

6.1

INTRODUCTION

The baseline for the study of physical, social and economic information is based on the following sources of information:

- documentary review of the scientific literature and publicly available information;
- a scoping mission carried out the week of November 12, 2018 and a mission of study of the initial state carried out the week of November 26, 2018 were carried out by the international consulting company ERM (mobilization of three international consultants) and at the support of the local expertise of the Ivorian consulting firm ENVAL (mobilization of four national consultants);
- a rapid 3-day biodiversity survey conducted by two ENVAL consultancy flora experts and two wildlife experts, including a national expert from ENVAL and a senior biodiversity expert from ERM; and
- public consultations and guided interviews carried out as part of the project during the scoping and baseline studies, supervised by a social expert from ENVAL and an ERM consultant. The reports of the consultations held the week of November 26, 2018 in the villages of Taboth, Sassako Begnini, N'Djem, Avagou, Adoukro and Abreby are presented in the Appendix.

At the time of finalizing this report (February 2019), ERANOVE plans to complete the baseline studies in order to refine the assessment of the sensitivity of the natural and human environment in the Project area. This will include:

- additional studies on biodiversity (search for presence or absence of chimpanzees in swamp forest areas in the north of the zone, in particular);
- a validation of the qualitative and quantitative capacity of the Continental Terminal aquifer at the site right, by means of hydraulic drilling and well testing, notably to determine its productivity, the quality of the groundwater, the presence or the absence of confinement of the aquifer in view of the geology to the right of the Project site;
- the extension of the socio-economic study to fishermen, potentially affected by the Project, particularly in the context of studies relating to the Resettlement Action Plan and the Livelihoods Restoration Plan carried out on behalf of the Project by the BNEDT.

6.2 *QUALITY OF AIR*

6.2.1 *Area of Study*

The air quality study area is defined according to the scope of the Project's estimated impacts on sensitive human and environmental receptors. As explained in Chapter 4, Framing and Project Areas, its extent depends on the components being evaluated. Thus, the air quality study area is divided into two distinct time phases:

- the 40-month construction phase, for which it extends to approximately 500 m around the project sites (including from the storage areas); and
- The 30-year operational phase, for which this zone expands to around 10 km around the project's main emission sources.

In this context, the area considered for the baseline assessment includes the maximum extent potentially impacted by the project, that of the operation phase, 10 km around the project's main emission sources.

6.2.2 *Methodology for data collection*

In the absence of an air quality monitoring network to regularly estimate pollution levels in Côte d'Ivoire, the assessment of air quality in the study area and the definition of the initial state of the project was qualitatively carried out as part of this study. Air quality measurements for NO_x and NO₂ (major pollutant related to the activity of a thermal power plant) are underway on the site of the future plant for a period of three months from December 27 2018. The measurement is carried out by passive sampling, using passive diffusion tube from the Passam approved laboratory. The results will be annexed to the ESIA when available and submitted to ANDE as well as other stakeholders interested in the Project.

6.2.3 *Climate*

Côte d'Ivoire is in the tropical equatorial climate zone. The country's climate is influenced by the seasonal movement of the Intertropical Convergence Zone (ITCZ). The alternation between the dry season and the rainy season results from the annual north-south migration of the ITCZ, which is due to the annual changes of position of the Earth in relation to the sun. The average air temperature recorded near Abidjan is 26 ° C.

Precipitation and humidity

The study area for construction and operation is characterized by heavy rainfall with rainfall ranging from 1,500 to 2,000 mm per year in Abidjan. The average annual rainfall for Abidjan between 1960 and 2012 was 1,910 mm¹. The main rainy season usually lasts from May to July. The short rainy season is between October and November. The months of August and September, often referred to as a short dry season, are dry and cool. The main hot and dry season is between December and April. The relative humidity in Abidjan usually exceeds 80% throughout the year².

Wind Systems

The direction of the prevailing wind is almost exclusively from the southwest in the region of Abidjan. The following figure identifies the average wind speed between 2011 and 2015. Wind speeds above 3 m / s are the most common, occurring approximately 54% of the time..

Table 6.1 *Average wind speeds (2011 -2015)*

Month	Number of hours above 3 m/s	Hours above 5.3 m/s
January	297	32
February	364	77
March	416	88
April	378	72
May	387	62
June	443	65
July	445	44
August	412	44
September	432	64
October	475	83
November	390	48
December	280	21
Annual	4719	701

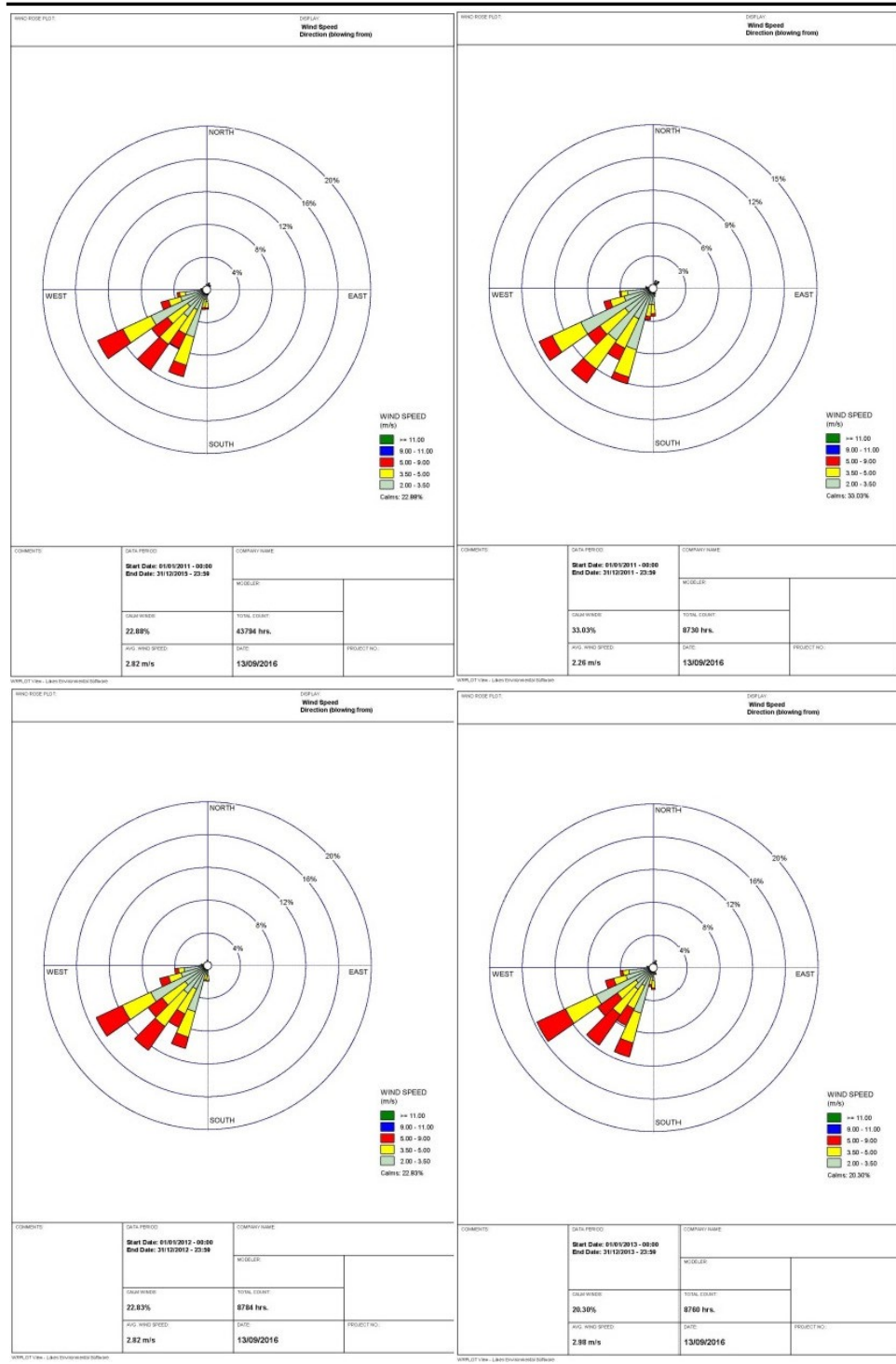
source: Meteorological data from the Abidjan airport obtained by ADM Ltd., 2011 - 2015 Processed by the USEPA AERMET program.

The Ivorian continental shelf is exposed to the anticyclonic system of the southern hemisphere. Just as in the equatorial zone, it is subject to the influences of the trade winds. There is significant seasonal and year-to-year variability in the wind field. The monsoon trade winds blow for 10 months of the year from the southwest and southeast. They are generally weak (3 to 4 m / s), regular and characterized by a daily cycle. Their speed may increase during the northern summer (4 to 6 m / s).

¹ Danumah, JH, Odai, SN, Saley, MB, Szarzynski, J Adjei, K., and Kouame, FK (2013), A Model for Stochastic Weather Generator Hydroclimatic Provision in Urban Flood Risk Assessment in District Abidjan (Ivory Coast .) in Filho, WL ed, Innovation Climate Change, Switzerland: Springer International.

² UNEP, Ivory Coast's Summary, <http://www.unep.org/DEWA/water/groundwater/africa/English/reports/CountrySummaries/Cotedivoire/Eng-COTE%20D'IVOIRE%20SUMMARY.pdf> accessed 9/11/16.

Figure 6.1 Wind Roses for Abidjan Airport 2011-2015



6.2.5 *Receptors*

The area of study covered by the air quality assessment extends up to 10 km around the project site. The sensitive receptors identified within this zone, both human and environmental, are as follows:

- the resident populations of the villages closest to the plant, Taboth and Avagou;
- the populations of the villages around the power plant, particularly those located downwind of the prevailing winds, ie to the northeast of the project site in the perimeter of the study area;
- the terrestrial flora and fauna present in the vicinity of the plant, particularly those located to the north-east of the plant; and
- Vegetation close to the construction site and roads used to transport materials.

6.2.6 *Initial Evaluation*

Measurement Campaign

An air quality measurement campaign focusing on the monitoring of nitrogen dioxides (NO₂) and nitrogen oxides (NO_x) is in progress at the site of the future plant. The measurement campaign is conducted by passive sampling, using passive diffusion tube from the Passam approved laboratory, in accordance with IFC technical guidelines for exposure times of passive tubes.

The location of the measuring points was chosen to be close to the most exposed receptors by the project, with prevailing winds in the sensitive areas mainly located in the northeast of the project site. All measurement points are within the study's ESIA study area and mostly downwind of the prevailing winds.

Characterization of air quality

No air quality data is currently available for the Project site. The characterization of air quality conditions in the Project area was qualitatively carried out following a literature review. This characterization will be updated according to the results of the current air quality measurement campaign, in particular to present the concentrations of pollutants considered.

Given the lack of sources of pollution in and around the Project area and the rural nature of the Project, it was considered that the air quality is not degraded.

Standards and reference Regulation

In the absence of existing Ivorian ambient air quality regulations, the modeled atmospheric concentrations are compared to the standards specified by the IFC EHS Directive and European regulations.

IFC's standards for air quality are detailed in the 2007 EHS Environmental, Health, and Safety Guidelines for Air Emissions and Ambient Air Quality. These guidelines reflect the recommendations of the World Health Organization (WHO), see <http://www.who.int/en>. European regulatory limits for air quality are laid down in Directive 2008/50 / EC.

IFC's standards are divided into two levels: recommended threshold values and intermediate transition objectives. These intermediate values are intended to enable emerging countries to progressively evolve towards threshold values, while taking into account the constraints related to their lower industrial development. They also apply to areas already subject to advanced air degradation at the time of initial project status. For this study, the recommended IFC cut-off values are applied.

6.3 ***NOISE***

6.3.1 ***Area of study***

The area considered for the study of noise is defined according to the scope of the impacts of the estimated project on sensitive human and environmental receptors. It is of variable extent, depending on the components evaluated. The area considered for the initial sound assessment includes the maximum extent potentially impacted by the project, ie 2 km around the project's main emission sources. As part of this study, only the site of the plant was considered for a quantitative study. The sound environment along the route of the power line and other associated infrastructure is presented qualitatively.

6.3.2 ***Emission Sources***

The project site is located near the village of Taboth and Ébrié lagoon. The main sources of noise are:

- the movement of machines and vehicles;
- maritime traffic on the lagoon Ebrié;
- village and agricultural activities in Taboth;

- the sounds of wildlife (including birds and insects during the day at night);

6.3.3 *Receptors*

The project site is located approximately 1 km southeast of the village of Taboth, in the town of Jaqueville, about 2 km south of the lagoon. The nearest residential areas are located approximately 350 m from the northwestern boundary of the lot (Camp Bété).

Sensitive receptors identified within this region, both human and environmental are as follows:

- resident populations of the village of Taboth, BT and Matthieu camps; and
- animal species living in the area.

6.3.4 *Initial Evaluation*

Methodology

The noise measurement campaign allows the evaluation of the initial sound levels at the project site. The measurements are representative of the sensitive receivers most exposed to the projected noise emissions of the project, and are therefore carried out within a radius of 2 km. The noise measurement protocol and the recording device are consistent with IFC's environmental, health and safety guidelines: Environment - Noise Management, as well as the requirements of the ISO 1996 Part 2 *Determination of Environmental Noise Levels*.

