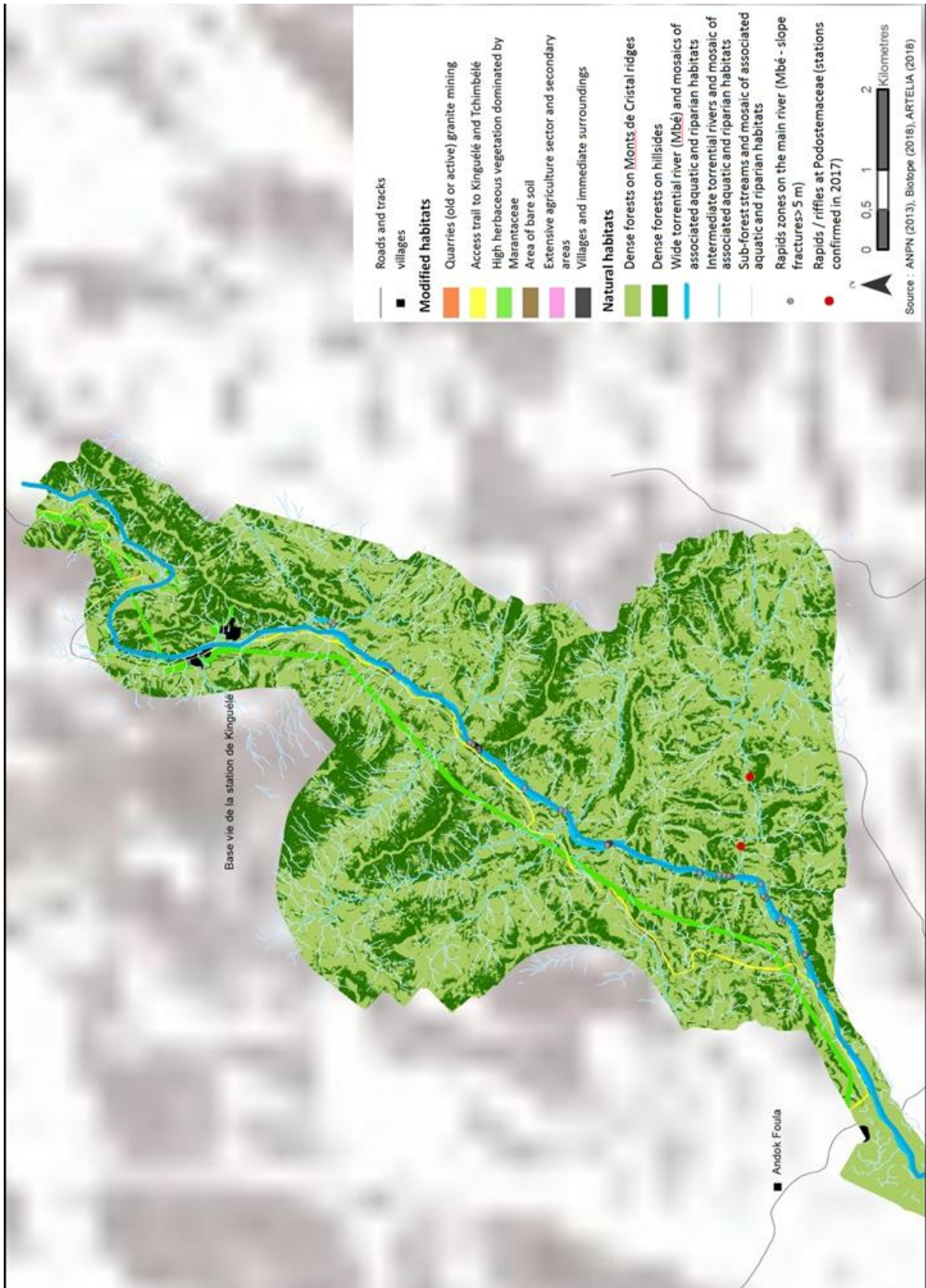


Map of habitats in close study area

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



More detailed map of habitat coverage in close study area

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

The flora and vegetation field surveys conducted within the scope of three field assignments (June, July and October 2017), which complemented an in-depth bibliographical analysis, conclude the presence of 10 plant species prompting a critical habitat in the study area due to their threat and/or endemism statuses. Three of them are aquatic; they belong to the Podostemaceae family (*Ledermanniella* genus) and grow on rocks in rapids. The other species are found in damp areas along watercourses and/or forest environments.



The ellipses show the locations of two different species
Intermediate river rapids and rock slabs supporting Podostemaceae in the River Méba



A Podostemaceae: genus *Ledermanniella*

With regard to the fauna, all groups were subjected to an initial detailed bibliographical analysis aimed at listing the species present. Four complementary field assignments were then conducted: two focusing on

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

fish (September 2017 and January 2018), one on amphibians (October 2017) and one combining expert surveys of large fauna and birds (December 2017).

The results of these operations reveal 4 butterfly , 4 fish , 2 amphibian (endemic frogs), 2 reptile (forest hinge-back tortoise and slender-snouted crocodile), 1 bird (African grey parrot) and 1 mammal (African forest elephant) species that prompt a critical habitat in the study area.



Coll. E. Vingerhoedt

Charaxes basquini, butterfly endemic to Gabon (male upper and lower sides)© <http://www.charaxes.be>



Fish *Brachypetersius gabonensis* © Y. Fermon



Fish *Chromidotilapia regani* © A. Lamboj

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Fish *Plataplochilus* sp. nov. © L. Chirio



Stévant's egg frog on the left, Efulen water frog on the right © M. Dewynter / Biotope



Forest hinge-back tortoise (*Kinixys erosa*) © P. Martin

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Slender-snouted crocodile © V. Prié / BIOTOPE



African grey parrot (Perroquet jaco) © Wikipedia



Family group of African forest elephants

1.3.3. Human environment

The study area is located administratively in the 3rd canton, Engong, which lies within Komo (Kango) Department of Gabon's Estuaire Province. It lies in the heartland and buffer zone of the Monts de Cristal National Park. The population density is low in this area.

The area of direct impact involves the sites specific to the project, which are directly affected by the hydroelectric scheme. These are the village of Andock Foula and the adjacent upstream and downstream areas as far as Atak landing (Alen Komo village), the River Mbé and the surroundings of Monts de Cristal National Park, where the reservoir is located.

The area of indirect impact includes villages, organizations and places that are influenced more indirectly by the scheme as illustrated by the first figure on the next page.

The area is accessible by navigation on the River Komo as far as Atak landing and, to a lesser extent, on the River Mbei by dug-out canoe, by train operated by SETRAG and by the Kango-Kougouleu Departmental road followed by an open section, maintained by SEEG to ensure upkeep of Kingulé and Tchimbélé dams. Traffic conditions are difficult during rainy seasons.

There are few public infrastructures in the project area:

- Virtually inexistent telecommunications
- No centralized power supply
- One school at Alen Komo
- One infirmary at the Colas housing area and a healthcare center far away at Kango
- No access to biologically safe drinking water in the villages and only at the SEEG and COLAS housing areas
- Landings at Andock Foula and Alen Komo.

The predominant economic activity in the area is slash-and-burn subsistence agriculture followed by fishing, forestry, hunting, food gathering and extremely limited commercial activity. In particular, forest products are extensively gathered by women and hunted by men. River fishing is undertaken by men (see 2nd map of areas on next page) and by women by trapping in small tributaries. Farming is undertaken in the immediate vicinity of villages but is limited by incursions of elephants, land occupation by the Monts de Cristal National Park, economic operators and a lack of marketable opportunities. The map below summarizes the land use in the project area.

A few major operators are established in the area:

- COLAS and Wally BTP, quarrying granite
- HUA JIA, BSG and SEEF, exploiting the forest and processing timber
- SEEG generating power at Kingulé and Tchimbélé dams
- Monts de Cristal National Park authority operating the national park.

Furthermore, there is a small-scale gold prospecting activity in two villages between Kingulé and Tchimbélé.

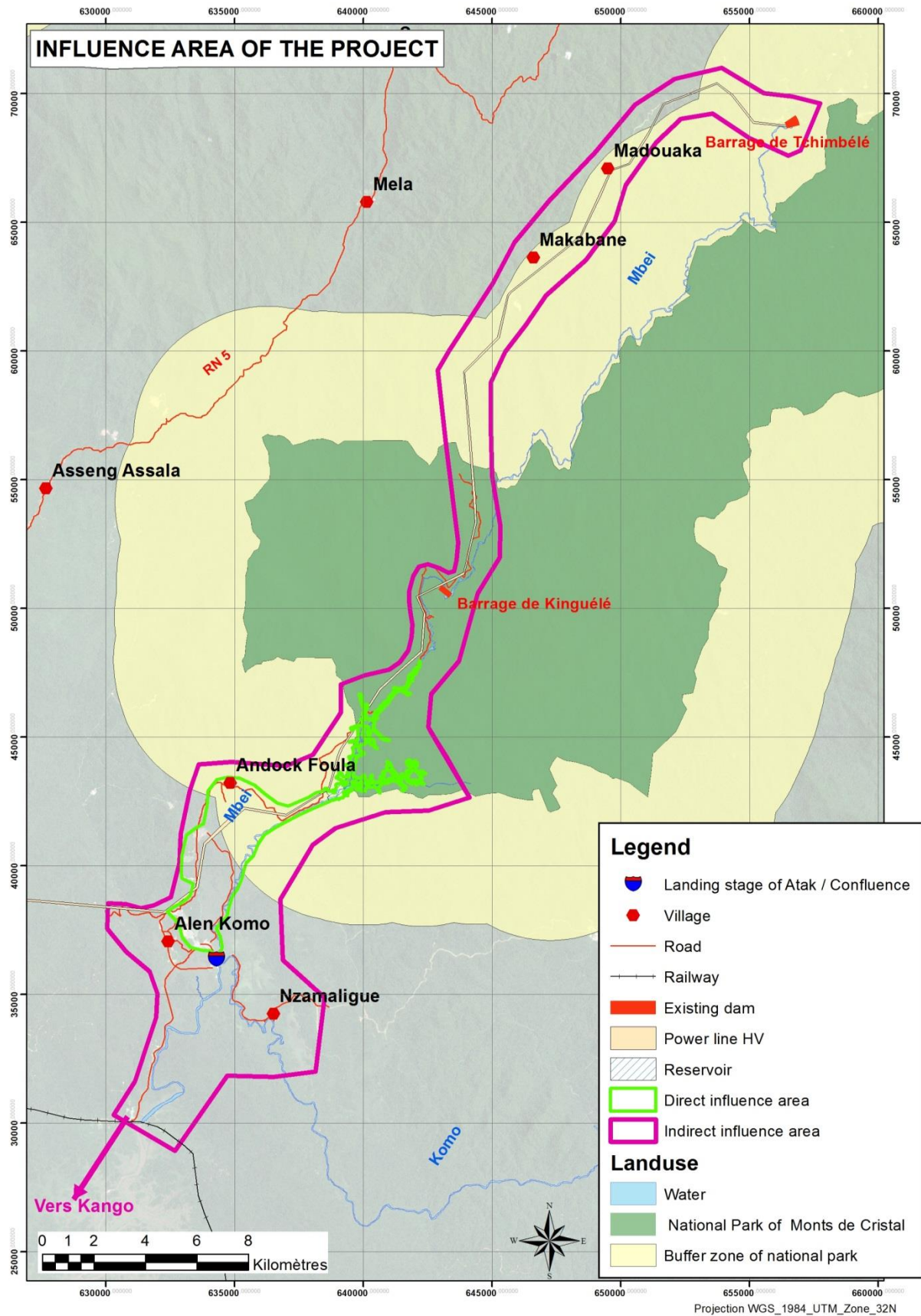
Most residents of the area of impact belong to Fang ethnic clans. They are often both Christian and animist. Traditional Fang ceremonies are performed and must be taken into account prior to starting works.

With regard to archeology, 14 sites of ancient human presence were revealed by carved stone artefacts in the form of small flint fragments (8 sites) and charcoal deposits, which appeared in auger holes at different levels (6 sites) during ground investigations. These sites span a period of 8000 years; only one is directly affected by construction.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

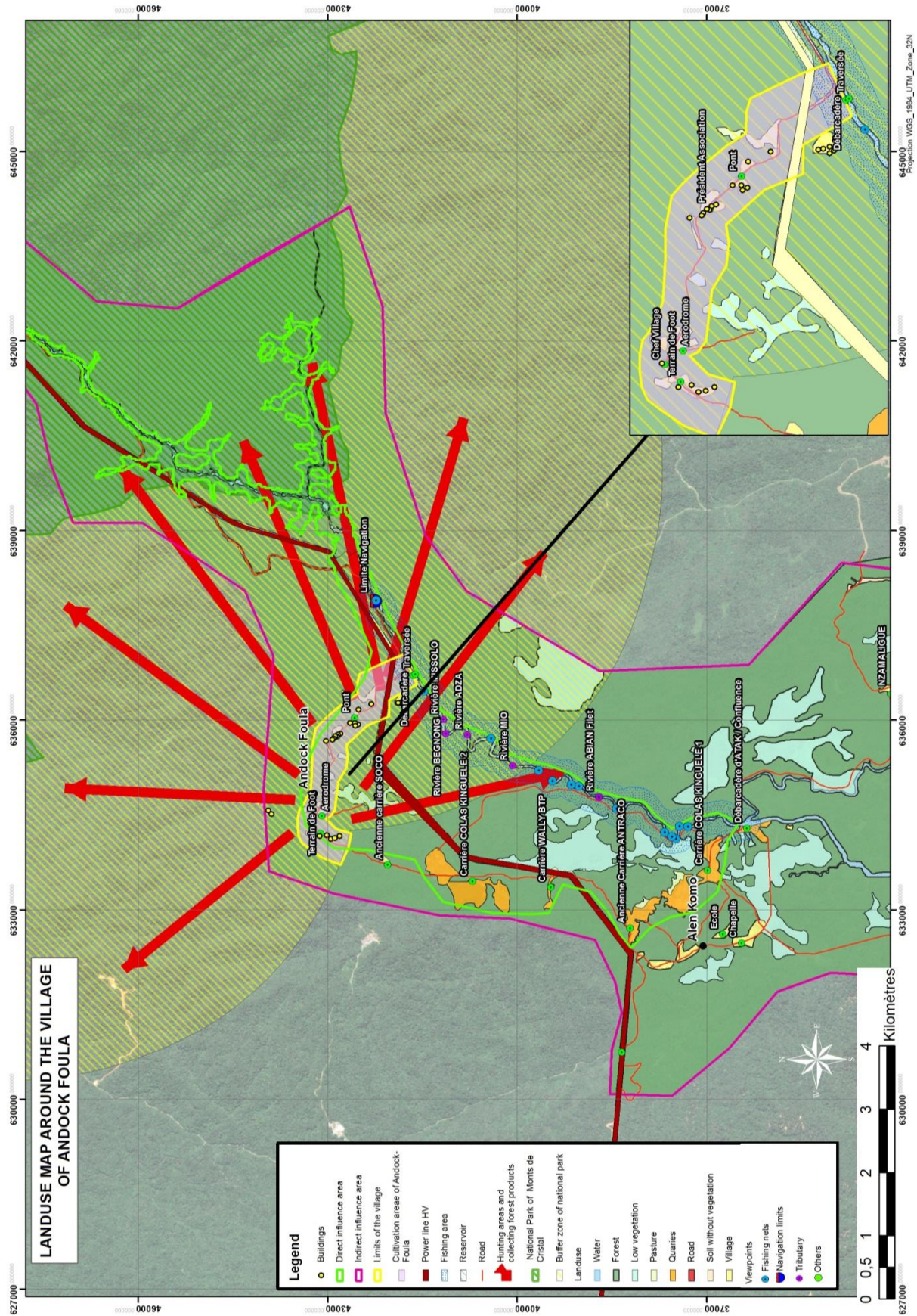


Note : After impact analysis, it was observed that the upstream area was not influenced by project social impacts
Project area of impact from a social effect standpoint

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Map of land and water use around Andock Foula

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

In 2017, there were 17 lineages embracing a total of 372 members and living descendants. However, $\frac{3}{4}$ of houses were unoccupied since virtually all the members of these lineages resided in towns and only came to the village for occasional local events. Only 34 people currently live in Andock Foula; $\frac{1}{3}$ of them are elderly. Many, former residents conserve strong ties with the village and are likely to return, if opportunities arise. During school holidays, these former residents gravitate towards their old village with their children and this increases the number of people present. Historically, village size in the area of indirect impact (Andock Foula, Alen Komo, Makabane, Madouacka, Atak and Nzamaligue) has varied widely depending on the surrounding locations of economic activity, especially quarries.