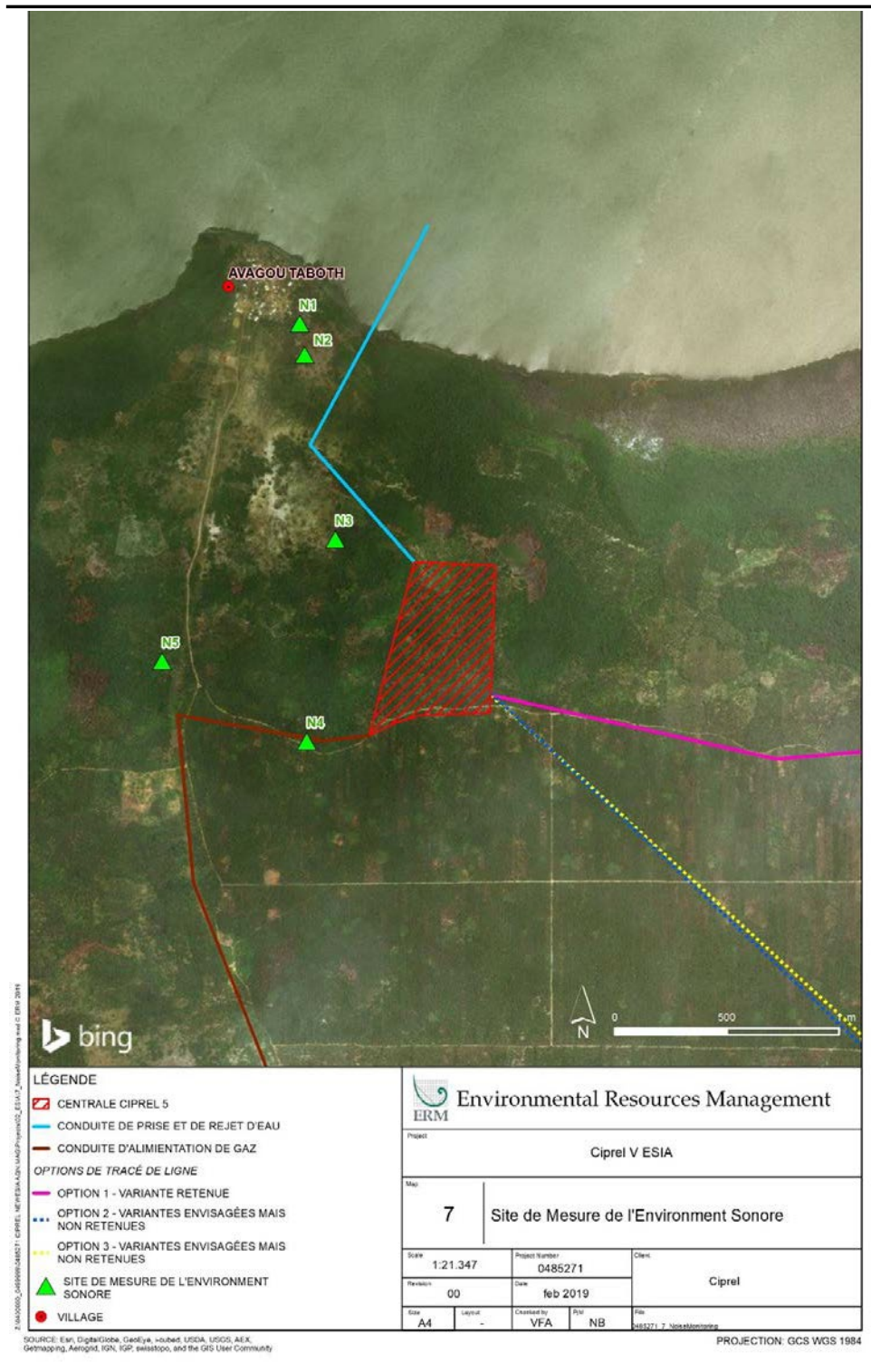
Campaign Measurement

Daytime and evening noise levels are measured as part of a measurement campaign in November 2018. The parameters measured at short intervals include the following indicators:

- LAeq, the general integrated equivalent noise level over the entire measurement interval, providing an average background value; and
- Lmax, L10 and L90, the statistical noise levels to assess the variability of levels at the measuring points.

The measurements are taken at the project site level and at the level of sensitive receptors within a radius of 2 km.

Figure 6.2 Sites of the noise measurement campaign



References for Standards and Regulation

Given its low level of development, the project site in the initial state is considered to be a "residential or rural area, with little traffic by land, river or air", in accordance with decree no. 01164 of 4 November 2008, concerning the Regulation of Releases and Emissions of Installations Classified for the

Protection of the Environment. In this context, the noise levels of residents are limited to 45 dB during the day and 35 dB at night.

The initial noise level assessment at the project site is also compared to IFC's international reference standards. The IFC General (2007) Environmental, Health and Safety (EHS) Guidelines for Noise Management recommend diurnal sound levels (7h-22h) of less than 55dB and night sound levels (22h-7h) of less than 45dB at sensitive receptors in the project area.

Recorded sound levels

The initial sound environment is influenced by the presence of local residents and birds and low road traffic. The highest measure is at the village of Taboth (site N1). All measurements taken during the day comply with the limits imposed by Ivorian and IFC regulations. On the other hand, the sound levels are higher than the Ivorian regulatory limits for all the receivers and those of the IFC for the N1 and N5 receivers.

Table 6.3 *Baseline sound levels in the project area*

Receptor	Distance to the project site	Initial daytime sound levels (¹) LAeq [dB (A)]	Initial nighttime sound levels (¹) LAeq [dB (A)]	Description of the acoustic environment when taking measurements
Village Taboth (N1)	1200 m	50	47 (²)	Presence of local residents and animals
Detached -area development, expansion of village Taboth (N2)	1000 m	41.5	41.5 (³)	Quiet without specific noise source
temporary housing (N3)	400m	38.5	38.5 (³)	Quiet influenced by wind and bird noises
isolated house (N4)	500m	42.0	42.0 (³)	Presence of local residents and animals
Farm and Home (N5)	1100 m	46.0	46.0 (³)	Presence of residents of farm animals and road traffic.

(¹) Modeled levels are compared with the lowest initial steps to allow a conservative approach in the valuation of the sound increases.

(²) Initial state unrated night. Given the presence of existing noise sources associated with village life (human activities, traffic, animals, etc.), it was assumed for the night a lower noise level by 3 dB over noise background day (decrease realistic day noise levels at night).

(³) Initial state unrated night. The receiver being located in a rural area and free from noise sources can generate significant variations in the acoustic environment between day and night, the background noise level at night was assumed to be equal to the background noise monitored daily.

6.4 *HYDROLOGY*

6.4.1 *Area of study*

The study area of the hydrogeological impacts related to the project includes the main components of surface water and the surrounding drainage regime, including the Ebrié Lagoon, and various shallows more or less connected to the lagoon. Soil and geological features related to coastal erosion, soil quality, and groundwater resources are also studied.

6.4.2 *Methodology*

The following sources were used for the baseline description:

- On-site tracking, conducted in November 2018;
- pre-study of CIPREL 5 configurations, Tractebel Engineering, October 2016 (initial project in Vridi) and November 2018 (new project in Taboth);
- Geotechnical study report produced by Labogem in June 2018;
- Physico-chemical analysis report and well water metals produced by Enval Laboratory.
- the following publicly available studies and reports:
 - Feasibility study of manual drilling and identification of potentially favorable zones, UFR-STRM Laboratory of Remote Sensing and Spatial Analysis Applied to Hydrogeology, Republic of Côte d'Ivoire, 2009;
 - Koffi and. al., Study of the geological, hydrogeological and geophysical environment of a site intended for the establishment of a technical landfill in the District of Abidjan; Journal of Asian Scientific Research, 2013, 3 (7): 762-774;
 - DEH et al. ; Assessment of the specific vulnerability of groundwater nitrates in the District of Abidjan; Int. J. Biol. Chem. Sci. 6 (3): 1390-1408, June 2012;
 - Jourda J. P. and. al., Management and protection of urban groundwater: contribution of a geographic information system to the realization of the vulnerability map of the continental terminal aquifer at the level of the conurbation of Abidjan, ESRI Francophone Conference, GIS 2003;

- Koffi et al., Remote Sensing Extraction of Major Fracture Networks from the Landsat Image of the Abidjan Region in Côte d'Ivoire, 2013. and
- Auguste K. Kouassi et al. (Universities NANGUI ABROGOUA and DALOA, Ivory Coast), Conceptual model of the aquifer of the Continental Terminal of Abidjan, Publication of 2014.

6.4.3 *Geology and Soils*

Area between Abidjan and Jacqueville

The geology of the area belongs to the Cretaceous-Quaternary coastal sedimentary basin, which stretches about 400 km along the coast and 10 km inland, or about 2.5% of the land mass of the country. The sedimentary formations of this basin consist of clays and sandy clays, sands and sandstones, conglomerates, glaucous sands and marls.

The coastal zone is mainly composed of coastal sediments. This implies the following soil characteristics:

- low hardness of the source rock;
- permeable bedrock;
- no alteration layer; and
- loose soil.

Project site area

The project site is located on the west coast of the Vridi Canal on the Quaternary-Pleistocene geological formation consisting of sandy soil on the surface.

The soil surface at the project site is sandy.

A soil study via a coring of 20 m depth was carried out. The nature of the soil is similar and consists of fine to medium sand on all the carrots. The nature of the soil along the SCI core is of the following nature:

- from 0.00 to 0.50 m: sandy little blackish clay;
- from 0.50 to 3.00 m: fine sand with little brown clay;
- 3.00 to 8.00 m: fine sand little beige clay;
- from 8.00 to 11.00 m: fine sand slightly yellowish clay;
- from 11.00 to 14.00 m: sand with little beige clay;
- from 14.00 to 15.30 m: yellowish medium sand; and
- from 15.30 to 20.00 m: medium sand reddish.

Figure 6.3 Illustration soil at the project site



Figure 6.4 Ground section, coring SC1

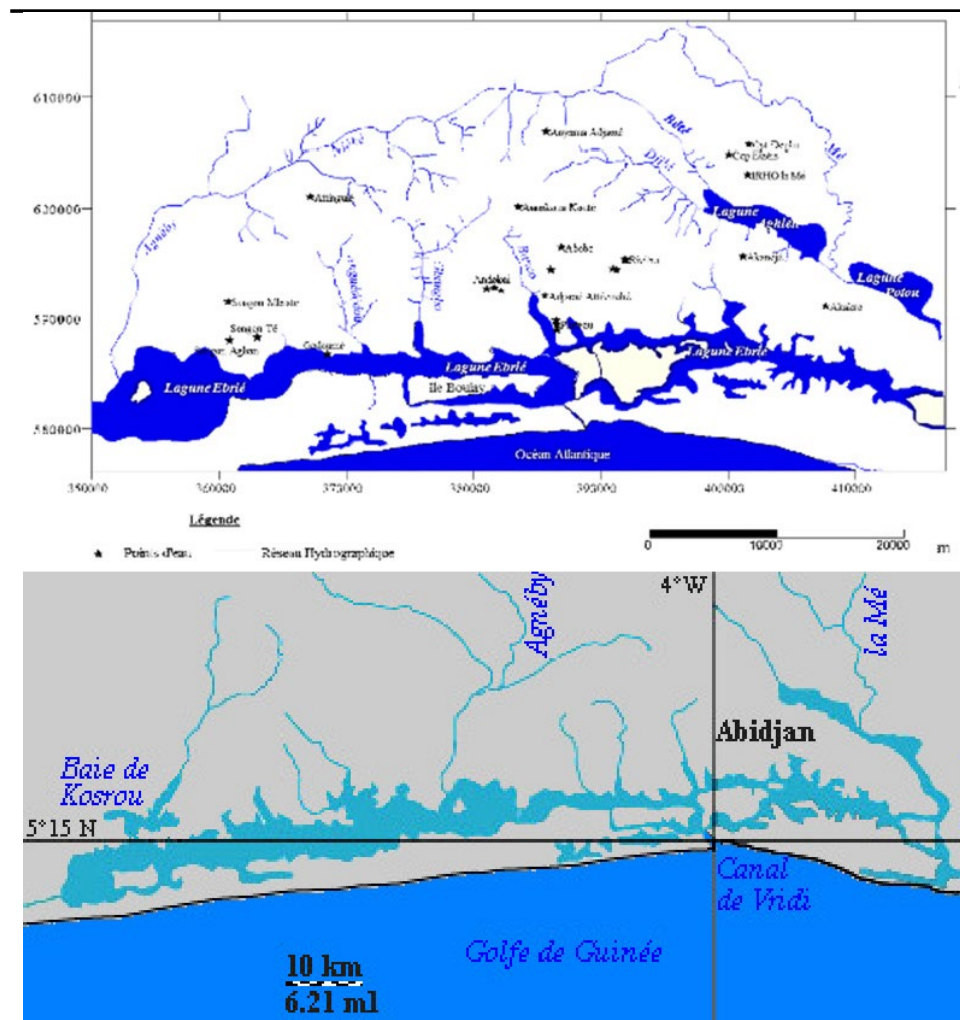


Source: LABOGEM, 2018

Extended Project Area

The hydrology in the zone of the site is mainly characterized by the presence of the Ebrié lagoon, located along the coastline on a stretch of 140 km and protected from the sea by a coastal sandy cordon. The Ebrié lagoon is fed by multiple streams and rains. The three main rivers that feed the lagoon, all located more than 20 km from the project site, are the Agnéby River, west of the project area and the Comoé and Mé rivers to the east. The following figure illustrates the hydrographic network of the district of Abidjan.

Figure 6.5 Hydrographic Network of the District of Abidjan



Source: BAIDAI 2011 life cycle analysis applied to a water production system drinking: If the industrial unit SODECI North Riviera, Institute of Education at the High Expertise and Research / Wikipedia: Lagoon Ebrié.

Ebrié Lagoon

The project site is located less than 1 km south of the Ebrié Lagoon.

This lagoon is one of the largest in West Africa with about 140 km long, 4 km wide and 4.8 km deep. Its total area covers 566 km² and its perimeter covers 644 km. It communicates with the Atlantic Ocean via the Vridi Canal.

However, because of its connection with the ocean, there is a flow of marine water into the lagoon that depends on the relative hydraulic levels of the lagoon. Inflow varies with seasons and tides (peak at high tides and in the dry season when lagoon water level is low). With the exception of the port area of Abidjan, the depth of the lagoon does not exceed 8 m.

For several years the lagoon underwent a significant level of pollution by receiving industrial discharges and the discharge of urban wastewater from Abidjan and to a lesser extent to Dabou and Songon. Nevertheless, the lagoon remains a territory used for fishing and navigation.

As shown in the table below, the lagoon has high bacteriological contamination rates, mainly due to urban wastewater discharges and lack of sanitation in Abidjan.

Table 6.4 *Coliformes during low water*

Location	WHO Standard ^(a)	Total coliforms (TC) (cfu/100 ml) ^(b)
Ile Boulay	0	0
yop Health	0	220
Banco Bay	0	1735

Note:

(a) WHO Guidelines for Drinking Water (2011).

(b) Bold text indicates exceeding WHO standards for drinking water.

Source: ETIALAG 2003.

Its hydraulic regime depends on terrestrial and marine exchanges, as well as on their hydraulic, morphological and bathymetric parameters. Depending on the season, its parameters vary as follows:

- Temperature¹ a minimum around 24.5 ° C at the end of the rainy season (August), a maximum of around 29 ° C in April and an annual average of about 28 ° C;
- Salinity and pH : the salinity of the lagoon decreases from May to November because of the freshwater supply of the rivers and consequently implies variations of the pH during the year;

¹ Pre-study CIPREL V Tractebel.

- turbidity: Turbidity depending on the location and marine trade. It can reach high levels in the lagoon; and
- dissolved oxygen : finally, in some parts of the lagoon the dissolved oxygen can reach more than 80% of saturation. Towards the east of the lagoon, in the relatively deep waters of the Abidjan Basin, the rates are much lower. Anaerobic conditions can be encountered, for example in the Bietri Basin.

Surface water quality analyses of the Ebrié lagoon were carried out in June 2018 at the level of the water intake and discharge pipe. The results are presented

Table 6.5 *Water quality in Ebrié lagoon (source: ERANOVE June 2018)*

Parameter	Unit	Lagoon Water (tide low)	Lagoon Water (tide high)
PH		7.3 at 28.5 ° C	7.3 to 28.9 ° C
Temperature	° C	28.5	28.9
Turbidity	NTU	13.8	18.9
Electric conductivity	µS / cm	4.7 to 28.8 ° C	4.5 to 28.5 ° C
Chloride	MgCl / L	173.9	177.3
Salinity	g / L	2.5	2.4
Sulfate	MgSO4 / L	134.2	147.1
Bicarbonate	mgCaCO3 / L	52	49
TDS	mg / L	2390	2380
Fluoride	mg / L	0.3	0.2
COD	mg O2 / L	79.1	67.8
BOD	mg O2 / L	30	20
Ammonium	mgNH4 / L	<0.1	<0.1
nitrates	mgNO3 / L	0.3	0.2
Oils and fats	Mg / L	<0.5	<0.5

6.4.5 *Hydrogeology*

Coastal Area

There are three levels of aquifers of varying importance on the coastal sedimentary basin:

- **Quaternary aquifer** contains a water table, the most vulnerable in the region of Abidjan, with a thickness of 4 to 20 m. The piezometric level is very close to the surface of the ground, the groundwater can therefore directly receive pollutants of various origins;
- **Maestrichtian aquifer** located at 200 m depth. It is operated by the SADEM for the production of mineral water, water "AWA"; and

- **Continental Terminal aquifer** Mio-Pliocene age, the water table contains commonly called "Abidjan water table" or "Continental Terminal waterable"

The thickness of the aquifer is 160 m maximum and minimum 30 m and its static level varies between 5 and 80 m (A.K Kouassi et al., 2014). It is used by the Water Distribution Company of the Ivory Coast (SODECI) for the Drinking Water Supply (AEP) of the Abidjan populations and its depth increases from South to North. This tablecloth has been experiencing problems of nitrate pollution in the southern part for some years.

Project Area

Exploitation of Groundwater

In the Avagou-Taboth area, the shallow aquifer is mainly used for domestic purposes by means of shallow wells in the shallow aquifer.

At the time of writing this report, ERANOVE has initiated a hydrogeological study to verify the capacity to produce water for use of the Project, without harming existing uses.

Figure 6.6 *Utilization of the shallow water table in Avagou-Taboth*



Features of the watertable

The Continental Terminal watertable is recharged by direct infiltration of rainwater and surface water (notably mentioned by A.K. Kouassi, 2014 and in the study of UFR-STRM, 2009). The thickness of the aquifer is between 30 and 160 m and its static level varies between 5 and 80 m (A.K. Kouassi et al., 2014). Groundwater has a pH around 4.4 and is characterized by low hardness and low mineralization. Due to the recharge from the north mainly, the direction of flow follows the north-south axis. The tablecloth knows a nitrogen pollution, saline, by sodium chlorides and a presence of nitrates. In addition, salt wedge penetration occurs in areas near the lagoon.

Vulnerability of the resource

Several studies¹ reveal areas with high levels of vulnerability to the risk of groundwater contamination. These areas of "strong" vulnerability are located in the north, in the recharge part of the watertable, and in the south of the region of Abidjan. The drilling is not deep and the connection rate to the sanitation network is very low with a high population density. The vulnerability map for areas sensitive to nitrate pollution is shown below.

These data can be extrapolated to the Project area, located in the Dabou district, but in comparable soil and hydrogeological conditions, at least as regards the landbelt between the lagoon and the ocean, suggesting following characteristics:

- Permeable soil allowing a good recharge of the watertable but increasing the risk of contamination in the event of a spill of liquid pollutants (for example, in the event of an accidental oil spill); and
- watertable subject to saltwater intrusion due to the high permeability of the soil and the proximity of the sea and the canal.

¹ DEH et al. , Evaluation of the specific vulnerability to groundwater nitrate District of Abidjan; Int. J. Biol. Chem. Sci. 6 (3): 1390-1408, June 2012.

Jourda and JP. al, management and protection of urban groundwater. inputs of a geographic information system for the realization of the map of vulnerability of the web of the continental terminal at the agglomeration Abidjan The Conference Francophone ESRI SIG 2003.

Auguste Kouassi K. et al. (Universities and Nangui Abrogoua DALOA, Ivory Coast), conceptual model of the aquifer of the Continental Terminal Abidjan, Publication 2014.

6.5 *Biodiversity*

6.5.1 *Area of study*

The project study area on the site of the project is associated with the development of the site. The study of the terrestrial flora and fauna and the aquatic environment of the Ebrié lagoon.

The study area is bounded to the north by the Ebrié lagoon and south by the sea. The villages Taboth / Avagou and Abrebi / N'djem represent the limits east-west.

6.5.2 *Methodology for data collection*

Three methodological approaches are carried out in the elaboration of this chapter, applied distinctly for aspects of terrestrial biodiversity and aquatic biodiversity:

- The field missions;
- The consultations of the population; and
- The review of publicly available technical and scientific literature.

In this study, two field missions were carried out:

- The scoping mission was carried out from 12 to 15 November 2018 and had for the purpose a preliminary identification of environmental sensitivities.
- The scoping mission was followed by a biodiversity inventory mission for 5 days from 26 to 30 November 2018, conducted by 2 flora experts from the ENVAL design office, including an accredited professor and senior consultant, and 2 wildlife experts including a national expert of ENVAL and a senior expert in biodiversity of the company ERM.

It should be noted that, at the time of writing this report (February 2019), CIPREL plans to complete the baseline studies by carrying out more detailed studies, notably concerning the assessment of the potential presence of chimpanzees in habitats. swamp forests, and a more precise characterization of sensitive habitats in the project's area of influence.

Also, the reports on flora and fauna inventories conducted in November 2016 as part of the ESIA of the Vridi-Ouest - Akoupé- Zeudji high voltage line were used. These inventories cover the eastern part of the study area.

A floristic inventory was carried out on the sites potentially impacted by the project. The inventory was conducted in support of field observations (using pruning shears to collect observed species samples and binoculars to observe tall tree foliage in distance) as well as extrapolations using satellite imagery and GPS. For field observations, the roaming survey method was adopted. It consists in traversing the environment by listing all the plant species found in the plots. This technique is suitable for fast inventories, difficult to penetrate sites or long runs. The works of Hutchinson and Dalziel (1954-1972), Lebrun

and Sortk (1991, 1992, 1995, 1997) and Ake Assi (2001, 2002) were used to confirm the taxa of the identified flora. Also, consultations with communities potentially impacted by the project were used to complete the flora inventory

was evaluated according to observations in the field, consultations with the population and a literature review. The presence of chimpanzees in the area of influence of the project was postponed during the consultations of the scoping mission. During the biodiversity inventory mission, wildlife experts visited the areas of the species' potential habitat in order to identify signs indicating their presence (tracks, droppings, nests, etc.).

The fauna inventory methodologies are summarized in Table 6.6.

Table 6.6 *Methodology for fauna inventory*

taxon	Method	Principle
amphibia	<ul style="list-style-type: none"> • acoustic method • visual method 	<ul style="list-style-type: none"> • Listen for specific croaking
reptiles	<ul style="list-style-type: none"> • Examination of shelter habitats • Collection of information from local populations 	<ul style="list-style-type: none"> • Search for habitats such as bedding, borders termite mounds, marshes, etc.
mammals	<ul style="list-style-type: none"> • direct or indirect observations • Collection of information from local populations 	<ul style="list-style-type: none"> • Physical observation or analysis of trace evidence (tracks, droppings, food scraps, etc.)
Birds	<ul style="list-style-type: none"> • Observations during the biodiversity inventory mission 	<ul style="list-style-type: none"> • Direct observation that requires the use of binoculars and telescope

The areas visited and specifically observed in relation to the natural environment during the scoping missions and the biodiversity inventory are presented in Figure 6.7.

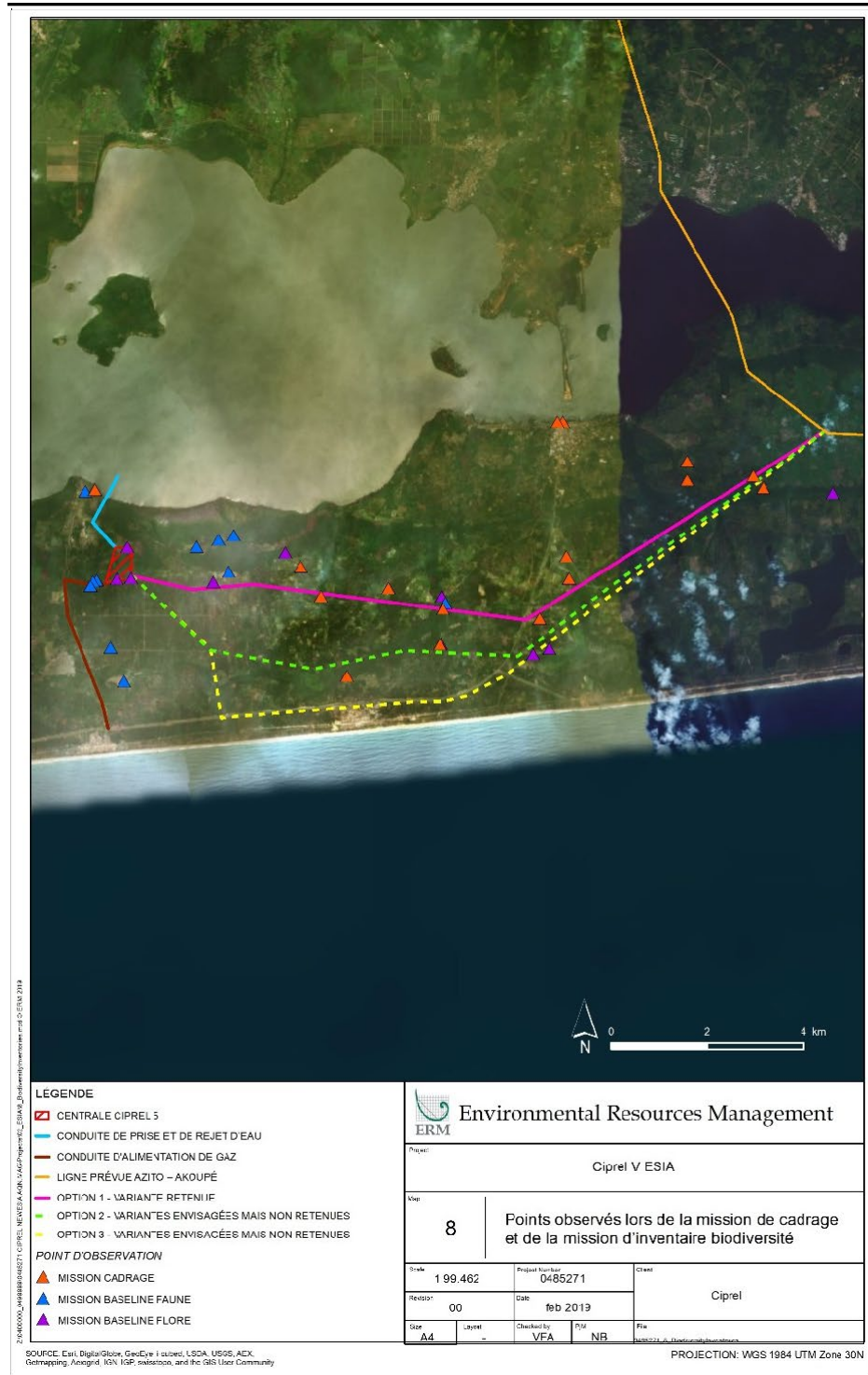
The aquatic biodiversity of the project is described in support of publicly available technical and scientific studies and through visual identification of fisheries catches and consultations with fishing communities.