Human development, within the meaning of the United Nations' Human Development Index (HDI), is low in the area: populations without access to water, healthcare, in a context of malaria prevalence, essentially subsistence economy, major rural exodus factor, high dependence on natural resources including for food, lack of communication (telecom, accessible transport systems) and commercial opportunities, etc.

Most dwellings in the area are timber, sometimes built on a concrete ground slab. Roofs are corrugated iron. A few houses are built in brick or concrete.

All the villages in the area suffer from acute desertification due to mass rural exodus of working age people seeking employment. As a result, the resident populations are aging.

Despite the presence of economic operators and the Monts de Cristal National park, very few village residents in the project area are employed and the inhabitants do not benefit from any significant returns. Moreover, customary activities (hunting, fishing, gathering, forestry) are restricted by the Monts de Cristal National Park. This situation featuring isolation, lack of opportunities and rural exodus is at the origin of a gradual abandonment of villages by inhabitants and public services.

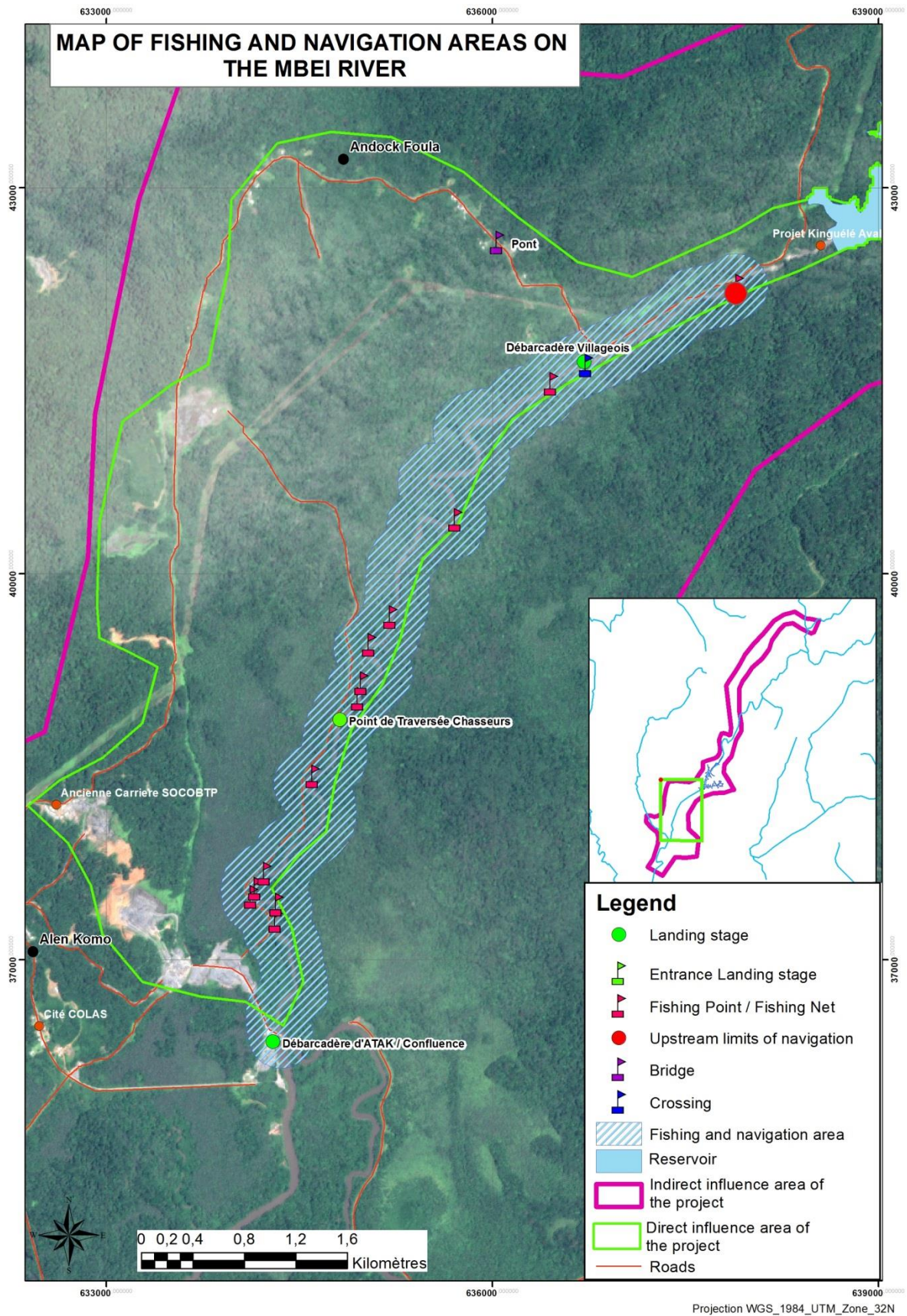
However, numerous development opportunities do exist in the area:

- There is a consensus among political and economic players and the inhabitants regarding the degraded situation in Komo Department and especially in its 3rd canton. Very major needs are recognised in terms of employment, healthcare, education, transport, power, drinking water, technical support and skills development.
- All the economic players are confronted by the same problems. They are open to dialogue and action and they sometimes implement social responsibility-based actions themselves. Efficiency gains could be achieved through dialogue and mutualization of actions.
- There is a potential for marketing farm and non-timber forest products, which could be processed and conveyed to urban centers. Processing of fishery products could also be developed as well as tourism in the Monts de Cristal National Park.
- There is major labor recruitment potential for not only low-skilled tasks, but also more skilled work. Many villagers have been trained in town and could return to their villages to take advantage of these opportunities.
- Construction of the Kingulé Aval facility will provide business opening for villagers in the project area, especially in the supply of farm products. In general, the village of Andock Foula will be dynamized by the project. In infrastructure terms, the road between Alen Komo and Andock Foula will benefit from the location of the Kingulé Aval facility.
- There are major opportunities for the existing rural power supply network. In addition to the villages, economic operators (Colas Gabon, Walli BTP, etc.) may be interested in the new source of electrical energy.
- Some groups, such as village women, are ready to organize themselves collectively, if they are provided with an opportunity.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Map of fishing and navigation areas on the River Mbé

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

In conclusion, within the scope of a hydroelectric scheme development, the human issues are generally few with regard to the great distance of the project site from the closest dwellings and to the small population potentially impacted by the project. However, the many social issues to be considered in relation to the project are:

- The presence of the Monts de Cristal National Park near the project site and the specific local governance resulting from this
- Forest usages around Andock Foula (hunting, gathering)
- River Mbé usages (fishing, navigation, crossing) and hydraulic safety
- The presence of Andock Foula village in relation to site and project main camp management
- Management of project land takes
- Area isolation, lack of education and healthcare infrastructures capable of treating the sick or evacuating the injured, presence of waterborne tropical diseases (malaria, bilharzia, etc.), epidemics (HIV AIDS, etc.) and high accident rate
- Very significant local needs and expectations in terms of development (employment, business opportunities, electrification, infrastructures, skills development, etc.)
- Social acceptability of the project
- Special attention to customs, traditions and rituals of local populations.

1.4. INSTITUTIONAL AND LEGAL CONTEXT

1.4.1. Institutional framework

The Ministry of Forests and the Environment is the competent authority in the development and application of government policies on water, forests, wildlife and protected areas. The General Direction of Environment and Protection of Nature (DGEPN) is in charge of implementing the Gabonese government's policies on the environment protection.

The following institutions are also on environment management and protection:

- The National Agency for the Preservation of Nature (ANPN), created in 2017 to the protection of all protected areas and of their natural resources in Gabon. The ANPN is also active in the management of human-wildlife conflicts.
- The National Climate Council (CNC), created in 2009, in charge of developing and guiding national policies on climate change.
- The Institute for Research in Tropical Ecology (IRET), a Gabonese public research body whose activities are entirely devoted to the study of the biodiversity of Gabonese forests.
- The institutions related to water and energy management are the following:
 - The Ministry of Water and Energy: competent authority in charge of implementing national policies on energy management. It supervises the following entities:
 - General Direction of Energy
 - General Direction of Hydraulic Resources (DGERH)
 - The Regulatory Agency for Drinking Water and Electric Power Sector (ARSEE): in charge of the regulation of the drinking water and electric power sector.
 - The National Council for Water and Electricity (CNEE): ensures in the name and on behalf of the State, the execution of the public service linked to the management of the water and public lighting networks.

- The Energy and Water Company of Gabon (SEEG), manages the distribution of water and electricity in Gabon.

In the project context, social refers to labor, human, and health and social protection rights. These components are under the responsibility of various ministries, namely:

- The Ministry of Health, in charge of implementing the national policies on health and risk prevention.
- The Ministry of Justice, Keeper of the Seals, in charge of policies related to Human Rights.
- The Ministry of Social Protection and National Solidarity, which draws up public policies related to social welfare for workers, families and vulnerable individuals (widow, orphan...).
- The Ministry of Labor, Employment and Youth, responsible for the implementation of national policies on employment and training.

Other institutions dedicated to infrastructure and transport, in the land and cultural fields could also be involved in the project.

1.4.2. Legal framework for ESIA's

The articles 30 and 31 of the Environment Code (CE), established by the Law No. 007/2014 of August 1, 2014 related to the protection of the environment in the Gabonese Republic, refer to impact assessments. In addition, Article 32 states that impact assessments must identify, assess and implement measures aiming at eliminating, reducing or compensating negative impacts in the short, medium and long term. The obligation to carry out an ESIA is stated within the provisions of decree 539 / PR / MEFPEPN of July 15, 2005 regulating environmental impacts studies. This decree identifies projects which are subject to compulsory impact study. Seventeen types of works are covered by its article 3, including "activities relating to the energy sector, in particular [...] large power hydroelectric plants».

The Kingulé Aval project therefore requires an impact study. It also takes into account other laws related to the following topics:

- Waste emissions and discharges: Decree No. 000541 of July 15, 2005 on waste management and Decree No. 000542 of July 15, 2005 regulating the discharge of certain products in surface waters.
- Classified installations for environment protection (ICPE): Decree n ° 000543 of July 15, 2005 stating the legal regime of ICPE. In accordance with this decree, this Project is subject to authorization.
- Natural resources and protected areas:
 - Forestry resources: the Forest code under Law n ° 16/2001 of December 31, 2001. Several legal texts complement this code: Decrees n ° 692 of August 24, 2004, n ° 1028 of December 1, Decree n ° 1205 of August 30 1993 and Decree No. 1206.
 - Hunting and fishing: Code of Fisheries and Aquaculture under Law No. 015/2005. Two decrees relate to this code: Decree No. 62 of January 10, 1994 and Decree No. 189 of March 4, 1987.
 - Protected areas: Law No. 03/2007 of September 11, 2007 related to national parks. This law is reinforced by the decree n ° 000118 of March 1, 2004
- Cultural heritage: **Law No. 2/94 of December 23, 1994 on the protection of cultural heritage.**
- Land:
 - Customary laws: Despite customary management of land, local communities do not have recognized land rights. According to national regulations, customary land rights relate only to the usufruct of the land and do not equal to private property.
 - Formal land tenure.
 - Expropriation for public utility.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

-
- Eviction for public utility, security and insalubrity.
 - Human rights, referring to two categories of rights:
 - Civil and political rights.
 - Economic and social rights.

1.4.3. ESIA Proces

The ESIA process is described within the manual of environmental impact studies (Annex 1 of the Environment Code). This manual indicates how the promoter must proceed to obtain authorization from the DGE. The diagram below provides a schematic overview of the procedure.