The following publicly available reports and studies have been utilized to complete this section:

- national and international regulations;
- ESIA of FOXTROT International November 2012;
- ESIA of the high voltage line Vridi West - Akoupé-Zeudji, April 2018; and
- sources of biodiversity data online:
 - WorldDatabaseonProtectedAreasWDPA , www.protectedplanet.net,
 - Wetlands Ramsar www.ramsar.wetlands.org , and

- International Union for Conservation of Nature (IUCN) www.IUCNredlist.org; and
- Other scientists items available publicly.

Figure 6.7 *Points that were the subject of observations and inventories during the scoping and biodiversity study missions*



6.5.3 *Location of Inventories*

The flora and fauna inventories focused on different preselected areas during the scoping mission to:

- representativeness of habitat types affected by the project; and
- their environmental sensitivity linked to the presence of sensitive habitats (eg shoal).

The types of habitats covered by the inventories are:

- palm swamps;
- swamp forests;
- temporarily flooded forests;
- wet meadows;
- fallows; and
- the cultivated areas (including plantations coconut and rubber as well as food crops)

The entire swamp forests and seasonally flooded forests is considered habitat of lowland.

To cover these habitat types, inventory activities focused on the following areas:

- the plant site;
- water intake/discharge pipe;
- shoal preserved north of the plant and along Option 1 of the power line;
- shoals preserved south of the center and in the Audoin classified forest; and
- other habitats along the line and the gas line.

6.5.4 *Protected areas or forest preserves in the project area*

Internationally recognized protected areas

The WDPA World Database of Protected Areas identifies two classified forests in the vicinity (10 km) of the study area. These are classified forests of Kokoh and Audoin. Around the study area are the classified forest of Anguédédou, an unknown classified forest and the Banco and Azagny National Parks. All protected areas are shown in Figure 6.8.

The Ramsar Convention, whose mission is the conservation and wise use of wetlands, identifies a wetland of international importance on the site of the "Azagny National Park". It is about fifty kilometers west of the project site, out of reach of the potential impacts of the project.

Figure 6.8 Protected Areas near the project



Source: WDPA World Database on Protected Areas.

Classified Forests and National parks

The designation of national parks and classified forests are issued respectively by the Ivorian Office of Parks and Reserves, in accordance with Law No. 2002-102 of 11 February 2002, and by the Society for the Development of Forests (SODEFOR), in responsibility for the protection and management of forest and forest resources in Côte d'Ivoire. In 1926, some 10 classified forests and 1 National Park in the district of Abidjan were defined for the protection of their natural habitats.

For Ivorian legislation, important biodiversity areas within a 10 km radius around the project site therefore include the Kokoh and Audoain Classified Forests (see Figure 6.8). The national parks of Banco and Azagny are respectively about thirty and fifty kilometers from the site, out of reach of the potential impacts of the project. Also, the classified forest unknown and that of Anguédédou are located on the other side of the Ebrîé Lagoon, out of reach of the potential impacts of the project (see Figure 6.8).

A classified forest does not have the same protection status as a National Park (eg Banco National Park) or a Protected Natural Reserve (eg N'ganda-N'ganda Reserve). As such, the majority of classified forests in the zone are highly degraded as a result of urban development and / or over-exploitation. Although SODEFOR has a safeguarding activity for a few forests, its basic objective is effective and sustainable forest management. The clearing of classified forests is not prohibited, indeed according to Articles 51 and 52 of the Ivorian Forest Code of 2015, any project of clearing a classified forest is subject to prior authorization from forest administration. Article 62 specifies that any deforestation required for the construction of infrastructure is

subject to prior decommissioning. Article 26 specifies that classified forests are subject to partial or total decommissioning in the same procedures and forms as their classification.

The high voltage line crosses the Audoin classified forest. This forest covers an area of 5286 ha and is mostly exploited by local populations. A minority part of this forest consists of shoal forming a wetland rich in biodiversity.

6.5.5 *Terrestrial biodiversity of the project area*

Mapping of key habitats in the area

A mapping of key habitats identified in the area, after field observations made in the ESIA supplemented by satellite mapping analysis is presented on the following page.

Habitat Inventory

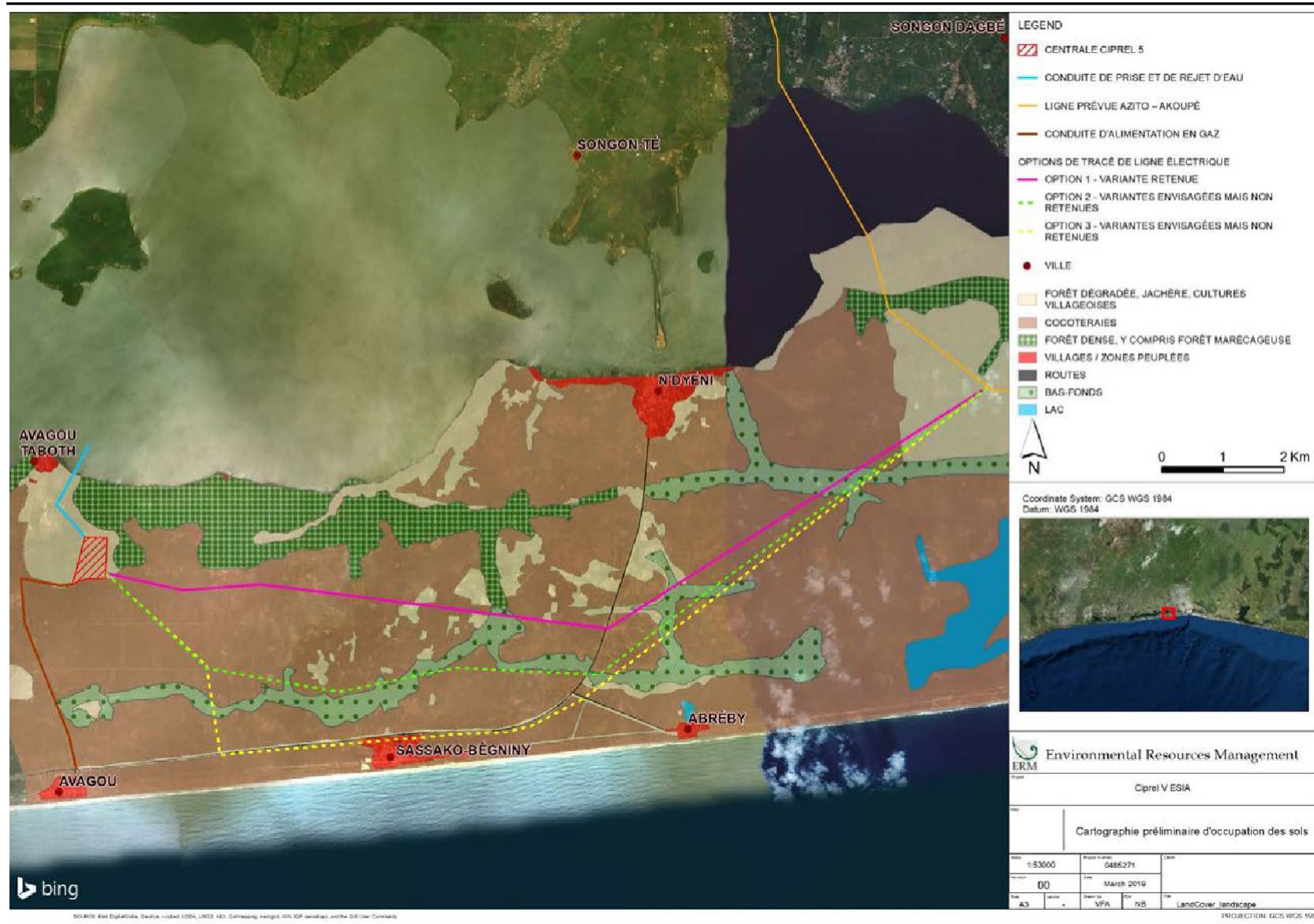
Observations in the field have identified six major habitat types in the project footprint area. These palm groves, swamp forests, seasonally flooded forests, wet meadows, as well as anthropic vegetation, namely fallow and cultivated areas. The entire swamp forests and temporarily flooded forests is the shallows.

Raffia Palm Grove

These are plant formations on peaty soil (Figure 6.10 A). They are subject to tidal regimes. These plant formations stem from the degradation of temporarily flooded forests and are in the process of reconstitution. They consist only of young raffia in high density. The raphials are dominated by species of the family Arecaceae such as *Raphia hookeri* G. Mann & Wendl H., *Raphia palma-pinus* (Gaertn.) Hutch. and *Laccosperma secundiflorum* (P. Beauv.) Kuntze (Figure 6.10 B).

In the study area, the raphial habitat is located at the edge of the lagoon on the line of the pipeline from the site of the power plant to the Ebrié lagoon.

Figure 6.9 Preliminary mapping of habitats in the project area



Note: This mapping is based on an analysis of satellite images available for free to the area and ERM field observations. It will be refined as part of supplements of studies relating to biodiversity.

Figure 6.10 Palm Grove (*Raffia*)



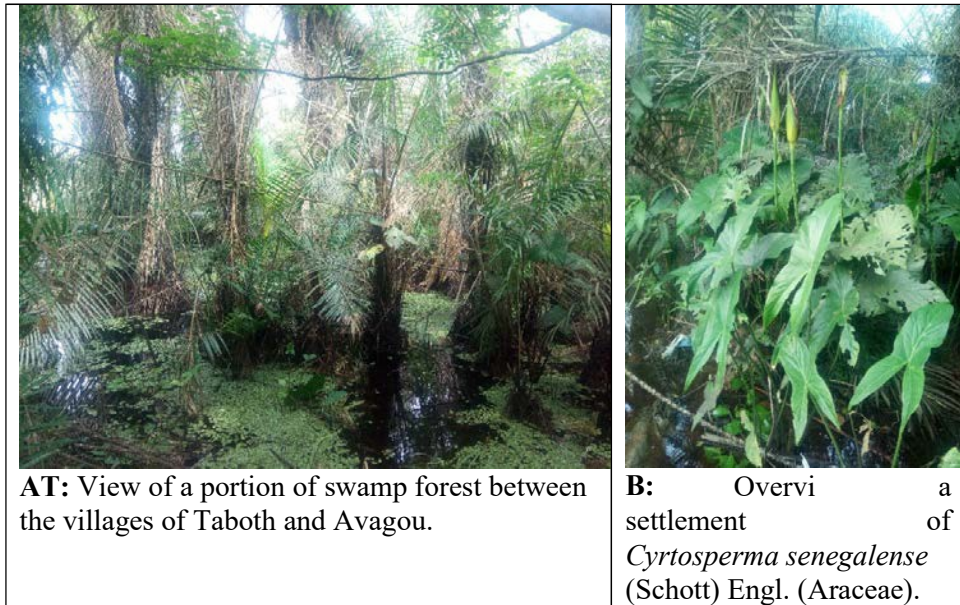
AT: Preview ground in Raphiales. B: view of a portion near the Raphiale Village Taboth

Swamp forests

These are forests on flooded soils throughout the year (Figure 6.11 A). This type of forest is dominated by species such as *Ficus trichopoda* Baker (Moraceae), *Hallea ledermannii* (Krause K.) Verdc. (Rubiaceae). Some species such as *Raphia hookeri* Mann & Wendl. (Arecaceae), *Raphia palma-pinus* (Gaertn.) Hutch. (Arecaceae) and *Cyrtosperma senegalense* (Schott) Engl. (Araceae) (Figure 6.11 B) are also present in large numbers.

In the zone of influence, swamp forests are at the heart of all lowland coves, predominant in the north of the zone of influence, adjacent to the Ebrié lagoon. These are the interconnected south-north and east-west bands throughout the study area.

Figure 6.11 Swamp Forest



In swamp forests, the emergent stratum is dominated by *Raphia palmipinus* (Gaertn.) Hutch. (Arecaceae) (see Figure 6.12), *Nauclea diderrichii* (De Wild. & T. Durand) Merr. (Rubiaceae) or *Bahia*, as shown in Figure 6.13. The latter species is recognized as "vulnerable" by IUCN. Adult individuals of this species are harvested and cut for use as lumber. The lower stratum is dominated by species such as *Cyrtosperma senegalense* (Schott) Engl. (Araceae), *Culcasia angolensis* Welw.ex Schott (Araceae), *Nephrolepis biserrata* (Sw.) Schott (Davalliaceae), *Pteridium aquilinum* (Linn.) Kuhn (Dennstaedtiaceae) and *Aframomum melegueta* K. Schum. (Zingiberaceae).

Figure 6.12 Overview of a foot of *Raphia palma-pinus* (Gaertn.) Hutch. (Arecaceae)



Figure 6.13 *Nauclea diderrichii* (De Wild. & T. Durand) Merr. (Rubiaceae)



Temporarily flooded forests

These are forests subject to periodic or temporary flooding (Figure 6.14 A). These climax communities develop on sandy soils (Figure 6.14 B). When the water rises, they are flooded and dry after the water recedes. Trees, with stilt roots of small size, often stand on mounds. Among the main woody species that make up these forests are *Hallea ledermannii* (K. Krause) Verdc. (Rubiaceae), *Xylopia parviflora* (A. Rich.) Benth. (Annonaceae) as well as *Raphia hookeri*'s feet.

In the area of influence, temporarily flooded forests are in bands around all swamp forests.

Figure 6.14 *Temporarily Flooded Forest*



AT: Preview a temporarily flooded portion of forest near the village of Sassako. **B:** Surface under forest temporarily flooded.

Wet Meadow

The wet meadows are the result of the clearing of temporarily flooded forests to produce vegetable crops. Following the abandonment of the land, and before the species of the environment of origin appear, these open formations and little wooded, with grass with cutting leaves, develop on soils flooded all year round (Figure 6.15). This vegetation is dominated by the following species: *Imperata cylindrica* L. (Poaceae), *Scleria depressa* (C.B.Clarke) Nelmes (Cyperaceae), *Nymphaea lotus* L. (Nymphaeaceae) and *Raphia hookeri*.

Figure 6.15 *A field portion near the town of Abrébi*



This type of habitat is the on north side of the strip of lowland Abrebi at the union of the three lines.

Fallows

Most of this type of vegetation consists of old plantations of perennial crops (coconut groves) and abandoned annual crops (Figure 6.16). The most common woody plants are *Ceiba pentandra* (Linn.) Gaerth. (Bombacaceae) or cheese maker, *Ficus exasperata* Vahl (Moraceae). The herbaceous species are very abundant and consist of *Chromolaena odorata* (L.) R. M. King & H. Rob. (Asteraceae), *Panicum maximum* Jacq. (Poaceae) and *Ageratum conyzoides* Linn. (Asteraceae).

Figure 6.16 *View of a portion of fallow*



Cultivated Land

These spaces are of two types: perennial crops (coconut groves, rubber trees) and annual crops. Perennial crops are grown over large areas. They are either coconut plantations belonging to SICOR (Figure 6.17 A) or coconut plantations or rubber plantations (Figure 6.17 B) belonging to village communities.

Figure 6.17 *Perennial plantations*



AT: View of a parcel of coconut plantation owned SICOR.

B: Overview of a village plantation plot near the village of rubber of Abrébi.

The emerging stratum in coconut palms is dominated by coconut individuals, *Cocos nucifera* Linn. (Arecaceae).

The undergrowth of coconut groves of SICOR is lined with *Mucuna pruriens* (L.) DC. var. *pruriens* (Fabaceae) and *Centrosema pubescens* Benth. (Fabaceae). While the undergrowth of village coconut groves is generally occupied by cassava crops, *Manihot esculenta* Crantz (Euphorbiaceae) (Figure 6.18). The undergrowth of coconut groves that are not occupied by cassava crops, is dominated by herbaceous species such as *Chromolaena odorata* (L.) R.M. King & H. Rob. (Asteraceae), *Diodia rubricosa* Hiern (Rubiaceae), *Lantana camara* Linn. (Verbenaceae), *Pueraria phaseoloides* (Roxb.) (Fabaceae), *Rauvolfia vomitoria* Afzel. (Apocynaceae).

Figure 6.18 *Undergrowth of a coconut plantation*



Milicia regia A. Chev. (Moraceae) or Iroko is the only species identified with special conservation status by the International Union for Conservation of Nature (IUCN) as "vulnerable", identified in coconut groves as shown in Figure 6.19.

figure 6.19 A *Milicia regia* A. Chev. (Moraceae) or Iroko plant



The undergrowth of rubber plantations, bare in places, is dotted by a few tufts of *Desmodium adscendens* (Sw.) DC. (Fabaceae), specimens of *Antiaris toxicaria* var. *africana* (Engl.) CC Berg (Moraceae) as shown in Figure 6.20.

Figure 6.20 *Antiaris toxicaria var. africana* (Engl.) CC Berg (Moraceae)



Annual crops are located mostly in lowland dry. In the lowlands, the village populations are growing vegetable growers (Figure 6.21). The use of herbicides is recurring to eliminate weeds such as *ageratum conyzoides* Linn. (Asteraceae), *C. odorata* (L.) RM King & H. Rob. (Asteraceae), *Desmodium adscendens* (Sw.) DC. (Fabaceae), *Diodia rubricosa* Hiern (Rubiaceae).

Figure 6.21 *Vegetation*



Table 6.7 Inventory of habitats in the area influence

biotope	Dominant species	Zone of preponderance	Description
Palm groves (Raffia)	<ul style="list-style-type: none"> • <i>raffia hookeri</i> • <i>Raffia Palm-pinus</i> • <i>Laccosperma secundiflorum</i> 	<ul style="list-style-type: none"> • Outside the lagoon Ebrié 	The Raphiales are vegetation on peat soil. They are subject to tidal regimes.
swamp forests	<ul style="list-style-type: none"> • <i>Ficus trichopoda</i> • <i>Hallea ledermannii</i> • <i>raffia hookeri</i> 	<ul style="list-style-type: none"> • interconnected strips north and south is West in the whole area of influence 	These are forests on flooded soils throughout the year.
Temporarily flooded forests	<ul style="list-style-type: none"> • <i>Hallea ledermannii</i> • <i>Xylopia parviflora</i> • <i>raffia hookeri</i> 	<ul style="list-style-type: none"> • strips around of All swamp forests 	These are forests under inondationspériodiques or temporary. These forests grow on sandy soils. Trees, small size with stilt roots, often stand on mounds.
Wet meadows	<ul style="list-style-type: none"> • <i>Imperata cylindrica</i> • <i>Scleria depressa</i> • <i>Nymphaea lotus</i> • <i>raffia hookeri</i> 	<ul style="list-style-type: none"> • On the north side of the tape shoal of Abrebi at The union of the three lines 	They are open formations and lightly wooded, with grasses sharp leaves that grow on flooded soils throughout the year.
fallow	<ul style="list-style-type: none"> • <i>Ceiba pentandra</i> • <i>Ficus exasperata</i> • <i>Chromolaena odorata</i> • <i>Panicum maximum</i> 	<ul style="list-style-type: none"> • Old plantations throughout the area of influence 	This type of vegetation is mostly made up of old plantations of perennial crops (coconut) and annual crops abandoned.
perennial crops (cultivated spaces)	<ul style="list-style-type: none"> • Coconut (<i>Cocos nucifera</i>) • Rubber tree (<i>Hevea brasiliensis</i>) • <i>Mucuna pruriens</i> • <i>Centrosema pubescens</i> 	<ul style="list-style-type: none"> • On the large areas throughout the area of influence 	Perennial crops are installed on large areas. They are either coconut groves belonging to the SICOR either coconut or rubber plantations belonging to village communities.
Annual crops (cultivated areas)	<ul style="list-style-type: none"> • Cassava (<i>Manihot esculenta</i>) • But (<i>Zea but</i>) 	<ul style="list-style-type: none"> • In bas drained funds 	Annual crops are located mostly in lowland dry. In the lowlands, the village populations are growing market gardeners.

The plant site and the gas pipeline are in coconut plantations. The raphiales are the dominant habitat north of the plant site, particularly along the potential route of the water discharge line from the power station site to the Ebrié Lagoon. Option 1 of the high voltage line impacts all describing habitats. To the west, before joining the other options, it crosses most of the corridor of cultivated spaces. It also crosses lowland habitat (swamp forest)

on four occasions (crossing length: 100, 300, 400 and 600 m).

Inventory of flora

Two species are endemic to Côte d'Ivoire. This is *Baphia bancoensis* Aubrév. (Fabaceae) and *Leptoderris miegei* Aké Assi & Mangenot (Fabaceae).

There are eight endemic species in West Africa. These are among others *Adenia dinklagei* Hutch. & Dalz. (Passifloraceae), *Landolphia membranacea* (Stapf) Pichon (Apocynaceae), *Afzelia bella* var. *gracilior* Keay (Caesalpinaceae).

Three species endemic to the Upper Guinea region are *Raphia palma-pinus* (Gaertn.) Hutch. (Arecaceae), *Tetracera alnifolia* Willd. Subsp. *alnifolia* (Dilleniaceae) and *Triclisia patens* Oliv. (Menispermaceae). The stem of *Tetracera alnifolia* or water liana is severed and the water that flows is drunk during long periods of hunting.

Irvingia gabonensis species (Aubry-Lecomte ex O'Rorke) Baill. (Irvingiaceae) and *Pterocarpus santalinoides* The Herit. ex DC. (Fabaceae). The fruits of *Irvingia gabonensis* are dried and pulverized for consumption as a sauce.

Four species declared "vulnerable" by IUCN have been inventoried. This is *Milicia regia* A. Chev., *Turraeanthus africanus* (formerly *C. DC.*) Pellegr. (Meliaceae) or Avodiré, *Afzelia africana* Sm. and *Nauclea diderrichii* (De Wild. & T. Durand) Merr. (Rubiaceae) or Bahia. Also, *Milicia excelsa* or Iroko, large tree, and present in the study area. All of these taxa are timber and cabinet making, which are the subject of intense exploitation. Figure 6.22 shows a young foot of Bahia and chevrons sawn by the people for personal use.

Figure 6.22 Bahia



B: For wood samples debited from the Bahia.

AT: Previewing a foot *Nauclea diderrichii* (De Wild. & T. Durand) Merr. (Rubiaceae) or Bahia.

On the other hand for *Afzelia africana* Sm. (Caesalpinaceae) and *Albizia ferruginea* (Guill & Perr.) Benth. (Mimosaceae) which are also vulnerable species, it is the disappearance of their habitats which is the main cause of their extinction.

Table 6.8 List of vulnerable and endemic species in Côte d'Ivoire

Scientific Names	Family	Status IUCN	Raphiales	Swamp forest	Temporarily flood forest	Wet meadow	fallow	Cultivated land
<i>Milicia regia</i>	Moraceae	VU	-	-	-	-	x	-
<i>Turraeanthus africanus</i>	Meliaceae	VU	-	-	-	-	x	-
<i>Nauclea diderrichii</i>	Rubiaceae	VU	-	x	x	-	-	-
<i>Albizia adianthifolia</i>	Mimosaceae	LC	-	-	-	-	x	-
<i>Afzelia africana</i>	Caesalpinaceae	VU	-	-	-	-	x	-
<i>Baphia bancoensis</i>	Fabaceae	-	-	-	-	-	x	-
<i>Leptodermis miegei</i>	Fabaceae	-	-	-	-	-	x	-

Overall flora is rich media crossed 164 key species (Appendix C).

According to the results of several inventories in undisturbed natural forest environments (Aké Assi 1997, Kouamé 1998, Kouassi 2007), the family of Rubiaceae remains by far the richest. It is followed by that of Euphorbiaceae. The results presented here give a flora dominated by Fabaceae, Araceae followed by Moraceae and Rubiaceae. The Rubiaceae that inhabit the undergrowth of undisturbed forests have become less numerous and have been supplanted by Apocynaceae and Fabaceae, which are open-species. This composition of the flora is representative of open environments degraded by human activities (food fields and perennial crops) that dominate the course of the route of the line. This same flora is in full recovery in fallows and secondary forests.

All these identified species have different properties and status according to their use and their states of preservation. The complete list of inventoried flora species and their conservation status is given in Appendix C. Table 6.9 summarizes the use of these species.

Table 6.9 *Principal uses of species recorded on the area influence*

uses	Number of species
Medicinal	7
Food	4
Lumber	2
Ornamental	2
TOTAL	15

Wildlife inventories

The strong human presence reduces the presence of nearby terrestrial animal species in the area of influence. The inventory of fauna was made possible thanks to the bibliographical research (including the ESIA of the high voltage line Vridi- West - Akoupé-Zeudji), the observations in the field, and by questioning various representatives of the local populations at various points in the study area.

The wildlife inventory identified 5 groups of vertebrates (amphibians and reptiles, large mammals, small terrestrial mammals, bats and birds). These inventories have been focused on areas identified as potentially more sensitive (see Section 6.5.3).

Amphibians and reptiles

As for reptiles, they are represented by four orders: saurians, snakes, crocodiles and turtles. According to information provided by the local population the species *Python sebae* would also be present in abundance in swamps. No crocodile species were observed during the biodiversity inventory despite the reported presence of *Osteolaemus tetraspis* and *Crocodylus suchus* by the population and observed in breeding from the wild population. According to the local community, the majority habitat of

these two species is in the lowlands; however, the presence of crocodiles has also been mentioned on the marshy shores north of the lagoon. Two species of tortoises (*Kinixys erosa* and *Pelusios cupulatta*) have also been recorded, respectively in a rubber plantation and in the swamp forest at the edge of the Ebrié lagoon. The turtle *Pelusios cupulatta* has been recorded in the lowlands along the Ebrié lagoon.