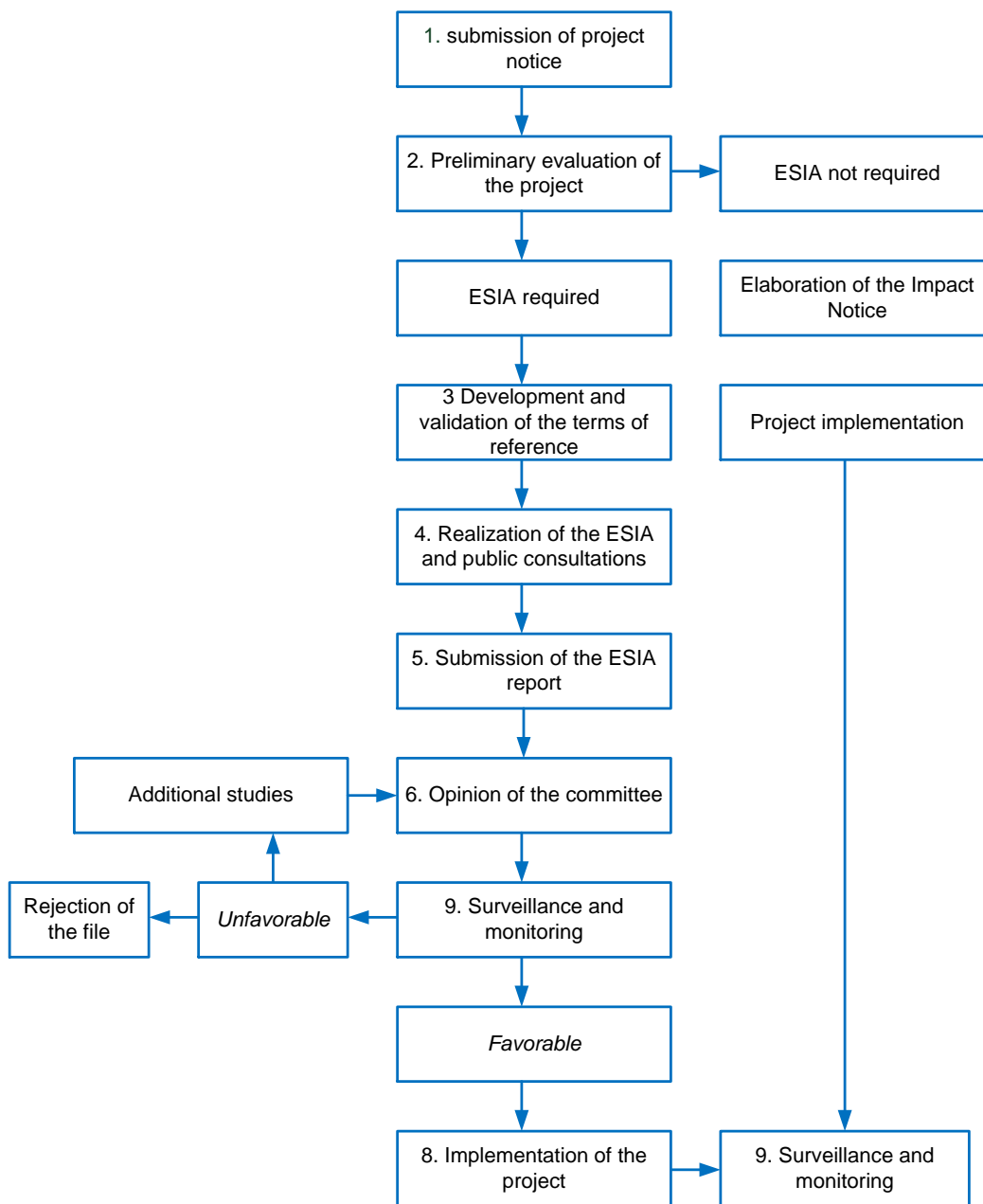
The procedures for issuing approval for carrying out environmental impact studies are regulated by Order No. 2 / PM / MEPNRT of April 14, 2006.

This document constitutes the ESIA of the project for submission to the DGEPN in accordance with the Gabonese regulations of the Environmental Code.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



ESIA process in Gabon.

1.4.4. International standards

As the consortium plans to request funding international from international donors, this ESIA also meets the standards of international donors such as the African Development Bank (AfDB) and the International Finance Corporation (IFC).

1.4.4.1. IFC STANDARDS

The IFC has issued a sustainability framework to promote sustainable development. This framework includes the following:

- The environmental and social sustainability policy, dated January 1, 2012, defining IFC commitment to sustainable development.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

- The Performance Standards (PS), defining responsibilities of IFC clients in terms of management of environmental and social risks and impacts.
 - PS 1: Assessment and management of environmental and social risks and impacts
 - PS 2: Labor and working conditions
 - PS 3: Resource efficiency and pollution prevention
 - PS 4: Community Health, safety and security
 - PS 5: Land acquisition and involuntary resettlement
 - PS 6: Biodiversity conservation and sustainable management of living natural resources
 - PS 7: Indigenous peoples
 - PS 8: Cultural heritage
- The Access to Information Policy, which outlines IFC's commitments to transparency.
- The environmental and social classification procedure, which classifies projects according to their impacts.

The environmental and social sustainability policy is made up of eight PS dedicated to borrowers. These PS are listed in the table below.

A series of tools supports the implementation of PS:

- The Guidance Notes (GN).
- The World Bank Group's Environment, Health and Safety Directives ("ESS Directives").
- Different manuals and good practices handbooks published by the World Bank Group.

1.4.4.2. REFERENTIAL OF THE AFRICAN DEVELOPMENT BANK

This ESIA must comply with a sustainable development framework recognized by the majority of donors. The AfDB's Integrated Backup System (ISS) has been chosen as a reference:

- The Integrated Safeguards Policy Declaration.
- A set of operational safeguards (OS) associated to environmental and social assessment procedures (ESAP) and to revised integrated environmental and social impact assessment guidelines:
 - SO 1: Environmental and social assessment. SO1 presents the process to determine the environmental and social category of a project and its resulting requirements in term of environmental and social assessment;
 - SO 2: Involuntary resettlement: land acquisition, displacement and compensation. This SO aims at facilitating the operationalization of the AfDB Policy on involuntary resettlement of 2003, within the framework of SO 1. The term "resettlement" refers to both physical and economic displacement;
 - SO 3: Biodiversity, renewable resources and ecosystem services. This SO recognizes the importance of biodiversity on the African continent and the value of key ecosystems for the population. Its objective is to protect and preserve biodiversity and ecosystems integrity by reducing and minimizing potential negative impacts if they cannot be avoided. The current study refers i to NP6 of the IFC, using its guidelines and criteria to determine modified, natural and critical habitats;
 - SO 4: Prevention and control of pollution, hazardous materials and efficient use of resources. The objectives of this SO are to manage and reduce pollution from projects including hazardous and non-hazardous wastes that pose a risk on human health and environment;
 - SO 5: Working conditions, health and safety. This SO sets out the main requirements on workers' rights and basic needs.

SO 2 to 5 support the implementation of SO 1 and establish specific conditions related to various environmental and social issues, including gender and vulnerability. Safeguards on such issues are triggered if the evaluation process reveals risks induced by the project.

1.5. IMPACTS AND MEASURES

1.5.1. Physical environment

1.5.1.1. IMPACT ON HYDROLOGY

Impact on upstream hydrology

Installation of the Kingulé Aval dam will result in a raising of the water area between levels 58 m NGG and 60 m NGG and will thus create a lake approximately 7 km long. The hydrodynamic conditions governing this water area during low water periods will therefore change in terms of maximum/minimum depths, wetted cross sections, average velocities and water volumes.

Upstream of the dam, there is no agricultural operation nor dwelling likely to be impacted by the rise in water level. On the other hand, the increase in water area land take during flood periods will cause flooding of the existing road in a fairly restricted sector.

Impact on downstream hydrology

The Kingulé Aval hydroelectric scheme is a run-of-river facility; in other words, it is not intended to regulate the river flows. There will be no significant change in seasonal hydrological regime downstream of the outlet point; all the inflows observed will be immediately transferred by the turbined flows at the powerhouse.

Based on the fact that the powerhouse will continuously turbine up to 90 m³/s and that higher flows will be maintained in the main river bed via the weir, no seasonal or weekly change in hydrology of the River Mbé is to be expected downstream of the installation outlet point.

Impact on downstream hydrology when operating under daily hydropeaking

The installation design flow allows operation under daily hydropeaking, which may significantly modify the downstream flow conditions over very short periods. The impact generated by the operating mode for the Kingulé Aval dam has been estimated by comparing existing water level and velocity variations under initial conditions (in the event of a release at Kingulé) with those forecast during operation. We observe that:

- Under current conditions, the operating mode at Kingulé causes a variation in level of 0.7 m downstream of the tailrace canal and of 0.5 m at Andock Foula. With regard to velocities, the mode of operation at Kingulé causes a variation in velocity of 0.3 m/s downstream of the tailrace canal and of 0.4 m/s at Andock Foula
- Under projected conditions, the operating mode at Kingulé Aval causes an average variation in level of 1 m downstream of the tailrace canal and of 0.8 m at Andock Foula, i.e. a variation in level of an additional 30 cm compared with the variations already observed in the watercourse. With regard to velocities, the Kingulé Aval design results in an average variation in velocity of 0.5 m/s downstream of the tailrace canal and of 0.6 m/s at Andock Foula, i.e. a variation in velocity of an additional 0.2 m/s compared with the variations already observed in the watercourse.

The impact generated on the water levels decreases from upstream to downstream.

The effect of the water level variations also plays an important part in water level variation in the river. The water level can indeed vary by an average 1 m during the course of a day.

Conclusion and measures

With the exception of the reservoir area, the project impact on the existing hydrology is considered **low**.

Measures will be implemented on behalf of the local population to limit the risks of drowning, when operating the facility under daily hydropeaking or restarting the turbines after a shutdown, including:

- A first wave of warning to inform users on the river of the future rise in water level
- Monitoring to ensure acceptable rates of depth increase and current as defined by the best practices implemented by French power utility EDF
- Installation of a warning system and regular awareness campaigns targeting River Mbé users
- Systems installed will ensure precision control of flow increases
- Once these measures are in place, the risk for the population will be less than the current risk.

1.5.1.2. IMPACT ON WATER QUALITY

Under normal operating mode, the analysis shows that the impact on water quality remains very **low** in the reservoir and at the outlet point. This low impact is linked to the small size of the reservoir in relation to the daily inflows and hence the short reservoir holding time.

In degraded operating mode (typically a few days/year), one scenario could potentially deteriorate the water quality: when turbinage is completely stopped, a valve near the bottom immediately (within the time required for the spillway to overspill) restores a minimum flow of 20 m³/s to conserve a minimum flow downstream. Given the origin of the water restored (near the bottom), there is a risk of passing de-oxygenated water; it is for this reason that the structure integrates an aerator immediately downstream of the valve.

The results of the water quality impact analysis also allow the forest in the reservoir area to be submerged without risk of degrading the water quality downstream.

1.5.1.3. EROSION- AND SEDIMENTATION-RELATED IMPACTS

Globally, the impacts caused by facility operation on sediment conveyance are considered **significant** to the extent that the projected dam reservoir will trap at least 65-70% of incoming fine solids and 100% of coarse incoming solids (sands and gravels). Current knowledge of catchment sediment dynamics would lead us to believe that the accumulation of structures in a river causes blockage of a more or less significant sediment volume at each obstruction, which disrupts sediment flow downstream and, indeed, as far as the coast; this is a key factor in estuary morphology, flood regime and species distribution.

Kinguélé Aval will cause a sediment build-up at its level and, in fact, an additional blockage in view of the other structures already built on the River Mbé. Kingulé Aval is therefore the source of a direct impact on sediment conveyance, which indeed comes in addition to the effects of the other existing dams on the same natural dynamic.

In view of the complexity of the river-estuary-mouth system, the impacts associated with modifying sediment conveyance deserve in-depth study through systematic monitoring to understand better the morpho-sedimentary dynamics in relation to operation of the dams and to quantify the impact as accurately as possible. The problem of sediment conveyance must therefore be considered on the scale of not only Kingulé Aval, but also the River Komo catchment and especially in relation to the Ngoulmendjim scheme, which will alter sediment flows in the other part of the Komo catchment.

However, the effects of these hydro sedimentary impacts will only be very minor because:

- There is no risk of bed incision through gradual erosion downstream of the facility
- In relation to sandy habitats, there is only slight modification that could be considered harmful in the downstream part of the River Mbé, which is subjected to dynamic variations in water level

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

- While it cannot currently be assessed, the highest risk could involve the long-term dynamics of the Gabon estuary itself and, in particular, mangrove functionality (a cumulative impact should there be developments on the River Komo).

Measures include:

- Project design integrating a bottom valve; to a degree, this will allow transit of the finest sediment fraction (silt and fine sand)
- Implementation of sedimentation monitoring on both the River Mbé and in the estuary. This monitoring will be necessary to understand and differentiate the effects of Kingulé Aval from the other existing facilities. If a significant impact on the natural environments, associated with sediment deficiency, was identified during this monitoring, possible remedial measures could be implemented, such as:
 - Annual dredging of reservoir tail area
 - Opening of dam at low water level during rainy season
 - Pumping/Dilution at high water with downstream discharge.
- This monitoring measure must be supported by all stakeholders operating in the catchment (operators of existing dams such as Tchimbélé and Kingulé, and consideration thereof in potential future dams such as Ngoulmendjim).

1.5.1.4. ESTIMATION OF GREENHOUSE GAS (GG) EMISSIONS

According to hypotheses, approaches and areas, GG emission figures vary between 114 and 236 ktCO_{2eq} for 100 years. With respect to average annual power generation, **these figures vary between 6 and 12 gCO_{2eq}/kWh.**

This range is very low compared with other reservoirs, especially in a tropical environment, or in relation to equivalent resources used for thermal energy generation: of the order of 400 gCO_{2eq}/kWh for natural gas, 800 for crude oil or 1000 for coal. It is therefore an excellent project from the standpoint of avoiding CO₂ emissions.

Hence, over 100 years, the Kingulé Aval scheme will provide a saving of approximately 7,300, 14,700 and 18,700 ktCO_{2eq} with respect to natural gas, crude oil or coal alternatives.

1.5.2. Natural environment

Biodiversity was considered very early as the main issue of the project and was integrated into the design as soon as alternatives were analyzed because of its location partly in the heartland and partly in the buffer zone of the Monts de Cristal National Park. Thanks to design measures, this process has permitted major reduction of the project's ecological footprint, while allowing the site's hydrological potential to be exploited. We initially recall that one of the prevailing arguments for creation of the Monts de Cristal National Park was conservation of its hydrological potential, with a view to its exploitation, in the face of the potential dangers represented by forest exploitation.

1.5.2.1. IMPACT ON THE MONTS DE CRISTAL NATIONAL PARK

All the facility's land takes amount to 0.08% (74.0 ha) and 0.3% (186.7 ha) of the buffer zone and the heartland of the Monts de Cristal National Park (Mbé sector), respectively. The table below shows the affected areas with respect to impact factors and type of land use. This clearly confirms that the presence of the reservoir is at the origin of the majority of the impact on forest areas, in particular those in the Monts de Cristal National Park.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Areas affected by project components with respect to land use

AREA IN HA	DIRT AND METALED ROAD	EXISTING QUARRY	VILLAGE	FOREST	LOW VEGETATION	WATER	TOTAL
Structure and site area	1.38	0.00	0.00	13.16	1.56	2.11	18.2
Project main camp	0.00	17.92	0.00	0.00	0.00	0.00	17.9
Main camp to landing road	8.92	0.00	0.00	0.00	0.00	0.00	8.9
Main camp to structure/site	10.15	0.00	0.00	0.00	0.00	0.00	10.2
Reservoir road realignment zone 1	0.35	0.00	0.00	0.31	0.00	0.00	0.66
Reservoir road realignment zone 2	0.30	0.00	0.00	1.39	0.00	0.00	1.70
Reservoir road realignment zone 3	0.71	0.00	0.00	0.07	0.00	0.00	0.78
Reservoir RN60 road (excl. realignment)	1.05	0.00	0.01	192.36	4.02	33.91	231
Total	22.86	17.92	0.01	207.29	5.58	36.01	290

Overall, the impact of the project land takes on the Monts de Cristal National Park is **high** with respect to the major challenge represented by the park in biodiversity terms (high biological value). The other types of land use will be affected far less significantly. Moreover, the impact is lower because the environments are already affected by anthropogenic activities. The land takes on areas other than forest remain **minor** outside the Monts de Cristal National Park. The project land takes involve no inhabited area, crop area or construction area.