Regarding the status of the different species identified, a Crocodile species (*Osteolaemus tetraspis*) is classified as Vulnerable, VU. It is on the IUCN Red List of Protected Species.

Amphibian species in degraded environments are *Hyperolius guttulatus* and *Phrynobatrachus* sp. The analysis of the taxonomic composition of amphibians in the Audoin classified forest shows that this fauna is similar to that of open habitats. Indeed, according to Rödel (2000), amphibian species such as *Amietophrynus maculatus*, *Amietophrynus regularus*, *Hoplobatrachus occipitalis*, *Afrixalus dorsalis*, *Hyperolius guttulatus*, and *Ptychadena pumilio* are typical of savannah areas and degraded habitats. This would be justified by the conversion of all the classified forest (excluding swamp) into rubber fields and plantations.

Potential amphibians in the lowlands include *Amietophrynus togoensis*, *Leptopelis macrotis*, *Leptopelis occidentalis*, *Afrixalus nigeriensis*, *Phrynobatrachus alleni*, *Phrynobatrachus liberiensis*, *Ptychadena superciliaris*, *Kassina arboricola*, *Hyperolius viridigulosus*, *Phrynobatrachus villiersi* and *Morerella cyanophthalma*. The last three are recognized as "vulnerable" by the International Union for the Conservation of Nature (IUCN). The globally threatened *Phrynobatrachus* frog (*Phrynobatrachus ghanensis*) has been reported (N. G. Kouame pers comm June 2012) in the Audoin classified forest, crossed by the line, and in the Banco National Park. It has an estimated area of occurrence (EOO) of 61,463 km². It has been registered in 9 protected areas, but it is likely to be underreported in its territory.

Table 6.10 Amphibians and reptiles

Order / Family	Species	IUCN status	Source of information
AMPHIBIANS			
arthroleptidae	<i>Leptopelis macrotis</i>	NT	Literature
	<i>Leptopelis occidentalis</i>	NT	Literature
Bufonidae	<i>amietophrynus maculatus</i>	LC	Literature
	<i>amietophrynus regularus</i>	LC	Literature
	<i>amietophrynus togoensis</i>	NT	Literature
dicroglossidae	<i>Hoplobatrachus occipitalis</i>	LC	Literature
Hyperoliidae	<i>Afrixalus dorsalis</i>	LC	Literature
	<i>afrixalus nigeriensis</i>	NT	Literature
	<i>Hyperolius guttulatus</i>	LC	Literature

Order / Family	Species	IUCN status	Source of information
	<i>Hyperolius viridigulosus</i>	VU	Literature
	<i>Kassina arboricola</i>	VU	Literature
	<i>Morerella cyanophthalma</i>	VU	Literature
petropedetidae	<i>Phrynobatrachus liberiensis</i>	NT	Literature
Phrynobatrachidae	<i>Phrynobatrachus calcaratus</i>	LC	Literature
	<i>Phrynobatrachus alleni</i>	NT	Literature
	<i>phrynobatrachus villiersi</i>	VU	Literature
ptychadenidae	<i>ptychadena pumilio</i>	LC	Literature
	<i>ptychadena superciliaris</i>	NT	Literature
Phrynobatrachae	<i>Phrynobatrachus ghanensis</i>	EN	Literature
REPTILES			
SAURIA			
Agamidae	<i>Agama agama</i>	NE	Literature
gekkonidae	<i>Hemidactylus sp.</i>	NE	Literature
Varanidae	<i>Varanus niloticus</i>	LC	Literature
SNAKES			
Boidae	<i>Python sebae</i>	NE	Local population
Elapidae	<i>western green mamba</i>	LC	Literature
	<i>eastern green mamba</i>	-	Literature
	<i>forest cobra</i>	-	Literature
CROCODILES			
crocodylidae	<i>Osteolaemus tetraspis</i>	VU	Local population
	<i>Crocodylus niloticus</i>	LC	Literature
	<i>Crocodylus suchus</i>	LC	Local population
TURTLES			
Pelomedusidae	<i>Ivory Coast Mud Turtle</i>	LC	Literature
testudinidae	<i>Forest hinge-back tortoise</i>	DD	Literature
	<i>Kinixys homeana</i>	VU	Literature
	Total cash (N = 32)		

EN: endangered; VU: Vulnerable LC: Least Concern, NE: not evaluated, DD: Data Deficient. In the yellow vulnerable species classified or endangered.

Large Mammals

The majority of mammalian observations have been indirect observations (droppings, footprints, food scraps and tracks).

According to several testimonies collected from habitats in the area, independently of each other, the swamp forest habitat present in some parts of the study area, particularly the swampy forests north of the Project area, would also serve as refuge and nesting to West African chimpanzees (*Pan troglodytes verus*). At the time of writing this report (February 2019), the presence of these chimpanzees has not been proven by direct observation of individuals, nests or other clues (excrement, food debris etc.). However, given the evidence gathered, the potential presence of chimpanzees in the

study area can not be ruled out. ERANOVE intends to have more in-depth studies carried out to look for possible signs of chimpanzee presence, and, if their presence is established, to characterize their populations in more detail.

The chimpanzee subspecies present in Côte d'Ivoire is that of West Africa, *Pan troglodytes verus* (Mittermeir et al., 2013). Chimpanzees are the great apes with the largest range, ranging from the Great Lakes region in south-east Senegal to the northwest. They also have a very large ecological range, ranging from lowland or mountain primary forests (up to 2,800 m altitude), to swamps and secondary forests, to dry forests and tree savannah mosaics. the driest areas of their range. Their diet is also very varied, chimpanzees are opportunistic omnivores. They use tools and consume meat (they are the most carnivorous of all great apes) throughout their range.

In areas of degraded forest (outside the shallows), Chimpanzees are known for making excursions to plantations, especially in the season when fruits are scarce. In the Project area, degraded and / or agricultural land could be used by chimpanzees for food. The swamp forest area would serve as a refuge or even nesting area, the potential chimpanzees being protected by the density of vegetation and marshiness of the undergrowth.

Due to the degradation of its environment, the ravages of the Ebola virus and poaching, the Chimpanzee is categorized in danger of extinction (EN A4bcde) by the IUCN (Humble et al., 2016) and listed in Appendix I of the CITES Convention and in Class A of the African Convention on the Conservation of Nature and Natural Resources. But *Pan troglodytes verus*, subspecies of West Africa, is rated CR by IUCN (critically endangered.) It is estimated that Côte d'Ivoire has lost 90% of its chimpanzee populations between 1990 and 2007 (Mittermeir et al., 2013).

The Chimpanzee was identified as a species at stake on the site during the scoping mission. The following biodiversity inventory mission collected numerous concordant testimonies (people consulted in various places independently, spontaneous statements of the people consulted) which indicate the presence of chimpanzees especially in the northern zone towards the Ebrié Lagoon, which supports the hypothesis of a refuge zone for this species. In addition, several testimonials from residents affected by chimpanzee actions indicate repeated intrusions of chimpanzees into pineapple, banana, maize, watermelon and coconut plantations on the outskirts of the swamp forest. As discussed, it seems that the activities of potential chimpanzees are more concentrated in areas of marsh forest that are well preserved and less accessible to local residents and hunters. In these areas, trees producing fruits such as the fruits of *Uapaca paludosa* are present.

The assumed range / refuge of this troupe of chimpanzees has been deduced from satellite imagery (see Figure 6.23), dense and highly preserved areas of swamp forest immediately south of the Ebrié lagoon. Witness observations (mainly southwestern and southern refuge areas) suggest that chimpanzees could potentially use an extended feeding zone. Evidence suggests that more

or less densely vegetated lowland networks from north to south could serve as a corridor for chimpanzee movements. However, evidence of chimpanzees was rarer as one moved south and east of the refuge area.

Figure 6.23 Supposed refuge of chimpanzees potentially present in the area study



Scientific data on the density of chimpanzees in different habitats and different countries vary considerably. According to the study of chimpanzees in West Africa: conservation status of the species action plan, Rebecca Kormos, IUCN / SSC Primate Specialist Group, IUCN, 2004 chimpanzees in Ivory Coast

need a living space with approximate troop of 20 km². This data comes from studies carried out in all the protected areas of Ivory Coast and mainly the Tai forest in the west of the country.

This estimate of living space can be considered as an average for natural habitats relatively well preserved environments (Tai forest etc). However, it is subject to variability with a large, as in the study conducted in Côte d'Ivoire by IUCN in 2004, that according to the findings made by ERM in various West African sites in the last 10 years - in fact, even in areas populated or heavily modified natural habitat, there is sometimes the presence of chimpanzee groups in forest galleries or island forests attending to feed the surrounding areas of fallow land or crops .

With an approximate area of 5-10 square kilometers of swamp forest well preserved as a refuge area, plus a mosaic of cultures, plantations and swamp forests in a large area can be estimated at between 20 and 40 km² between Avagou-Taboth and the limit is the study area, it is assumed that the area could accommodate up to a troop of chimpanzees. The territorial behavior of the chimpanzee and the relative isolation of the swamp forest area relative to other forest areas supports this hypothesis (the nearest areas with a known population of chimpanzees are Azagny and Banco National Park respectively 60 km and 40 km west of the project area.)

Regarding the size of the company, the estimated number of people at this point would be speculative. The minimum number of individuals known for a troop of about 5, and the maximum number is usually between 10 and 20 individuals (representing a density of about 1 person for 2 to 5 square kilometers, representing a high density, but not impossible given the chimpanzees resilience in communities impacted by man, as stated above).

This estimate is still a hypothesis based on the reported information to be confirmed or refuted specifically by further studies What realize the project in the area. The terms of reference of the Project scheduled chimpanzee research study are explained in Chapter 8 of this ESIA report, Environmental and Social Management Plan.

Table 6.11 Species Inventory and Taxonomic Classification of Large Mammals

Orders / Species	Common name	IUCN status	Type signs
SMALL ANIMALS			
<i>Euxerus erythropus</i>	palm rat	LC	Literature
<i>Gambian pouched rat</i>	giant rat	LC	Literature
<i>Heliosciurus rufobrachium</i>	Squirrel red foot	LC	Literature

Orders / Species	Common name	IUCN status	Type signs
<i>Protexerus stangeri</i>	Squirrel Stanger	LC	Literature
<i>epixerus</i>	Squirrel palms	LC	Literature
<i>Cricetomys emini</i>	giant rat	LC	Literature
<i>African brush-tailed porcupine</i>	African brush-tailed porcupine	LC	Literature
<i>crested porcupine</i>	porcupine	LC	Literature
<i>greater cane rat</i>	Aulacode	LC	Literature
<i>Xerus erythropus</i>	Squirrel digging	LC	Direct observation
<i>Anomalurus peli</i>	Anomalure Pell	DD	Literature
PRIMATES			
<i>diana monkey</i>	diana monkey	VU	Literature
<i>sooty mangabey</i>	sooty mangabey	NT	Literature
<i>Cercopithecus petaurista</i>	petaurista	LC	Literature
<i>Cercopithecus lowei</i>	Cercopithecus Lowe	LC	Vocalization
<i>Cercopithecus campbelli</i>	Campbell's Mona Monkey	LC	Literature
<i>Colobus vellerosus</i>	Colobus vellerosus	VU	Literature
<i>Galagoiides demidovii</i>	Galago of Demidoff	LC	Literature
<i>Western chimpanzee</i>	Chimpanzee	CR	Témoignagesdela local population
<i>Perodictitus potto</i>	Potto	LC	Literature
<i>western red colobus</i>	red colobus	IN	Literature
<i>olive colobus</i>	green Leaf Monkey	NT	Literature
CARNIVORES			
<i>Caracal aurata</i>	African golden cat	NT	Literature
<i>Crossarchus obscurus</i>	common mongoose	LC	Literature
<i>Civettictis civetta</i>	African Civet	LC	Literature
<i>genetta johnstoni</i>	genetta johnstoni	VU	Literature
<i>Cape Genet</i>	Genette Spotted	LC	Literature
<i>Herpestes sanguineus</i>	slender mongoose	LC	Literature
<i>Lutra maculicollis</i>	Otter Neck	NT	Literature
ARTIODQCTYLES			
<i>Hippopotamus amphibius</i>	common hippopotamus *	VU	Literature
<i>Cephalophus Niger</i>	black duiker	LC	Literature
<i>royal antelope</i>	Royal antelope	LC	Literature
<i>Maxwell's duiker</i>	Maxwell Duiker	LC	Literature
<i>Tragelaphus eurycerus</i>	Bongo	NT	Literature
<i>Tragelaphus scriptus</i>	bushbuck	LC	footprint; droppings; Trace food
ONGUELES			
<i>Tragelaphus scriptus</i>	bushbuck	LC	Literature
<i>Maxwell's duiker</i>	Maxwell Duiker	LC	Literature
<i>royal antelope</i>	Royal antelope	LC	Literature
hyracoids			
<i>Dendrohyrax arboreu</i>	Tree hyrax	LC	Literature
<i>Dendrohyrax dorsalis</i>	Tree hyrax	LC	Literature
pholidota			
<i>Manis tricuspis</i>	Tree pangolin	NT	Literature

Orders / Species	Common name	IUCN status	Type signs
<i>Phataginus tetradactyla</i>	Long-tailed pangolin	VU	Literature
<i>Phataginus tricuspis</i>	common pangolin	VU	Literature
<i>Smutsia gigantea</i>	giant pangolin	NT	Literature
	Total species (N = 44)		

* Literature insufficient evidence, probably not present; EN: endangered; VU: Vulnerable LC: Least Concern, NE: not evaluated, DD: Data Deficient. In the yellow vulnerable species classified or endangered.

Small land mammals

The results of the inventory conducted in the part of the east of the high voltage line in the classified forest Audoin as part of the ESIA of the high voltage line Vridi West - Akoupé-Zeudji showed the existence 11 small mammal species including 4 insect species (shrews) and four rodent species. They were identified mainly in swamps, fallows and rubber plantations.

The *Crocidura buettikoferi* species ranked as Near Threatened is the only species on the IUCN Red List. It is found in the marshy forest of Audoin.

Table 6.12 *List of small mammals*

Family / Species	Common name	IUCN status	Type sign
Soricidae			
<i>Crocidura buettikoferi</i>	Crocidure Büttikofer	NT	Literature
<i>Crocidura muricauda</i>	Crocidure in mouse tail	LC	Literature
<i>Crocidura obscurior</i>	dark Crocidure	LC	Literature
<i>Crocidura olivieri</i>	great African Crocidure	LC	Literature
<i>Crocidura poensis</i>	N / A	LC	Literature
Muridae			
<i>Dasymys rufulus</i>	Rat hirsule red	LC	Literature
<i>Hybomys trivirgatus</i>	N / A	LC	Literature
<i>Hylomyscus simus</i>	Rat soft hair Simus	LC	Literature
<i>Lophuromys sikapusi</i>	West bristling Mouse	LC	Literature
<i>Malacomys edwardsi</i>	Rat Edwards malaria	LC	Literature
<i>Praomys rostratus</i>	Deer mice of Africa West	LC	Literature
<i>natal multimammate mouse</i>	Mouse multiple breasts Native	LC	Literature
<i>Mus musculoides</i>	N / A	LC	Literature
<i>Mus setulosus</i>	Dwarf West Mouse	LC	Literature
Gliridae			
<i>Graphiurus lorraineus</i>	N / A	LC	Literature
	Total cash (N = 15)		

EN: endangered; VU: Vulnerable LC: Least Concern, NE: not evaluated, DD: Data Deficient. In the yellow vulnerable species classified or endangered.

Bats

The results of the inventory conducted in the eastern part of the high voltage line in the Audoin classified forest as part of the ESIA of the Vridi-Ouest - Akoupé-Zeudji high voltage line showed 4 species of bats including *Epomops buettikoferi* and *Pipistrellus nanus* are the most dominant.

Concerning the conservation status, the species *Eidolon helvum* is classified near- threatened (NT) while the other species are of Least Concern (LC).

The big frugivorous bats, especially the species *Eidolon helvum* (Flycatcher of the African palms), are very consumed in Ivory Coast. In addition to the loss of its habitat, the high consumption of this species is a serious threat to its survival.

Figure 6.24 *The two dominant Megachiroptera (Hypsignathus monstrosus and Epomops buettikoferi)*



Table 6.13 *List of bats*

Suborder / Species	Common name	IUCN status	Type sign
Megachiroptera			
<i>Eidolon helvum</i>	Roussettesdespalmiers African	NT	direct observation
<i>hammer-headed bat</i>	monstrous Hypsignathe	LC	direct observation
<i>Epomops buettikoferi</i>	Epomophore of Büttikofer	LC	Literature
<i>Casinycteris ophiodon</i>	Fruit bat	NT	Literature
Microchiroptera			
<i>Pipistrellus brunneus</i>	pipistrelle brown	NT	Literature
<i>Pipistrellus nanus</i>	pipistrelle dwarf	LC	Literature
Total cash (N = 6)			

EN: endangered; VU: Vulnerable LC: Least Concern, NE: not evaluated, DD: Data Deficient. In the yellow vulnerable species classified or endangered.

Birds

Birds were observed during the scoping mission. These species include the solitary cuckoo *Cuculus solitarius* (Cuculidae), the bull eel *Bubulcus ibis* (Ardeidae); swallow of *Hirundo senegalensis* (Hirundinidae) mosquitoes, weaver Constable *Ploceus cucullatus* (Ploceidae), gray sparrow *Passer griseus* (Passeridae), green pigeon *Treron calvus* (Columbidae) and black kite *Milvus migrans* (Accipitridae).

The results of the inventory conducted in the eastern part of the high voltage line in the Audoin classified forest as part of the Vridi-West - Akoupé-Zeudji High Voltage ESIA show 156 species of birds in 48 families. They have been identified in the lagoon, in the lowlands / swamp forest and in fallows and crops.

The birdlife of the lake and its surroundings is composed of 80 species of birds divided into 30 families. Which represents respectively 18 % and 33% and in terms of the number of species and families of birds in the area of influence. No protected species of global interest have been identified in this habitat. The lagoon and surrounding water is one of the habitats studied the least diversified in terms of birdlife.

In the marshy forest of Audoin, 80 species (or 51% of all species) belonging to 30 families were counted. The largest number of bird species has been identified in this site. Three bird species on the Red Bird List and whose protection is of global interest (Birdlife International, 2016) have been identified. Of these two species, two are classified as "Near Threatened": the Tailed-tailed Chuck (*Lamprotornis cupreocauda*) and the Green-tailed Bulbul (*Bleda eximius*); and one is classified as "insufficient data": the Eisentraut Indicator (*Melignomon eisentrauti*).

Banco National Park is home to the brown-cheeked hornbill *Bycanistes cylindricus*, the red-headed owl *Scotopelia ussheri*, two "vulnerable" species listed by IUCN.

In fallows and crops, 77 species (49%) belonging to 28 families have been inventoried. It has been noted, the presence of a near-threatened species (NT). This habitat is second in terms of species richness of the site, it is indeed a feeding area for birdlife.

Modified and Natural habitats

According to IFC PS 6, a modified habitat is defined as "areas that may contain a large proportion of plant and / or animal species of non-native origin, and / or in which human activity has modified the primary ecological functions and species composition in the area "(IFC PS 6 paragraph 12).

A natural habitat is defined as' areas composed of viable assemblages of plant and / or animal species of primarily native origin, and / or in which human activity has not significantly altered the primary ecological functions and the species composition in the area "(IFC PS 6 paragraph 13).

Following the scoping mission and the on-site biodiversity inventory mission, it appears that the terrestrial habitats of the project site and surrounding areas have already undergone very advanced degradation. The Project consists of two types of zones as defined in Chapter 5, Methodology.

The plant area and southeast of the plant is a semi-natural zone characterized by a modified rural habitat (which is a mostly modified habitat) with smaller and minority preserved natural habitat areas (basement). funds). The area to the north and north-east of the plant site is characterized by the predominance of lowlands and swamp forest with preserved natural habitats. This area is shown in Figure 6.12 and corresponds mainly to the expected area of possible refuge for chimpanzees potentially present in the area.

The confluence zone of the three options of the line between N'djem villages, Abreby and pylon No. 55 of the Vridi-West - Akoupé- Zeudji power line is characterized by the same habitats as the semi-natural zone of the power plant. , which consists mainly of modified habitats with linear islands of natural habitat corresponding to the lowlands.

Identification of critical habitats

Identification of Critical Habitat is required by PS 6 to control risks and avoid, mitigate and compensate for impacts to high value biodiversity areas, including:

- 1) habitat of significant importance for Critically Endangered (CR) and / or Threatened (EN) species;

¹2012. IFC Performance Standards on Social and Environmental Sustainability, published in January 2012. Available at: http://www.ifc.org/wps/wcm/connect/115482804a0255db96fbff1a5d13d27/PS_English_2012_Full-Documents.pdf?Mode=AJPERES.

- 2) habitat of significant importance for endemic and / or restricted species;
- 3) habitat supporting significant overall concentrations of migratory species and / or congregatory species;
- 4) highly threatened and / or unique ecosystems; and or
- 5) areas associated with crucial evolutionary processes.

Critical Habitat is only relevant for a development project if it can be affected by this project. Determination of critical habitat has been undertaken for protected areas, habitats and identified species in the project area of influence. The criteria and thresholds used for the determination are set out in IFC Performance Standard 6.

This initial identification determines whether a feature is likely to be identified as a trigger for Critical Habitat classification, and are presented in Table 6.14. The quantitative thresholds for Levels 1 and 2 of Critical Habitat Criteria 1 to 3 are not assessed because they require:

- data on global and regional populations (existing or proxy could be used); and
- information on the presence and / or density of the species concerned requiring more in-depth inventories.

This latter point is missing for the area in the literature, and the baseline data collection field surveys have failed to collect quantitative data or credible data on the presence or absence of a species. For inherently rare species, the fact that they are not found in the specific field study does not necessarily mean that they are absent. At a minimum, this requires in-depth inventories with a reasonable effort / results ratio.

In this situation a probabilistic framing is the only scientifically reliable option. Any additional quantification effort would not increase the certainty or accuracy of the assessment.

Discrete Management Unit Determination

Assuming that the presence of trigger species for critical habitat is proven, the discrete management unit (DMU in the terminology of IFC Performance Standard 6) should be characterize critical habitat. In the case of the Project, this could consist of an area of approximately 50 km² of mosaic of natural and modified habitats bounded on the north by the Ebrié lagoon, on the south by the coastline.

¹ https://www.ifc.org/wps/wcm/connect/a359a380498007e9a1b7f3336b93d75f/Updated_GN6-2012.pdf?Mode=AJPERES

To the east and west, the boundaries seem at this stage more difficult to determine without a more complete characterization of the sensitivity of the lowland areas - however, the Taboth-Avagou road could be a reasonable limit in view of the impacts. potential of the Project on natural environments.

The results of the assessment identification show that lowlands / swamp forests are critical habitat as defined by IFC PS6 for Criteria 1 and 4.

Table 6.14 Critical Habitat Assessment

Species/ feature	Description / distribution / threshold	Classified as Critical Habitat (Y / N / P)
Criterion 1 - Species critically endangered or threatened species		
Chimpanzee African western (<i>Pan troglodytes verus</i>) CR (<i>critically endangered</i>)	<p>Presence of species in the natural habitats of the area of influence (lowlands, swamp forests) according to the local population.</p> <p>Level 1 threshold: Habitat required to accommodate ≥ 10% of the world population of a species listed as EN or CR by IUCN. With a global population of Pan troglodyte verus estimated at 18,000, it is impossible that the project area could accommodate 10% of the population.</p> <p>Level 2 threshold: Regular presence of at least one individual of a species listed as CR by IUCN.</p>	Y, if the presence of chimpanzees is confirmed
<i>Phrynobatrachus ghanensis</i> (EN, <i>endangered</i>)	<p>The Phrynobatrachus frog (<i>Phrynobatrachus ghanensis</i>) has been reported in the scientific literature at Banco National Park and Audouin Forest Reserve.</p> <p>Level 1 threshold: Habitat required to accommodate ≥ 10% of the world population of a species listed as EN or CR by IUCN. The world population is not known, the data in the DMU are unknown.</p> <p>Level 2 threshold: Habitat with significant regional concentration of a species listed as EN by IUCN, which could be considered a DMU for this species. No information on presence at the DMU, but known presence in the immediate vicinity. Probability of presence in the MISP, but it is not possible to assess whether it reaches a significant regional concentration.</p>	Perhaps, if the presence of the frog proved with a large population on a regional basis, but this seems unlikely

Species/ feature	Description/ distribution/ threshold	Classified as Critical Habitat (Y / N / P)
Criterion 2 - Endemic species/restricted habitat		
<i>Morerella cyanophthalma</i> Endemic of COI, and restricted ranks	<p>The <i>Morerella cyanophthalma</i> frog has a known occurrence in the Banco and Azagny National Parks and the Tanoé marshlands east of the Comoé River.</p> <p>Range of distribution: approximately 8000 km². Zone of effective presence: not known. This species is assessed as probably abundant when present, but with a very irregular distribution in its range.</p> <p>Level 1 threshold: habitat known to host 95% of the world's population: Unlikely.</p> <p>Level 2 threshold: habitat hosting more than 1% but less than 95% of the world's population, the habitat being a discrete management unit for this species, based on information available: No information available at this stage</p>	P, but impossible to prove because of the lack of data on populations global level.
<i>phrynobatrachus villiersi</i> <i>Endemic eastern hardwood forest ecoregion Guinéeene in Ivory Coast and Ghana</i>	<p>This species is only known in southwestern and southeastern Côte d'Ivoire and southwestern Ghana. The global population is not known. The area of presence is 50 000km².The occupation area is 2000km². It is a species found in primary forests and not found in secondary forests</p> <p>Level 1 threshold: habitat known to host 95% of the world's population: Unlikely.</p> <p>Level 2 threshold: habitat hosting more than 1% but less than 95% of the world's population, the habitat being a discrete management unit for this species, based on information available: No information available at this stage .</p> <p>Using adapted habitat comparisons in the DMU (approximately 20km²) and the area of occupancy (2,000km²), the adapted habitat in the DMU is 1% of the potential area. If present, it could reach HC's threshold</p>	P, but impossible to be given lack of data on populations at global, using similar distribution boxes, if identified in the DMU autravers study depth, she could trigger critical habitats.
Criteria 3 - Migratory / congregatory species		
None listed in the project area	Some areas of Ebrié Lagoon in the Azagny National Park (Ramsar Site) area are important areas for international bird migration. In this study, no areas of particular importance for bird migration were observed	N