1.5.2.2. LOSS OF NATURAL AND CRITICAL HABITATS

The project land takes will affect these habitats to a greater or lesser extent. Likewise, these habitats present challenges of varying scale in relation to conserving biodiversity. The following table shows the land takes with respect to type of habitat modified, natural and critical.

Land takes in modified, natural and critical habitats

HABITATS	MODIFIED	NATURAL	CRITICAL	TOTAL
Structure and site area	12% (2.2 ha)	88% (16.0 ha)	88% (16.0 ha)	18.2
Project main camp	100%	0	0	17.9
Main camp to landing road	100%	0	0	8.9
Main camp to structure/site	100%	0	0	10.2
Reservoir road realignment zone 1	100%	0	0	0.66
Reservoir road realignment zone 2	50% (0.85 ha)	50% (0.85 ha)	50% (0.85 ha)	1.70 (at MWL)
Reservoir road realignment zone 3	100%	0	0.00	0.78 (at MWL)
Reservoir MWL 62 m (incl. road realignment)	2.2 (5.9 ha)	97.8 (261.1 ha)	97.8 (261.1 ha)	267 (at MWL)
Total	47 ha	278 ha	278 ha	325

Modified habitats (village, quarry areas, agricultural area, road, HV transmission line corridor) are not considered critical although the presence of critical fauna may occasionally be associated with them, in particular African forest elephants, which cause extensive crop damage. However, these modified areas cannot be considered habitats for critical species because they no longer allow such species to develop.

For each habitat, the table below summarizes the estimated area/distance destroyed by the project land takes, the estimated area of critical habitats in their sustainable management units, the challenge represented by each habitat as revealed by existing data analysis and the potential global risk (without avoidance-reduction-compensation measures).

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Summary of risks for habitats in the project area

HABITATS	TYPE	CRITICAL (CRITERIA C1, C2 AND C3)	SENSITIVITY (SCARCITY, THREAT, CONSERVATION INTEREST) FOR PROJECT SITE	DISTRIBUTION OF HABITAT IN SUSTAINABLE MANAGEMENT UNIT	AREA OR DISTANCE IN PROJECT LAND TAKE	POTENTIAL GLOBAL RISK FOR HABITAT
(1) Rapids and rock slabs supporting Podostemaceae (intermediate rivers)	Aquatic natural	Yes (C1, flora)	Yes Rare habitat through tropical Africa (threatened by hydroelectric projects)	A few 10s - 100s or 1000s of m ² Very seldom prospected	A few 10s of m ²	Major
(2) Wide torrential rivers (Mbé-type)	Aquatic natural	Yes (C1, crocodile) Yes (C2, fish)	No Frequent on Monts de Cristal Nat. Park, Gabon and Africa. Locally well conserved, low conservation value	40 km between project site and Tchimbélé lake (1)	9 km	Significant
(2b) Intermediate size rivers (Biwane-, Sobéa/Missoho- and Méba-type)	Aquatic natural	Yes (C1, frogs, crocodile) Yes (C2, fish)	No Frequent on Monts de Cristal Nat. Park, Gabon and Africa. Locally well conserved, low conservation value	80 km (1)	9 km	Significant
(3) Sub-forest streams	Aquatic natural	Yes (C1, frogs) Yes (C2, fish)	No Frequent on Monts de Cristal Nat. Park, Gabon and Africa. Locally well conserved, low conservation value	800 km (1)	30 km	Significant
(4) Marshy shallows	Riparian natural	Yes (C1, C2, flora)	Yes Fairly rare and threatened at Gabon scale	Occasional habitat along intermediate and wide rivers (1% of linear length). A few 1000 m ² to a few hectares	A few 100s of m ²	Significant
(5) Rocky flooding riverbanks (mosaic of rocky flooding riverbank habitats)	Riparian natural	No	No Widely present in Monts de Cristal	Linear habitats along riverbanks (30% of linear length in wide rivers, 10% in intermediate rivers) 20 km, 10 ha	4 km 2 ha	Low
(6) Riparian forests	Riparian natural	Yes (C1, C2, flora, butterflies, frogs)	Yes Fairly rare and generally indirectly threatened by forest exploitation in Gabon	Linear habitat several meters wide (3 - 5 m) on each bank (intermediate and wide rivers) 120 km, 120 ha	39 km 39 ha	Significant

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

HABITATS	TYPE	CRITICAL (CRITERIA C1, C2 AND C3)	SENSITIVITY (SCARCITY, THREAT, CONSERVATION INTEREST) FOR PROJECT SITE	DISTRIBUTION OF HABITAT IN SUSTAINABLE MANAGEMENT UNIT	AREA OR DISTANCE IN PROJECT LAND TAKE	POTENTIAL GLOBAL RISK FOR HABITAT
(7) Dense rainforests on Monts de Cristal ridges	Terrestrial natural	Yes (C1, flora, tortoise, parrot, forest elephant)	No Forest-type frequent in Monts de Cristal foothills and locally well conserved	500 - 800 km ² (2)	Approx. 100 - 200 ha depending on gradient criteria, linked to following habitat	Significant
(8) Dense rainforests on hillsides	Terrestrial natural	Yes (C1,C2, flora) Yes (C1, tortoise, parrot, elephant)	No Forest-type frequent in Monts de Cristal foothills and locally well conserved	500 - 800 km ² (2)	Approx. 100 - 200 ha depending on gradient criteria, associated with preceding habitat	Significant
Swampland supporting <i>Halopegia azurea</i>	Riparian natural	No	No Widely present in Monts de Cristal	Occasional habitat along intermediate and wide rivers (10% of linear length)	3.9 km	Low
(10) Meadows supporting <i>Anubias barteri</i>	Riparian natural	No	No Widely present in Monts de Cristal	Habitat extending regularly along intermediate rivers and streams (basis: 25% of linear length) 220 km	10 km	Low
Villages (garden) and their immediate surroundings	Modified	No	No	n/a	Negligible	None
Extensive agricultural areas	Modified	No	No	n/a	negligible	None
Granite quarries and disused quarries	Modified	No	No	n/a	18 ha	Low
Corridor regularly cleared along HV transmission line	Modified	No	No	n/a	negligible	None
Roadside vegetation	Modified	No	No	n/a	negligible	None

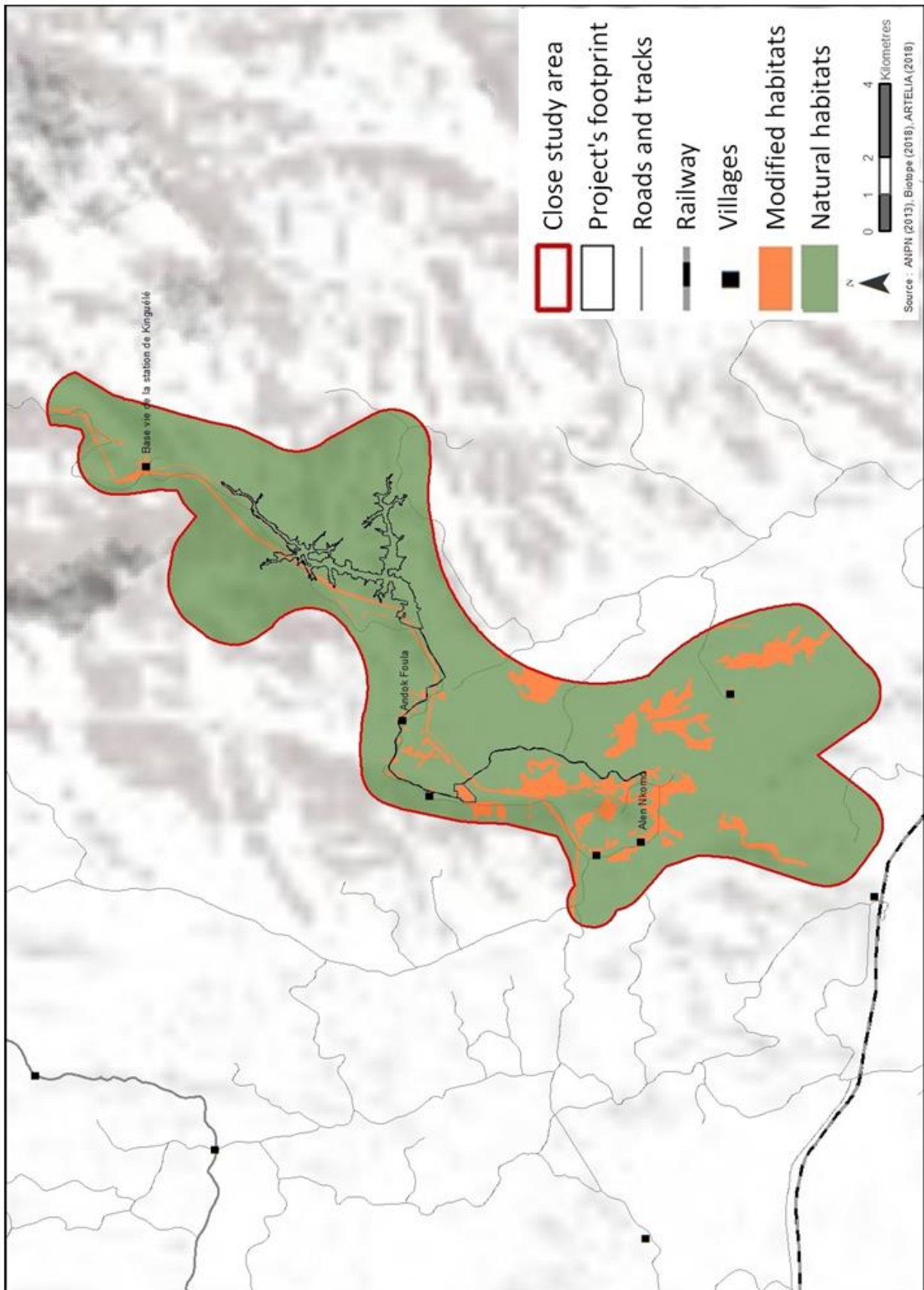
(1) based on map estimation with ratios between wide torrential river (typically River Mbé at project location), intermediate size river (typically River Méba near project location) and other sub-forest streams of 5%, 10% and 85% respectively depending on ratios determined in study area backed by LIDAR data. (2) 50% ratio based on analysis of slopes, provided by LIDAR, between "Dense rainforests on hillsides" and "Dense rainforests" on Monts de Cristal ridges".

n/a: not applicable. The notion of sustainable management unit is only determined for species prompting a critical habitat on the scale of this one. In this case, modified habitats do not otherwise constitute "critical" habitats based on the key to understanding provided in the introduction to this section.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

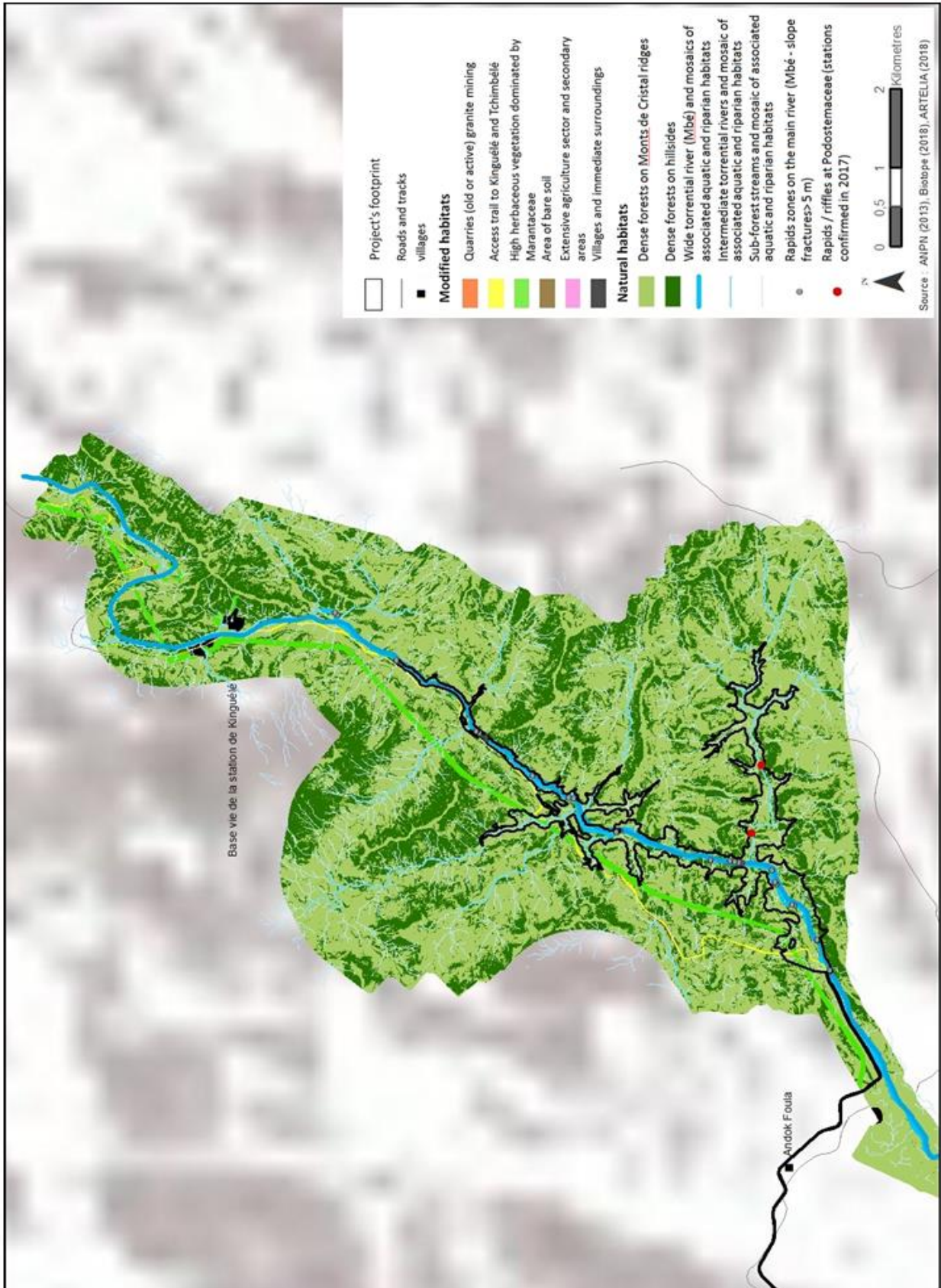


Project land takes in modified and natural habitats

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Land takes in critical natural habitats

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

1.5.2.3. LOSS OF FLORISTIC ECOLOGICAL RICHNESS

Based on current knowledge, the project is likely to destroy or disturb a large proportion of known populations of ten CR- or EN-classified plant species and/or subject to limited distribution (1/2 to 1/5 of referenced stations). The potential global risk is therefore considered major for these species.

Potential global risk caused by project land takes in relation to floristic species indicating a critical habitat

SPECIES	HABITAT(S) IN STUDY AREA	POTENTIAL GLOBAL RISK
Aquatic and waterside flora		
<i>Ledermanniella sanagaensis</i> EN	Aquatic habitat . Rapids/Rock slabs supporting Podostemaceae	Study area station represents 1 of 2 known stations Major
<i>Ledermanniella letestui</i> EN Species known only in Gabon		Study area station represents 1 of 4 known stations Major
<i>Ledermanniella linearifolia</i> EN		Study area station represents 1 of 4 known stations Major
<i>Thaumatococcus flavus</i> EN Species known only in Gabon	Riparian habitat . Marshy shallows	Study area station represents 1 of 4 known stations Major
<i>Veyretella hetaerioides</i> EN Species known only in Gabon		Study area station represents 1 of 4 known stations Major
<i>Pauridiantha longistipula</i> EN	Riparian habitat . Riparian forest	Study area station represents 1 of 5 known stations Major
<i>Phyllobotryon sp. nov.</i> CR Species known only in Gabon	Riparian habitats . Marshy shallows . Riparian forest	Study area station is the only one known today Major
<i>Palisota cristalensis sp. nov. ined.</i> EN Species known only in Gabon		Study area station represents 1 of 3 known stations Major
Terrestrial flora		
<i>Campylospermum klainei</i> EN Species known only in Gabon	Terrestrial habitat . Dense rainforests on hillsides	Study area station represents 1 of 2 currently known stations Major
<i>Sirdavidia solananna</i> EN	Terrestrial habitat . Rainforests in ridges	Study area station represents 1 of 3 known stations Major

1.5.2.4. LOSS OF FAUNISTIC ECOLOGICAL RICHNESS (EXCLUDING FISH)

Destruction of portions of habitat does not necessarily imply an impact on the species population, who may move away. For example, conversion of a few hectares of forest (habitats comprising "Dense rainforests on Monts de Cristal hillsides" and "Dense rainforests on Monts de Cristal ridges") into a reservoir is unlikely to modify the populations of mobile fauna, which is currently far from saturating its environment, such as butterflies, the forest hinge-back tortoise, the grey parrot and the African forest elephant. On the other hand, for Stévar's egg frog with a large population density in the project area, the conversion of habitats comprising "Sub-forest streams" and "Adjacent forest areas" into a reservoir may result in a significant reduction in its numbers.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Potential global risk caused by project land takes in relation to faunistic species indicating a critical habitat

SPECIES	HABITAT(S) IN STUDY AREA	QUANTITATIVE APPROACH
Fish		
<i>Brachypetersius gabonensis</i>	Aquatic habitat All types of watercourse in study area	Species fairly frequent in study area. Cumulative linear length of species habitat of approx. 48 km in land take. Low
<i>Chromidotilapia regani</i>	Aquatic habitat Wide and intermediate rivers	Naturally rare species. Cumulative linear length of species habitat of approx. 39 km in land take. Significant
<i>Grasseichthys gabonensis</i>	Aquatic habitat Wide river (Mbé)	Naturally rare species. Cumulative linear length of species habitat of approx. 9 km in land take. Significant
<i>Plataplochilus sp. nov.</i>	Aquatic habitat All types of watercourse in study area	High presence of species in study area. Cumulative linear length of species habitat of approx. 48 km in land take. Significant
Aquatic fauna (excluding fish)		
Stévert's egg frog <i>Leptodactylodon stevarti</i> EN	Aquatic and riparian habitats Intermediate size rivers. Sub-forest streams. Adjacent forest areas. Absent from flood plain of major watercourses.	Estimated population in project land is several 100 or even 1000 individuals. Habitats in small streams and adjacent forest areas will only be slightly impacted by the project in a small area at the mouth of these streams in the River Mbé and over a linear length that depends on the distance of the stream from the reservoir inlet (low at reservoir inlet and longer near the dam with a maximum difference in level of approximately 35 m). Cumulative linear length of species habitat of approx. 39 km in land take. Significant
Efulen water frog <i>Petropedetes palmipes</i> EN	Aquatic and riparian habitats Intermediate size rivers featuring large blocks of rock washed by the water. Adjacent forest areas.	Only 3 individuals have been observed; densities are probably naturally low. Project affects a small proportion of the River Mbé. Cumulative linear length of species habitat of approx. 9 km in land take. Low
Slender-snouted African crocodile <i>Mecistops cataphractus</i> CR	Essentially aquatic habitat Intermediate to wide forest rivers.	Very discreet species, probably present in study area, but unconfirmed by field data. Numbers unknown. Creation of a small reservoir lake will probably be favorable to this species. In any case, hunting is the main threat to this species. Disappearance of the forest and loss of prey diversity is also a factor in the decline of this species, which seems less tolerant than its cousin the Nile crocodile. Cumulative linear length of species habitat of approx. 9 km in land take. Low
Terrestrial fauna		
Forest butterflies with low distribution <i>Charaxes basquini</i> <i>Bebearia faraveli</i> <i>Euphaedra abri</i> <i>Euphaedra sabinae</i>	Terrestrial habitat Forests (all types)	Impacted areas are small compared with the forest habitat of these species. The reservoir lake does not form an impenetrable barrier and the land takes will have no significant impact on species populations. Cumulative area of species habitat of approx. 233 ha in land take. Low
Forest hinge-back tortoise <i>Kinixys erosa</i> EN	Terrestrial habitats Dense rainforests on hillsides Dense rainforests on Monts de Cristal ridges	Impacted areas are small compared with forest habitat of this species, whose numbers are little known but are considered to be in decline mainly because of hunting for bush meat. Cumulative area of species habitat of approx. 200 ha in land take. Low

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

SPECIES	HABITAT(S) IN STUDY AREA	QUANTITATIVE APPROACH
African grey parrot <i>Psittacus erithacus</i> EN	Terrestrial habitats Dense rainforests on hillsides Dense rainforests on Monts de Cristal ridges	Impacted areas are small compared with the habitat of this species. Facility land takes will not impact its population. Main threat to species is poaching for selling since it is appreciated as a pet bird. Cumulative area of species habitat of approx. 200 ha in land take. Low
African forest elephant <i>Loxodonta cyclotis</i> EN (Central Africa)	Terrestrial habitats Dense rainforests on hillsides Dense rainforests on Monts de Cristal ridges	Impacted areas are small compared with the habitat of this species. Poaching is the main threat to this adaptable species. The reservoir lake will increase the effect of an 8 - 10 km long barrier to crossing the River Mbé, potentially modifying its movement routes. The facility land takes' potential global risk remains low for this species. Cumulative area of species habitat of approx. 200 ha in land take. Low
Other emblematic and threatened mammals and fauna	Terrestrial habitats Dense rainforests on hillsides Dense rainforests on Monts de Cristal ridges	The population density of large mammals is low or even very low in the Monts de Cristal National Park because of major cynegetic pressure due to its proximity to Libreville and existence of the Kougouleu-Médouneu main road running between the two Park sectors. These results are corroborated by a study of the "halo of defaunation", which extends over a 10 km estimated distance around the rural villages in Gabon and especially across the whole Congo basin (except for the African forest elephant). We also note that the reservoir lake will reinforce the natural barrier and will limit access to the Monts de Cristal National park heartland from power utility SEEG's road. Negligible

1.5.2.5. IMPACT ON FISH BIODIVERSITY

The impact factors affecting fish ecological richness are of three main types. They result from:

- Modifications of the physical environment as described in previous sections and, especially (i) hydrodynamic modifications in the dam zone and downstream thereof and (ii) modifications of the physical chemical characteristics of the water (dissolved oxygen, organic matter, material in suspension)
- Ecological discontinuity created by the spillways and dams (during construction and throughout the operating period), more specifically in relation to longitudinal movements of aquatic species.

Impacts due to modification of the physical environment

Analysis of facility operation has shown that the impact of modifications of the physical environment will be **significant** in the reservoir area and **low** downstream of the dam except in degraded operating mode (turbining stopped).

In the reservoir, the specific richness may sustain transformation but, in every case, it will be linked to the fauna present natively in the river unless species are introduced therein. In the reservoir area, this will result in:

- Transition to the advantage of species preferring calm, deeper water to the detriment of species related to more dynamic environments (rheophilic species)
- Temporary disturbance/adaptation of habitats related, in particular, to the new riverbank levels: (i) disappearance and re-conquest of riverbank aquatic plants, (ii) sedimentary stabilization of riverbank profiles and (iii) re-conquest of newly flooded areas by fish species
- The habitat of species in small lateral watercourses will be reduced based on the linear length flooded by the reservoir lake

- Greater vulnerability to the presence of invasive exotic species that perform well in this new habitat (aquatic flora and fauna, including fish).

The impact of facility operation is therefore considered **significant** because it potentially affects rheophilic species with limited distribution, whose numbers will decrease and whose distribution will be disturbed.

Downstream of the tailrace canal, small flow changes and water quality will typically not disturb the populations of fish and other aquatic organisms. The impact of facility operation will have a low impact on aquatic organisms downstream of the project area. Likewise, the typology and distribution of aquatic and riparian habitats will not be impacted by slight modifications of the physical environment. The impact of operating the facility is therefore considered **low** downstream of the outlet point.

However, if turbining is stopped, the impact of facility operation on the habitats and the aquatic and riparian organisms is considered **high** between the outlet point and the confluence with the River Komo and there may be a deterioration in water quality. The impact will be **low** after the confluence with the River Komo.

Ecological discontinuity

The impact of ecological discontinuity on populations of migratory/mobile species is reckoned to be **low** in consideration of the species concerned as neither critical habitat indicators nor threatened species and of the proportion of the Komo basin rendered inaccessible by the project.

However, the cumulative nature of the ecological discontinuities on the Mbé and Komo catchment scale must be emphasized, considered **significant** and requires measures to be implemented at river basin scale by all operators.

1.5.2.6. BIODIVERSITY CONSERVATION MEASURES

Implementation of a Biodiversity Action Plan (BAP)

In addition to taking into account biodiversity conservation at design stage, the FGIS/MERIDIAM consortium has decided to comply with the requirements of the International Finance Corporation (IFC)'s benchmark (Performance Standard 6), which requires that the facility must also create greater biological richness in the case of critical habitats such as those found in the Monts de Cristal National Park. In compliance with this benchmark, a BAP must be developed to avoid, reduce and compensate for impacts on biodiversity. The purpose of the BAP is twofold:

- It marks the commitment of the FGIS/MERIDIAM consortium to executing the project in compliance with IFC Performance Standard 6 dedicated to protecting biodiversity and hence its commitment to conduct a high level of monitoring and compensation in relation to the impacts of its dam project at the Kingulé Aval site at the edge of the Monts de Cristal National Park
- The BAP brings together all the components necessary for (i) properly understanding of the biodiversity-related issues and (ii) implementing avoidance, reduction and compensation measures. In short, the BAP is a component part of the Environmental and Social Management Plan (ESMP) dedicated to biodiversity.

Several objectives are therefore pursued in this action plan:

- To protect and conserve terrestrial and aquatic biodiversity (fauna and flora)
- To respect the mitigation hierarchy (avoidance/reduction/compensation approach) by covering the facility's construction, filling and operation phases
- To ensure "no net loss" of biodiversity for natural habitats and "net gains" in biodiversity for critical habitats.

The BAP scope includes the aquatic and terrestrial domains impacted directly or not by the project.

The BAP embraces several components or approaches:

- An approach to conserving habitats

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

- An approach to conserving species
- An approach to ensure construction that respects biological richness
- Additional measures in the operation phase
- A participative approach to improving knowledge and awareness.

These approaches and measures also integrate a compensation strategy that must provide net gains in biodiversity for habitats and species impacted by the project wherever possible and, failing this, on other sensitive habitats and species in the Monts de Cristal National Park area.

Measures developed through the Biodiversity Action Plan (BAP)

Right from project design stage, an analysis of the alternatives considered project impact on biodiversity by seeking a solution with the least impact on the habitats identified at a preliminary stage:

- The downstream alternative was opted for mainly because the dam, the housing project for operating staff and the other project facilities (penstocks, hydroelectric powerhouse, transformer, outlet works) are located outside the Monts de Cristal National Park heartland and therefore minimize the land takes in the National Park
- The normal top water level NTWL at 60 m (MWL at 62 m), the lowest of the alternatives retained, reduced, on the one hand, the reservoir land take in the Monts de Cristal National Park and avoided, on the other hand, opening a new by-pass road and hence other land takes and roads penetrating into the National Park.

These measures adopted at design stage partly ensured reduction of the project land take in the following habitats (major and significant global risk):

- Wide torrential rivers (critical habitat) and (2b) intermediate rivers (critical habitats): YES, approximately 15% reduction
- Marshy shallows (critical habitat): YES, approximately 10% reduction
- Riparian forests (critical habitat): YES, approximately 15% reduction
- Dense rainforests on hillsides (critical habitat): YES, approximately 50% reduction
- Dense rainforests on Monts de Cristal ridges: YES, approximately 50% reduction.

However, these reduction measures do not permit a decrease in the global risk to the environment to an acceptable level and it remains high. A series of other reduction and compensation measures will be developed within the scope of the Biodiversity Action Plan (BAP) and their basis is introduced in the present BAP.

The BAP comprises a series of measures that will enable avoidance and reduction of some of the impacts and compensation of residual impacts to ensure an increase in global biological richness. These measures are as follows:

- Project Owner biodiversity expert E&S team for implementing the BAP
- External audit of BAP monitoring performance
- Additional surveys of threatened habitats
- Consultation and site visit to search for sites to be restored
- Consultation to finalize compensation ratios and to select compensation and restoration sites
- Implementation of compensation operations
- Implementation of restoration operations
- Monitoring and inspection of compensation and habitat restoration actions
- Strengthening of national parks agency ANPN to combat poaching

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

- Design of a biota-friendly water intake system
- Inspection monitoring of species conservation actions
- Site management of physical environment quality
- Additional management of social influx to protect biodiversity
- Plant nursery and plant multiplication
- Work planning
- Protection and access
- Procedure and resources for safeguarding threatened species
- Fight against invasive species (flora)
- Minimum flow in the event of operating incident
- Fishing ban in reservoir, which is located within the national park, and introduction of fish
- Consultation of other Mbé and Komo river operators to establish a coordinated monitoring program
- Study and conservation fund for Podostemaceae in Gabon
- Study and conservation fund for fish in Gabon
- Monts de Cristal National Park eco-tourism evaluation and awareness campaign
- Publication of results obtained in an activity report.

1.5.3. Human environment

The Kingulé Aval hydroelectric project has very little impact on the social environment, in which it is placed: no loss of buildings or cultivated land, no displacement of population or major economic losses, small reservoir with no effect on vectors of waterborne diseases.

Its main impacts on the social environment are:

- Loss of approximately 65 ha of forest area used for hunting and collecting non-timber forest products, i.e. approximately 7% of the area available for use by the inhabitants of Andock Foula. To compensate for this impact, a lump sum will be offered by the Project Owner and discussed with the village. This budget will be distributed in the form of community project finance or technical support for Andock Foula inhabitants
- Pollution sources associated with the construction site, part of which will be located in Andock Foula: noise, road traffic, dust, influx of workers and potentially of people wanting to return to the village. Site management measures based on best practices recognized by international financial donors will be implemented to prevent and curtail pollution, noise and dust. Furthermore, a temporary medical dispensary will be built for the needs of the site and, during some periods, this will be open to the inhabitants of the village for emergencies. A partnership will be set up with Kango hospital with regard to preventive health actions (vaccination, fight against malaria and HIV/AIDS, etc.). A community vigilance committee will be set up to detect possible informal population installations. Two bored water wells with pumps will be installed at Andock Foula to ensure adequate supplies in the event of possible temporary growth of the village. Finally, a bus will be chartered, as required, to transport children of site workers living in the village as far as the school in Alen Komo
- Small changes in the River Mbé flow due to the operating mode implemented at the new facility may cause difficulties in relation to navigation and fishing. To compensate for this impact, the project will finance renovation of the professional fishermen's fishing equipment (net, outboard engine). A new landing will be built by the project in the event that the existing village landing is adversely affected (improbable according to the calculations).

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

In addition to the reduction, avoidance and compensation measures implemented, the FGIS/MERIDIAN consortium wishes to contribute to local development by taking voluntary enhancement measures. These measures include:

- A local recruitment procedure. It is proposed that priority is given to residents with the same skills (villagers and resident workers or nationals) in the villages within the project's area of direct or indirect influence, namely Andock Foula, Alen Komo, Atak, Madouacka, Makabane and Nzamaligue, followed by other Gabonese residents. On-site recruitment, including at the gates, will be prohibited. Site operators may be recruited through delocalized recruitment offices outside the construction site and the contractor area. Throughout construction, the project management will communicate recruitment needs and the application contacts and procedure to the villages in the project area of influence.
- Local contribution and development plan (LDP). Two major actions are planned:
 - Electrification of Andock Foula village: project management undertakes to find a power access solution for Andock Foula.
 - A local development fund (Departmental level) during facility operation will finance small local development projects benefitting the population and environment of the villages in the project area of influence with the participation of all stakeholders. Among possible projects identified to date, we can quote the following (list obviously not finalized):
 - Actions in the healthcare field involving improvement of technical platforms at healthcare centers, means of accessing these centers and access to medicinal products
 - Actions in the education field involving improvement of conditions for pupils and means of accessing schools
 - Actions in the cultural field with revitalization of knowledge and local Fang culture, conservation of knowledge and promotion of traditional medical and botanic knowledge
 - Implementation of a partnership with other entities (financial donors, scientists, the Monts de Cristal National Park, specialists) with a view to implementing a pilot project to resolve the man-elephant conflict.

1.6. PUBLIC CONSULTATIONS

1.6.1. Activities

A full public consultation process was conducted during the ESIA in line with Gabonese legislation and international standards. This involved visiting local administrations and meetings with their representatives, unstructured interviews of customary and village authorities, interviews of economic operators in the area, semi-structured interviews of villagers, focus groups, an informal survey, interviews of ministerial authorities, interviews of non-governmental and community associations and public meetings.

Public meetings were held at village assemblies in Andock Foula on 10th October 2017 and in Alen Komo on 14th October 2017. The inhabitants and nationals, along with their representatives and local authorities, had been invited in advance to ensure maximum attendance. The ESIA team, the project itself and its related studies, along with the consultation program, were presented prior to holding an open discussion with the attendees. Furthermore, focus groups were organized at Makabane and Madouacka on 12th October 2017, following the same procedure.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



Left: Andock Foula, October 10 2017. Right: Alen Komo, October 14 2017
Public meetings

After validation of the draft ESIA and its related drawings by the Promoter, a second series of consultations was implemented to continue the open dialogue with project territorial stakeholders. Study results were given to them in compliance with Gabonese legislation and international standards. The draft ESIA and its related drawings were finalized in the wake of these meetings.

Consultations were carried out at 3 meetings held in the villages of Andock Foula and Alen Komo on 30th July 2018 and of Kango on 31st July 2018 in the presence of the local authorities (Prefecture, Departmental Council, mayor's office, village chiefs and dignitaries), representatives of the ministries most involved ("DGEPN" environmental agency, forestry and water agency, energy ministry), printed and televised media journalists and many other attendees (inhabitants, nationals, NGOs, economic operators, public services, etc.).



Andock Foula



Alen Komo



Kango

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

1.6.2. Concerns and wishes

The populations currently have strong feelings about the hydroelectric projects at Tchimbélé and Kingulé, which are considered of no use to them in a context of bans on hunting and felling in the Monts de Cristal National park, youth unemployment and desertification due to lack of opportunities and infrastructures. They refuse development of a new facility on their territory without deriving benefits and, in priority, electrification. The populations and their representatives also deplore the lack of dialogue and support. This feeling was expressed many times (blocking of road, written petition, oral statements, etc.).

The inhabitants demand a centralized electrification solution (connection to national grid). Electrification is effectively considered not only a component of quality of life (lighting, television, refrigeration, air conditioning, etc.), but also a driver of development in deserted villages.

Other fundamental population needs expressed concern the road - a crucial issue for the economy and health - the lack of a dispensary and medicinal products, and the lack of a telephone system. Moreover, ritual ceremonies must be held by villagers prior to starting work in accordance with Fang's animistic religion.

The villagers also expressed the need for support in (i) managing conflicts with elephants, (ii) marketing agricultural products, (iii) developing growth of non-timber forest products and (iv) transporting people and goods to and from villages. The populations also expressed their wish to see the dam main project camp located near their village to benefit from business opportunities created by the project (e.g. sale of farm products).

Opportunities for receiving tourists were also raised.

In general, the populations demand respect and consideration on the part of project management.

The Departmental health services expressed an ongoing state of acute shortage of medical equipment, the need for a vaccination center as well as access to drinking water and electricity in the villages.

On the social side, the Monts de Cristal National Park advises the project team to give priority to local employment and electrification. On the environmental side, the efficiency of protection against poaching and illegal felling would be enhanced, if the national parks agency ANPN has more eco-guards. Finally, the Monts de Cristal National Park is concerned about the recurrent problem of human-elephant conflicts, which are assuming ever increasing proportions

Experts used the opinions and remarks gathered during the various meetings in their impact assessment and in the definition of measures. The following measures were discussed directly with communities:

- Strengthening of the technical platform of Kango hospital;
- Access to the site's infirmary in the event of an emergency;
- Establishment of a local monitoring and awareness committee, which will also participate in the management of grievances and demographic influx;
- Promote local employment;
- A set of proposed livelihood restoration actions. These actions are detailed proposals within the Livelihood Restoration Plan (LRP) and will be selected in consultation with the villagers before development and implementation;
- Public consultation in Andock Foula to finalize the terms of compensation that could include (i) community investments at village level and or (ii) technical support to improve livelihoods (see LRP);
- In the same way, additional actions eligible under the Local Development Contribution Plan were directly listed with the villagers including the electrification of Andock foula;

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

- The location of the base was also discussed with villagers so that it is "neither too far nor too close" to the village;
- Support the populations of Andock Foula in carrying traditional ceremonies to appease the spirits before the construction start

1.7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

1.7.1. Aim of the esmp

The ESIA is a **planning document**, which provides decision-makers with the information needed for deciding whether to commit to the project or abandon it. The state of the physical, biological and human environment prior to launching the project is described in detail in the ESIA, the potential impacts are analyzed technically and the proposed mitigation measures are clearly justified therein.

The ESMP serves a very different purpose. It is an **operational document**, which is intended to complement this analysis by defining the operational conditions in which these measures will be implemented. As soon as the project is launched, the ESMP becomes the reference document for all its stakeholders in terms of both monitoring action programmed and resolving conflicts. The ESMP is therefore a document complementary to the ESIA report and which is designed to facilitate implementation and monitoring of the multiple measures proposed in the ESIA.

The present ESMP, which accompanies the ESIA within the framework of authorization and financing requests, is destined to evolve until the start of both construction and operation. The present version of ESMP commits the Project Owner, the main Contractor and the Operator to implement the measures identified in the ESIA in accordance with their respective roles and responsibilities. This ESMP is principally intended to be integrated into the contract documents that bind the three main project stakeholders.

The ESMP framework must be constraining but not restrictive: constraining because it must impose adherence to implementing measures at the required places and times upon each of the project parties according to its role and responsibilities and non-restrictive because the ESMP must favor, as far as possible, performance-related goals over means-related goals.

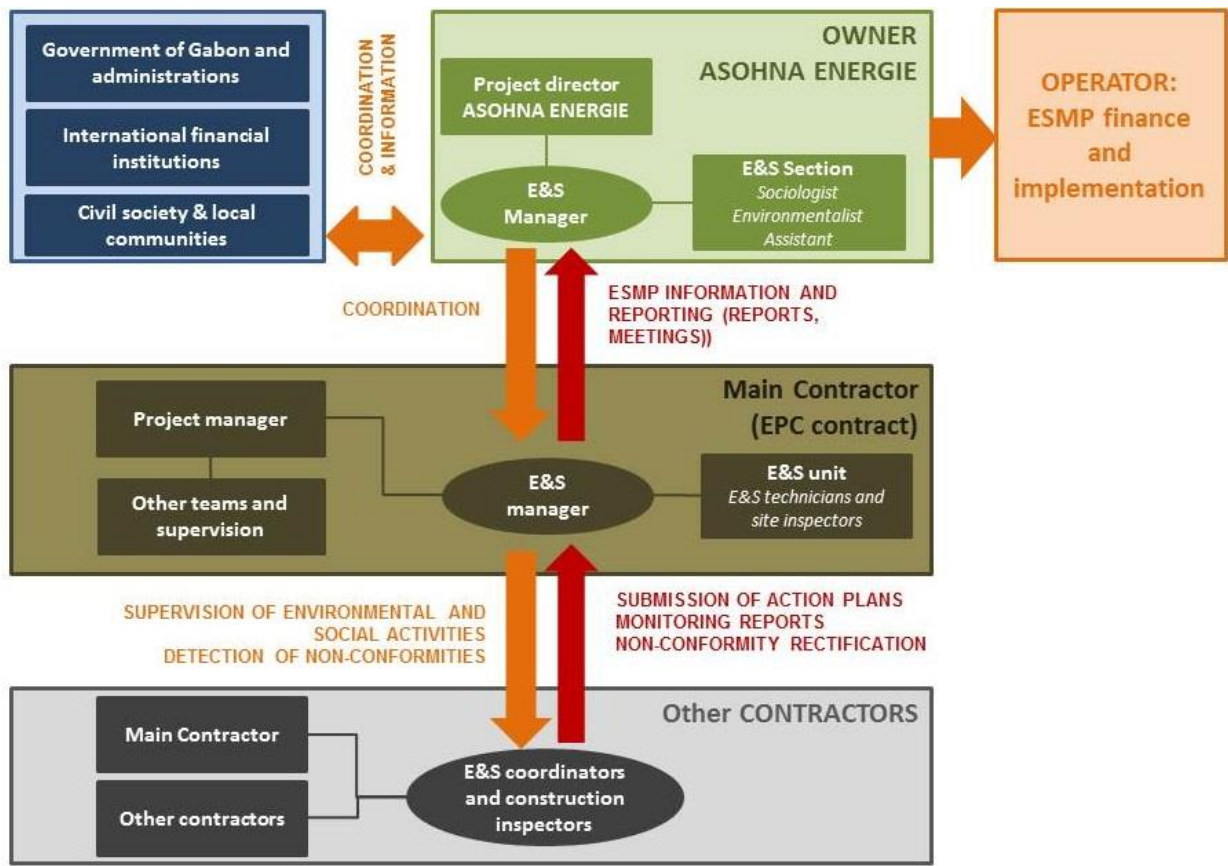
1.7.2. Organization

Project Owner ASOHNA ENERGIE (C), controlled by Meridiam and GPC (an FGIS subsidiary), will draw up a call for tenders to select a Main Contractor (MC) capable of supplying the programmed installations on a "turnkey" basis. In other words, the Project Owner will draw up an Engineering, Procurement, Construction (EPC)-type contract. The Main Contractor selected will assume responsibility for designing and constructing the project installations and will therefore assume the roles of both engineer and construction contractor.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1



General organizational diagram

1.7.3. Procedures and action plans

The ESMP covers all the measures aimed at conserving the integrity of the physical, biological and human environment in the area impacted by the Project. To ensure proper implementation and inspection, the ESMP is composed of a set of procedures and action plans, which are summarized in the table below.

Summary of environmental and social management procedures and plans

PROCEDURES AND ACTION PLANS	RESPONSIBILITY		IMPLEMENTATION PERIOD (YEARS)	PHASE
	FINANCE	IMPLEMENTATION		
MAIN PROCEDURES				
Project Owner E&S team (mobilization, operation) with E&S manager and E&S section team recruitment RES: international expert, E&S section: national social expert, national biodiversity expert, secretariat, vehicle	Project Owner	Project Owner	5 yrs full time, 5 yrs part-time	Phase prior to construction, construction phase, operation phase
E&S manager & E&S section team mobilization	Project Owner	Project Owner	1	Phase prior to construction
Communication procedures and Stakeholder Engagement Plan	Project Owner	Project Owner	5	Phase prior to construction and construction phase
Implementation of a Grievance mechanism	Project Owner	Project Owner	5	Phase prior to construction and construction phase
Recruitment procedure	Main contractor	Main contractor	0.5	Phase prior to construction
S&E manager audit procedures	Project Owner	Project Owner	10	Construction and operation phases

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

PROCEDURES AND ACTION PLANS	RESPONSIBILITY		IMPLEMENTATION PERIOD (YEARS)	PHASE
	FINANCE	IMPLEMENTATION		
Expert panel audit procedures. 2 international experts with 2 x 9-day assignments/year	Project Owner	Project Owner	5	Phase prior to construction, construction phase, 1 st year of operation
PRELIMINARY ACTION PLAN (EXCLUDING BIODIVERSITY)				
Additional studies	Main contractor	Main contractor	1	
Drafting E&S specifications for contractors	Project Owner	Project Owner	1	Phase prior to construction
Drafting of detailed ESMP for main contractor and Project Owner check	Main contractor	Main contractor	0.5	Phase prior to construction
Drafting of detailed ESMP for operator	Operator	Operator	0.5	Before start of operation
ENVIRONMENTAL AND SOCIAL MANAGEMENT DURING CONSTRUCTION (EXCLUDING BIODIVERSITY)				
Atmospheric, dust and noise emission management plan	Main contractor	Main contractor	3.5	Construction phase
Earthwork and erosion management plan	Main contractor	Main contractor	3.5	Construction phase
Waste management plan	Main contractor	Main contractor	3.5	Construction phase
Explosive, hazardous product and pollutant management plan including spill response plan	Main contractor	Main contractor	3.5	Construction phase
Water quality and discharge monitoring management plan	Main contractor	Main contractor	3.5	Construction phase
Environmental monitoring plan: water quality monitoring in River Mbè every 2 months	Project Owner	Project Owner	4.5 (incl. 1 yr before construction)	Phase prior to construction Construction phase
Environmental monitoring plan: air quality monitoring every month	Project Owner	Project Owner	3.5	Construction phase
Environmental monitoring plan: noise pollution monitoring every month	Project Owner	Project Owner	3.5	Construction phase
Road traffic management plan	Main contractor	Main contractor	3.5	Construction phase
Camp, access and installation security management plan	Main contractor	Main contractor	3.5	Construction phase
Occupational health, hygiene and safety plan	Main contractor	Main contractor	3.5	Construction phase
Social influx management plan	Main contractor	Main contractor	3.5	Construction phase
Community health plan	Main contractor	Main contractor	3.5	Construction phase
Cultural heritage management plan. Provision for promoting discoveries and arrangements for archaeologist.	Main contractor	Main contractor	3.5	Construction phase
Compensation procedure for loss of services provided by ecosystems and for fishing	Project Owner	Project Owner	6	Construction phase and 1 st 2 years of operation
ENVIRONMENTAL AND SOCIAL MANAGEMENT DURING OPERATION (EXCLUDING BIODIVERSITY)				
Waste management plan	Operator	Operator	Operating phase.	
Explosive, hazardous product and pollutant management plan including spill response plan	Operator	Operator		
Water quality and discharge monitoring management plan	Operator	Operator		
Environmental monitoring plan: water quality monitoring twice a year	Operator	Operator		
Environmental monitoring plan: monitoring of reservoir and dam downstream sedimentation every 3 years	Operator	Operator		
Environmental monitoring plan: monitoring of estuary dynamics and morphology every 5 years	Operator	Operator		

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

PROCEDURES AND ACTION PLANS	RESPONSIBILITY		IMPLEMENTATION PERIOD (YEARS)	PHASE
	FINANCE	IMPLEMENTATION		
ACTION PLAN FOR BIODIVERSITY CONSERVATION (SEE BAP)				
Main procedure (Project Owner E&S team and expert panel)	see detail in BAP			All phases
Preliminary action plan before construction				
Action plan during construction phase (incl. compensation and restoration)				
Action plan during operating phase				
VOLUNTARY CONTRIBUTION TO LOCAL AND REGIONAL DEVELOPMENT				
Voluntary contribution to local and regional development. Main objective: electrification of villages	Project Owner			Operating phase
Voluntary contribution to local development	Project Owner			Operating phase

Main contractor operates under an EPC-type contract.

1.7.4. Environmental performance indicators

Monitoring the efficiency of environmental and social management plans and programs is essential by ensuring targets are fully achieved on time and related impacts are either avoided, mitigated or compensated. For each plan or program, several quantitative indicators are proposed to guaranty this monitoring work, along with a dedicated period of time.

Monitoring the indicators will be under the responsibility of the Contract Holder. The CH will set up a reporting system with the main contractor and other companies in order to generate needed information for the compilation of the proposed indicators.

Proposed indicators are here below presented. Notice that Indicators could be modified during the ESMP implementation through auditing control process and update.

ESMP monitoring indicators

PLANS AND MEASURES	PERFORMANCE TARGETS OBLIGATIONS OF MEANS AND / OR RESULTS	FOLLOW-UP PERIOD	MONITORING FREQUENCY	MEANS OF FOLLOW-UP
MAIN PROCEDURES and ENVIRONMENTAL AND SOCIAL PRELIMINARY MANAGEMENT PLAN WORK				
External communication procedure	<ul style="list-style-type: none"> ▪ 100 % of respondents say they are satisfied with the communication procedure 	Preconstruction Construction	Yearly	<ul style="list-style-type: none"> ▪ Satisfaction survey among sample of stakeholders and PAP
Procedure for reception and complaints following up	<ul style="list-style-type: none"> ▪ 100 % of respondents say they are satisfied with the complaints procedure ▪ 100 % of complaints submitted were followed up and answered within less than 30 days. 	Preconstruction Construction	Quarterly	<ul style="list-style-type: none"> ▪ Satisfaction survey among sample of stakeholders and PAP ▪ Complaints database
Recruitment procedure	<ul style="list-style-type: none"> ▪ Percentage (80%) of local jobs positions (Gabonese) compared vs total workforce available for the project ▪ 100 % of staff have received initial environmental and social training 	Preconstruction Construction	Quarterly	<ul style="list-style-type: none"> ▪ Complaints database
Control procedures	<ul style="list-style-type: none"> ▪ Less than 10 NC level I ▪ Less than 5 NC level II ▪ No level III NC 	Preconstruction Construction	Quarterly	<ul style="list-style-type: none"> ▪ RES audits
Preparation of company detailed specifications	<ul style="list-style-type: none"> ▪ ESMP obligations are included in the project contracts 	Preconstruction	Unique	<ul style="list-style-type: none"> ▪ Audit of the DCE of the AO and contract of the main contractor by the RES

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

PLANS AND MEASURES	PERFORMANCE TARGETS OBLIGATIONS OF MEANS AND / OR RESULTS	FOLLOW-UP PERIOD	MONITORING FREQUENCY	MEANS OF FOLLOW-UP
Administration support program for monitoring of the ESMP implementation and preservation of hydroelectric potential	<ul style="list-style-type: none"> ▪ Validation of the manufacturer's ESMP and audit grid ▪ 100% of the budgets available for field missions 	Preconstruction Construction	Quarterly	<ul style="list-style-type: none"> ▪ Administration audit
Additional study on the natural environment	<ul style="list-style-type: none"> ▪ See PAB 	Preconstruction	See PAB	<ul style="list-style-type: none"> ▪ See PAB
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN WITHIN EXECUTION PHASE				
Environmental management				
Air emissions, dust and noise management plan	<ul style="list-style-type: none"> ▪ Avail, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance ▪ No complaints 	Construction	Monthly	<ul style="list-style-type: none"> ▪ DES Report ▪ Complaints register ▪ RES Audit
Civil work and Erosion Management Plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance ▪ No complaints ▪ MES rejection less than 50% and 100% increase for level 1 and 2 non-compliance thresholds respectively. ▪ 100 % of areas are rehabilitated after works. 	Construction	Monthly	<ul style="list-style-type: none"> ▪ DES Report ▪ Complaints recorder ▪ RES Audit
Waste management plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance ▪ No complaints 	Construction	Monthly	<ul style="list-style-type: none"> ▪ DES report with waste tracking sheets ▪ Complaints recorder ▪ RES Audit
management plan for explosives, dangerous products and pollutants	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance ▪ Avail of lists of approved products corresponding to 100 % of products used ▪ 100% pesticide compliance WHO and Gabonese regulations ▪ Avail of procedure related to explosives handling, use and storage ▪ Preparation of daily reports on the use of explosives 	Construction	Monthly	<ul style="list-style-type: none"> ▪ DES Report ▪ RSES audit ▪ Explosives monitoring daily report (if used)
Quality management and release monitoring plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO including the approved operating procedures for various water treatment facilities ▪ No level 2 and 3 non-compliance ▪ 100 % of wastewater is treated ▪ 100 % of site maintenance and hydrocarbon storage facilities have watertight blanket and hydrocarbon separator 	Construction	Monthly	<ul style="list-style-type: none"> ▪ DES report including the release monitoring report ▪ RES Audit

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

PLANS AND MEASURES	PERFORMANCE TARGETS OBLIGATIONS OF MEANS AND / OR RESULTS	FOLLOW-UP PERIOD	MONITORING FREQUENCY	MEANS OF FOLLOW-UP
	<ul style="list-style-type: none"> ▪ Approved sedimentation pool for the recovery of wash water containing concrete ▪ Absence of impact on water quality due to activities on site, evaluated along the streams. ▪ Non-compliance rate values in accordance with Gabonese regulations and/or international standards (WHO, SFI, etc.) 			
H release plan	<ul style="list-style-type: none"> ▪ Avail of the Plan validated by the PO 100 % of spills met treatment actions undertaken daily. 	Construction	Monthly	<ul style="list-style-type: none"> ▪ DES Report ▪ RES Audit
Environmental monitoring plan (Air, Noise and Water of Mbé river) (Excluding biodiversity)	<ul style="list-style-type: none"> ▪ Avail, validation and implementation of the plan validated by the PO ▪ No complaints (water, noise and waste) ▪ Mbé river: < 10 % gap between upstream and downstream of discharges / site (same day) in connection with the project. ▪ Mbé river : similar to previously known measurements 	Construction	Monthly to bi-monthly	<ul style="list-style-type: none"> ▪ RES report, including environmental monitoring report ▪ Complaints record ▪ RES Audit
Social management				
Road traffic management plan	<ul style="list-style-type: none"> ▪ Avail, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance ▪ 100 % of drivers trained in road safety ▪ No road accident involving a project vehicle 	Construction	Monthly	<ul style="list-style-type: none"> ▪ RES audits
Camp, access and facilities management plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the Project-Holder ▪ No level 2 and 3 non-compliance ▪ No illness or affliction due to living conditions and hygiene on site ▪ No accident by local residents on the project site or caused by the project 	Construction	Monthly	<ul style="list-style-type: none"> ▪ E&S specifications ▪ Contract of Project-Holder and contractors ▪ DES Report ▪ RES audits
Occupational hygiene, health and safety plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance ▪ 100 % of workers trained for various plans of prevention ▪ No illness or affliction due to living conditions and hygiene on site ▪ No accidents on site ▪ No deaths on site 	Construction	Monthly	<ul style="list-style-type: none"> ▪ E&S specifications in the main contractor and operator contract ▪ DES Report ▪ RES audits ▪ Health center data
Social influx management plan	<ul style="list-style-type: none"> ▪ No installation of migrants within a defined radius around the site area ▪ 100% of worker's children living with family in Andock Foula (excluding the camp) have a school transport solution toward Alen Komo school ▪ 100% of opening bars within a defined radius around the site area are identified and visited 	Preconstruction Construction	Quarterly	<ul style="list-style-type: none"> ▪ DES Report ▪ CSR Audit : Physical visit to (i) the area prohibited for installations and dedicated installation zones and (ii) open bars and restaurants.
Community health plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance 	Construction Operation	Quarterly	<ul style="list-style-type: none"> ▪ RES report including results of the prevalence monitoring by

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

PLANS AND MEASURES	PERFORMANCE TARGETS OBLIGATIONS OF MEANS AND / OR RESULTS	FOLLOW-UP PERIOD	MONITORING FREQUENCY	MEANS OF FOLLOW-UP
	<ul style="list-style-type: none"> ▪ Awareness to hygiene practice of 100% of workers and 2 villages residents, such as sexual risks, including distribution of condoms and voluntary checking of sexual deceases. ▪ Project should not be impacted by STDs and HIV / AIDS ▪ No influence of the project on water generated diseases 			<p>the Komo hospital and lists of people sensitized</p> <ul style="list-style-type: none"> ▪ CSR audit
Cultural materials management plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO including procedure of fortunate discovery ▪ 100% of the remains discovered are carefully stored according to procedure of archaeological materials fortunately exposed 	Construction	Monthly	<ul style="list-style-type: none"> ▪ DES Report ▪ Archaeologist's site visit notes
PRME for compensation for the loss of ecosystem services	<ul style="list-style-type: none"> ▪ Consultation with PAPs for compensation terms ▪ 100% of the compensation budget used within 6 years 	Construction	To define together with the population	<ul style="list-style-type: none"> ▪ RES quarterly visit ▪ Compensation program final audit
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN DURING OPERATION PHASE				
Environmental management				
Waste management plan	<ul style="list-style-type: none"> ▪ Existence of the Plan validated by the PO ▪ Compliance with the Plan, no level 2 and 3 non-compliance ▪ No complaints 	Operation	Quarterly	<ul style="list-style-type: none"> ▪ Operator's waste tracking sheets ▪ Complaints record
Management plan for dangerous and polluting products	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance ▪ Presence of approved product lists corresponding to 100 % of products in use ▪ No WHO 1A or 1B product ▪ Compliance with the Plan, no level 2 and 3 non-compliance 	Operation	Quarterly	<ul style="list-style-type: none"> ▪ Operator's dangerous products management monitoring report
Accidental release plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO ▪ No level 2 and 3 non-compliance ▪ 100 % of the spills were treated on daily basis. 	Operation	Monthly	<ul style="list-style-type: none"> ▪ Operator accident report
Water quality management and releases quality monitoring plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO including the presence of approved operating procedures for the various water treatment facilities ▪ No level 2 and 3 non-compliance ▪ 100 % of wastewater is treated ▪ Measurements of non-compliance thresholds values in accordance with Gabonese regulations and or international standards (WHO, SFI, etc.) 	Operation	Quarterly	<ul style="list-style-type: none"> ▪ Operator's release monitoring report
Environmental monitoring plan (excluding biodiversity)	<ul style="list-style-type: none"> ▪ Mbé river: < 10 % gap between upstream and downstream of the structure ▪ Mbé river: similar with previously known measurements values ▪ Report the evolution of sedimentation 	Operation	Biannual (water) Annual (sedimentation)	<ul style="list-style-type: none"> ▪ Operator's environmental monitoring report

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

PLANS AND MEASURES	PERFORMANCE TARGETS OBLIGATIONS OF MEANS AND / OR RESULTS	FOLLOW-UP PERIOD	MONITORING FREQUENCY	MEANS OF FOLLOW-UP
	<ul style="list-style-type: none"> ▪ Report the cleaning operations (if applicable) 			
Social management				
Public health and safety management plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO ▪ No accident of a local resident caused by the operation of the structure 	Operation	Quarterly	<ul style="list-style-type: none"> ▪ RES Audit ▪ Operator monitoring report
OTHER				
Contribution to local development plan	<ul style="list-style-type: none"> ▪ Objective priority: Electrification solution for 4 villages within the project impacting area when it is executed ▪ 100% of the annual budget used 	Construction Operation	Annual	<ul style="list-style-type: none"> ▪ RES Report
Emergency prevention and management plan	<ul style="list-style-type: none"> ▪ Existence, validation and implementation of the plan validated by the PO, the operator and authorities ▪ Annual alert exercise for the entire chain 	Operation	Annual	<ul style="list-style-type: none"> ▪ Operator monitoring report

1.7.5. Grievance redress mechanism

A grievance redress mechanism will be set up, allowing local communities to report issues related to construction. Specifically, this mechanism aims at:

- Informing project affected persons (PAP) and other stakeholders about their rights to share their concerns with project representatives
- Encouraging free expression of requests, grievances, complaints, issues and concerns related to the project;
- Promote the use of non-judiciary procedures for projects related issues;
- Provide an accessible and culturally acceptable mechanism to enable individuals and communities to express their concerns transparently;
- Deal effectively, fairly, impartially and transparently with grievances from people affected by the project;
- Establish and improve permanent relationship based on trust and mutual respect among stakeholders.

The most frequently expected complaints relate to::

- Noise and / or dust near construction site and along the road (supplying trucks)
- Disputes related to recruitment procedures;
- Grievance relating to properties damaged by construction activities (machinery moving back into a field or garden and destroying part of the crop, damage to fences or other structures, running over chickens or cattle, etc.).

The grievance redress mechanism follows the steps presented below :

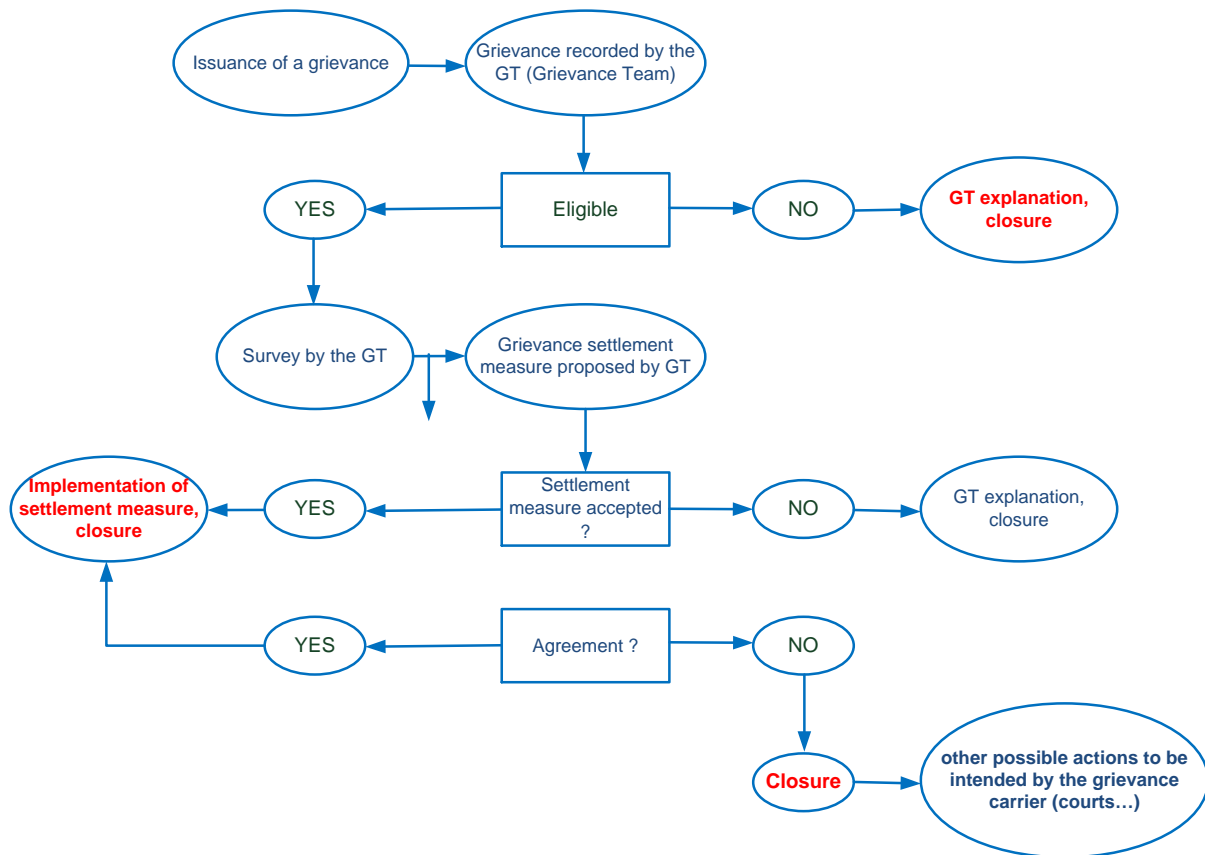
- Reception and registration. Grievance submitted orally or in writing are collected by the Grievance team (GT).Grievance are recorded in a grievance registry by the GP in order to keep a handwritten physical files; as well as in the project societal database. Several channels will be available in order to communicate with the Grievance Team.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

- Investigation or survey. An investigation will be initiated within one to two weeks after reception of a grievance. The purpose of this investigation is to check the case and to determine the level of seriousness of the grievance. The investigation will be carried out by the GT (simple cases) or by a mediation committee (CM) assisted by the GT (cases requiring mediation). The CM composition will be agreed with communities, customary and administrative authorities of the project area. Members could be selected from the project monitoring committee (see SEP), which generally monitor the project at local and departmental levels.
- Greivance settlement. Two entities can manage the settlement of a grievance: (i) the GT sufficient for most simple cases and (ii) the mediation committee (CM) in order to settle the grievance independently and impartially through mediation.
- If the person that has submitted the grievance is not satisfied, he can then go to ordinary court.



MGRP flowchart

1.7.6. ESMP budget

The table below presents a summary of the ESMP procedures and plans, précising for each item responsibilities, phases, implementation schedule, as well as the budget to be offered by the PO.

The budget is described for the pre-construction phase (evaluated to one year) and for the construction phase (evaluated to 3.5 years), adding, if necessary, the first year of operation.

As for the operating phase, the total budget is indicated for the period of the concession, ie 30 years. The total budget includes the pre-construction, construction and operation budgets.

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1**ESMP Budget**

EP : Main Contractor (EPC-type contract), PO : Project Owner, EXP : Operator. . .

CORRECTIVE ACTION / ACTION	RESPONSIBILITY		DURATION (YEARS)	PHASE	BUDGET			
	FUNDING	IMPLEMENTATION			PRE-CONSTRUCTION (1 YEAR) IN K €	CONSTRUCTION (3.5 YEARS) IN K €	CONCESSION	TOTAL
Main procedures								
PO E&S team (Constitution and operation) with RES recruitment & SES team) RES : International expert SES : National social expert, National biodiversity expert, secretariat, vehicle Controls the implementation of E&S aspects by the main company and the operator, consultation and coordination with PAPs, implementation of SEP, Grievance mechanism and the compensation procedure	PO	PO	5 years full time 30 years part time	Preliminary work phase, construction phase Operation phase	137	548	497	1,182
RES training & SES team	PO	PO	1	Preliminary phase of works	5			5
Communication procedures and SEP (including grievance management)	PO	PO	5	Preliminary phase of works and construction phase	Included with E&S team	Included with E&S team		Included with E&S team
Recruitment procedure	EP	EP	0.5	Preliminary phase of works	5			5
CSR control procedures (audits)	PO	PO	10	Construction and operation phase		Included with E&S team	Included with E&S team	Included with E&S team
Control procedures (audits) panel of experts Two international experts, with 2 missions of 9 days per year	PO	PO	5	Preliminary work phase, construction phase And first year of operation	28	112		140
Administration support program for monitoring the implementation of ESMP	PO	PO	5	Preliminary work phase, construction phase And first year of operation	22	80		102

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

CORRECTIVE ACTION / ACTION	RESPONSIBILITY		DURATION (YEARS)	PHASE	BUDGET			
	FUNDING	IMPLEMENTATION			PRE-CONSTRUCTION (1 YEAR) IN K €	CONSTRUCTION (3.5 YEARS) IN K €	CONCESSION	TOTAL
Administration support program for the preservation of hydroelectric potential	PO	PO	Concession	Construction and operation phase		Included in PAB budget	Included in PAB budget	
SUB-TOTAL	-	-	-		197	740	four hundred ninety seven	1,433
Preliminary action plan (excluding biodiversity)								
Additional studies	EP	EP	1		(1)			(1)
Preparation of companies' E&S specifications	PO	PO	1	Preliminary phase of works	Included with E&S team			Included with E&S team
Preparation of the detailed ESMP of the main company and control by the MO	EP	EP	0.5	Preliminary phase of works	Included with E&S team			Included with E&S team
Preparation of the operator's detailed ESMP	EXP	EXP	0.5	Before the start of operations	Included with E&S team			Included with E&S team
SUB-TOTAL	-	-	-		0	0	0	0
Environmental and social management during construction phase (excluding biodiversity)								
Air emissions, dust and noise management plan	EP	EP	3.5	Construction phase		200		200
Earthworks and Erosion Management Plan	EP	EP	3.5	Construction phase		200		200
Waste management plan	EP	EP	3.5	Construction phase		700		700
Explosives, Hazardous Products and Pollutants Management Plan including Accidental Spill Management Plan	EP	EP	3.5	Construction phase		200		200
Water quality management plan and discharge monitoring	EP	EP	3.5	Construction phase		300		300
Environmental monitoring plan: monitoring of Mbè water quality every two months	PO	PO	5	Preliminary work phase; Construction phase	11	45		55
Environmental monitoring plan: air quality monitoring every month	PO	PO	3.5	Construction phase		Included with E&S team		Included with E&S team

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

CORRECTIVE ACTION / ACTION	RESPONSIBILITY		DURATION (YEARS)	PHASE	BUDGET			
	FUNDING	IMPLEMENTATION			PRE-CONSTRUCTION (1 YEAR) IN K €	CONSTRUCTION (3.5 YEARS) IN K €	CONCESSION	TOTAL
Environmental monitoring plan: monitoring of noise pollution every month	PO	PO	3.5	Construction phase		Included with E&S team		Included with E&S team
Road traffic management plan	EP	EP	3.5	Construction phase		150		150
Camp, access and facility management plan	EP	EP	3.5	Construction phase		1,100		1,100
Occupational hygiene, health and safety plan	EP	EP	3.5	Construction phase		500		500
Influx management plan	EP	EP PO	5	Preliminary phase of works; Construction phase	7	21		27
Community health plan	EP	EP PO	3.5	Construction phase		200 Included with E&S team		200
Cultural heritage management plan Provision for discoveries and support for the archaeologist	EP PO	EP PO	3.5	Construction phase		10		10
LRP for compensation for the loss of ecosystem services	PO	PO	4	Construction phase and first year of operation	17	122		139
SUB-TOTAL	-	-	-		34	3,747	0	3,781
Environmental and social management during operation phase (excluding biodiversity)								
Waste management plan	EXP	EXP	Concession	Operation phase		4	116	120
Hazardous and pollutant management plan including accidental spill management plan	EXP	EXP	Concession	Operation phase		2	58	60
Water quality management plan and discharge monitoring	EXP	EXP	Concession	Operation phase		2	58	60
Environmental monitoring plan: monitoring of water quality twice a year	EXP	EXP	Concession	Operation phase		5	145	150
Environmental monitoring plan: monitoring of sedimentation in the reservoir and downstream of the structure every 3 years	EXP	EXP	Concession	Operation phase		4	96	100

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

CORRECTIVE ACTION / ACTION	RESPONSIBILITY		DURATION (YEARS)	PHASE	BUDGET			
	FUNDING	IMPLEMENTATION			PRE-CONSTRUCTION (1 YEAR) IN K €	CONSTRUCTION (3.5 YEARS) IN K €	CONCESSION	TOTAL
Environmental monitoring plan : contribution to monitoring the dynamics and morphology of the estuary every 5 years as part of the cumulative impact of the Mbé and Komo hydroelectric projects	EXP	EXP	Concession	Operation phase			90	90
SUB-TOTAL					0	18	562	580
Biodiversity Action Plan (See PAB)								
Main procedure (MO E&S team, expert panel and ANPN support for BV monitoring). The budget comes in addition to the E&S team budget of the ESMP see first line of the budget					1	8	43	52
Preliminary action plan before works execution					206	-	-	206
Action plan in the works execution phase (including compensation and restoration)		See PAB		See PAB	141	1,267	617	2,025
Operational phase action plan					25	199	71	295
Follow-up actions					62	294	423	779
Land values based on the value of the trees (700 ha, i.e. an overall ratio of 1 to 2.5)					0	200	0	350
SUB-TOTAL					435	1,967	1,154	3,706
TOTAL ESMP including PAB and 10% contingency in k €					732	7,119	2,435	10,286
TOTAL ESMP including PAB and 10% contingency in million CFA francs					488	4,746	1,623	6,857

Kinguélé Aval Hydroelectric Development (34MW)

Environmental and Social Impact Study

NON TECHNICAL SUMMARY FOR SUBMISSION TO AFRICAN DEVELOPMENT BANK (AFDB)- REV 1

Budget for the contribution of local and regional development

CORRECTIVE ACTION / ACTION	RESPONSIBILITY		DURATION OF IMPLEMENTATION (YEARS)	PHASE	BUDGET			
	FUNDING	IMPLEMENTATION			PRE-CONSTRUCTION (1 YEAR) IN K €	CONSTRUCTION (3.5 YEARS) IN K €	CONCESSION IN K €	TOTAL
Voluntary contribution to local development								
Voluntary contribution to local development. Main objective of village electrification	PO	PO	4	Construction phase		500		
Voluntary contribution to local development	PO	PO	4	Construction phase		200		
TOTAL in k €						700		700
TOTAL in million CFA francs						467		467