Species/ feature	Description / distribution / threshold	Ranked as Habitat Review (O / N / P)
Criteria 4 - highly threatened or unique ecosystems		
Shoal/swamp forest habitats	<p>The qualitative thresholds for these criteria are:</p> <p>(i) habitats that are likely to decrease significantly in area or quality; (ii) habitats with a small spatial extent; and or (iii) habitats containing unique assemblages of species, including assemblages or concentrations of restricted biome species.</p> <p>The habitat of shoal / swamp forests represents a unique wetland ecosystem limited to the coastal zones of the eastern Gulf of Guinea¹ countries, which are intrinsically of small spatial extent, threatened by deforestation, agricultural practices, cultivation of palm oil, urban development etc. The habitat has a great wealth of flora and fauna and is home to species subservient to wetlands. We find in particular:</p> <ul style="list-style-type: none"> • An endangered amphibian species (Phrynobatrachus ghanensis) and potentially two endemic amphibians • Critically endangered species of primate (Pan troglodytes verus) 	Y
Criteria 5 - Crucial to evolutionary process		
None listed in the project area	No key evolutionary processes taking place in the project area of influence	NOT

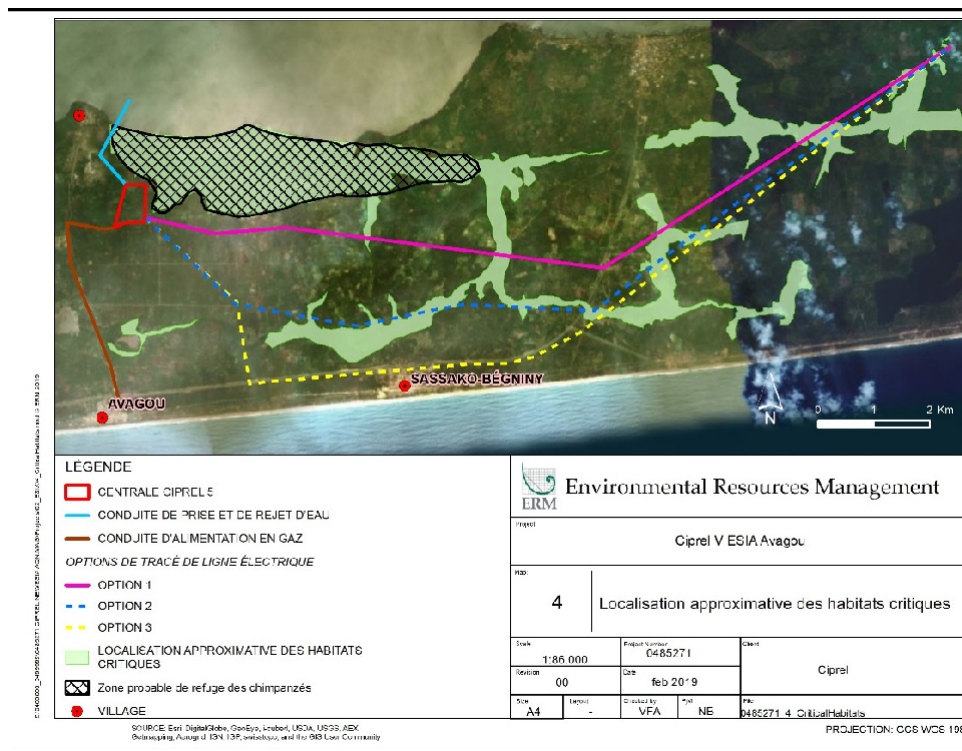
Explanations column "Classified as Critical Habitat": Y = Yes; N = No; P = Potential

The results of the assessment identification show that lowlands / swamp forests could be critical habitat as defined by IFC PS6 for Criteria 1 (if chimpanzees are proven) and 4.

Figure 6.25 shows critical habitat areas according to criterion 4 of the IFC in the study area. The area estimated to be the most suitable for hosting chimpanzees (Criterion 1) is the area to the north shown in Figure 6.25 below.

¹ Eastern Guinean forests, World Wildlife Fund Terrestrial Ecoregions Collection, 2014

Figure 6.25 Approximate location of critical habitats potentially identified at this stage of studies



6.5.7 Aquatic environments

Habitat

The main aquatic habitats likely to be impacted are surface water and the surrounding drainage regime, including the Ébrié Lagoon and the shallows and minor watercourses in the area due to hilly terrain. The lowlands in the area have already been discussed in the section on terrestrial natural environments. The Ebrié lagoon is an aquatic habitat likely to be impacted by the project because of the catch and the rejection of the cooling water of the plant. The project is more than 10 km distant from Lakes Bakré, Labion and Dadié, resulting in negligible impact risk. These areas are therefore not part of the area of influence.

The lagoon is supplied with fresh water by streams and rains passing through the Vridi Canal to reach the sea. Sea water enters the canal during high tides (daily variations) and during the dry season. Thus, considering the equilibrium and the interaction between diurnal and seasonal variations caused by seawater intrusion and seasonal freshwater inputs, the lagoon is composed of a series of estuarine biotopes. up to the brackish and brackish waters, depending on the distance from the link with the sea. Despite the polluted state of its waters, the Ebrié lagoon nevertheless supports many species of fish, most of them feeding on phytoplankton and zooplankton. The plankton population varies seasonally depending on temperature, salinity and water type.

Biodiversity

At the base of the food chain, autotrophic production is carried out by phytobenthos and phytoplankton. They constitute, in the Ebrié lagoon, the principal source of primary production because of the importance of the quality of oxygen produced during the phenomenon of photosynthesis. This contributes to the enrichment of the lagoon ecosystem in organic matter and beyond in living matter exploitable by man. The macrophyte plant associations encountered are composed of submerged hydrophytes and floating hydrophytes.

Three groups make up the majority of the benthos in the lagoon: polychaetes, molluscs and crustaceans. The molluscs present in the lagoon include edible species such as mangrove oyster *Crassostrea gasar* and clams *Iphigenia delesserti*. Among the most common bivalves of the lagoon, *Anadara senilis* is observed in the area near the Vridi Canal, particularly south of Boulay Island, on funds ranging from pure sands to vases, between 0.7 and 5 m . *Anadara senilis* is one of the species whose presence marks the entry into the brackish field (sea-lagoon contact). This species is not listed in the IUCN Red List.

Crustaceans include several important species of penaeid shrimp of great economic importance and which constitute an important part of the lagoon biomass: in particular the shrimp *Penaeus notialis* in their juvenile phase, *Macrobrachium Vollenhovenii* and *Callinectes amnicola*.

About forty polychaetes occupy the lagoon. Most of them are marine species that settle in the dry season near the Vridi Canal, on the bottom where the salinity is above 20g / L-1. This fauna disappears with the arrival of the rainy season; the cycle is repeated the following year but we do not necessarily find the same species.

The lagoon is home to many species of fish that have adapted to the varying chemical characteristics of the water since the creation of the canal. Especially the *Ethmalosa fimbriata*, of great economic and ecological importance which represents 70% of the catches of fish. This fish is able to adapt to important variations in salinity and water temperature. Aquaculture was introduced into the lagoon. The breeding of the following species is practiced: *Chrysichthys nigrodigitatus*, *Heteribranchnus longfilis* and *Sarotherodon melanotheron*. During the consultation missions with the fishing communities as part of the ESIA of the Vridi-West-Qkoupé-Zeudji power line, the following species could be identified (see Table 6.15). None of these species are considered threatened according to the IUCN Red List classification. The revision of the available bibliography does not suggest the presence of fish species considered endangered or endemic to the country in the lagoon. Figure 6.26 shows the catch of fishermen observed during the mission of the biodiversity inventory.

In the project area, the villagers reported the presence of many species of fish such as the cameroun (see Table 6.15).

Table 6.15 *Aquatic species identified in fishing nets (during the field mission of the ESIA for Vridi-West high voltage line - Akoupé-Zeudji)*

Family	Species	IUCN status
Hemiramphidae	<i>Hemiramphus balao</i>	LC
Elopidae	<i>Elops lacerta (herring)</i>	LC
Paralichthyidae	<i>Cytharichthys stampfilii</i>	LC
mojarra	<i>Eucinostomus melanopterus</i>	LC
Carangidae	<i>crevalle jack</i>	LC
	<i>Trachionotus teraia</i>	LC
Polynemidae	<i>Giant African Threadfin</i>	LC
Haemulidae	<i>Pomadasys jubelini</i>	LC

The West African Manatee (*Trichechus senegalensis*) is a species identified by IUCN as "vulnerable" and would be present in less developed and disturbed areas of the lagoon, particularly near the mouths of the Comoé River at East and Agneby to the west. It is considered to be present in the study area according to the literature and rare sightings were reported by the fishermen during the mission of the biodiversity inventory.

Figure 6.26 *Photos of the catch of fishermen during the biodiversity inventory mission*



6.6 SOCIAL CONTEXT

6.6.1 Area of Study

The study area in the initial state of socio-economic conditions is of variable extent, depending on the components evaluated. In particular:

- The closest receptors to the activities of the CIPREL V power station are the populations of the village of Taboth, 1.2km north of the Project site, and more specifically the "BT" camp attached to the village of Taboth and about 500m from the southwestern boundary of the land.

- The receptors closest to the power line activities are the populations residing in the different localities near the corridor of the line operating in a close environment, that is to say less than 1 km apart. else of the line.

Each section on the social framework includes a short description of the national and local context.

6.6.2 *Methodology for data collection*

The assessment of the baseline social context was based on site visits and consultations conducted as part of the Project ESIA.

A scoping mission of the study took place the week of November 12, 2018 in the presence of ERM, ENVAL and CIPREL. Public consultations were conducted during the week of November 24, 2018 during the identification mission of the initial state of the Project.

The public consultations were conducted using questionnaires designed for the populations living in the communities crossed by the Project. All local communities (see Section 6.6.3) were consulted as part of this process. All the interviews were conducted taking care to present the Project and to make it clear to the interviewees that the purpose of the consultation was, among other things, to identify the potential impacts of the Project. Focus groups were also conducted with men and women in the village of Taboth.

Reports and studies available publicly have also been exploited:

- the Greater Abidjan Planning Master Plan Development Project (SDUGA), JICA, March 2015;
- General Census of Population and Housing 2014, INS; and
- online data sources referenced in the text.

6.6.3 *Administrative structure and local community*

Administrative Structure

The site of the plant is in the sub-prefecture of Attoutou and the planned route of the line crosses the sub-prefecture of Jacquville. The sub-prefectures of Attoutou and Jacquville are included in the department of Jacquville.

Covering an area of 3,205 km², the department of Jacquville is limited to the north by the department of Dabou, to the south by the Atlantic Ocean, to the east by the District of Abidjan and to the West by the department of Grand - Lahou.

In addition to the deconcentrated State structures (Prefecture, Sub-prefecture, Agriculture, water and forest directorates, National Education, etc.), the department has two decentralized entities, namely the municipality and the regional council.

Since September 28, 2011, the department Jacqueville is part of the administrative region of major bridges for capital region Dabou by Decree No 2011-264 of 28 September 2011. The department has two Jacqueville subprefectures : Jacqueville Attoutou.

Local Communities

The local administrative authority is exercised by the sub-prefecture of Attoutou in the zone of the site of the power plant and by the sub-prefecture of Jacqueville in the area of the power line.

The Project area of influence is as follows:

- the site of the CIPREL V plant and the connection station is located on the territory of the village of Taboth;
- the natural gas supply line and the stitching station are on the territory of Avagou;
- the discharge of the water from the plant is done in a lagoon in an area potentially used by fishermen from Taboth, Camp Mathieu and Adoukro; and
- the route of the power line crosses lands Taboth, of Adoukro and probably N'djem.

The village of Sassako-Begnini claims the territory crossed by the line which is recognized administratively as territory of Adoukro. Adoukro is historically a camp of Sassako-Begnini which obtained the title of village.

Alternative routes of power line across Abreby lands.

Thus, the social receptors considered in the study are the village of Taboth in the sub-prefecture of Attoutou and the villages of Avagou, Sassako-Begnini, Adoukro, N'djem and Abreby in the department of Jacqueville, as well as camps identified during site visits, near the plant site, the line or the lagoon:

- BT camp (1 household attached to Taboth) about 500m from the power plant
- the Mathieu camp on the edge of the lagoon and attached house 750m of the line (about 10 households);
- André camp 300m from the line (1 home);
- Ahu Gideon camp 400m from the line (2 households);
- Ambrose camp 150m from the line (8); and
- Michel Lobio camp 100m from the line (20 people).

A dwelling, the BT camp, and a farm northwest of the power station shown in Figure 6.27 are located at a distance of 650 m from the plant.

The villages of Taboth, Avagou, Sassako-Begnini, Adukro, N'djem and Abreby are managed by the village chiefdom. With the exception of the BT and Mathieu settlements attached to the village of Taboth, the other camps mentioned above are managed by their landlord who employs the temporary inhabitants as a labor force.

It should be noted that the village of Adoukro recognizes a customary chief and representative of Sassako-Begnini, different from the administrative chief recognized by the Ivorian authorities. Adoukro is also claimed by the village of Taboth.

Figure 6.27 Locations of villages and camps in the Project area



6.6.4 Demography

National level

The Ivorian socio-demographic context is marked by rapid population growth associated with urbanization and industrialization. An overview of population indicators at the national level is provided in Table 6.16. The rate

of urbanization has increased, with an estimated 54.2% of the population living in urban areas, compared to 43% in 1998. 36% of the population is aged 15 to 34, this rate rising to 78% when considering the proportion of those under 35 years of age.

Table 6.16 *Summary of demographic indicators, Ivory Coast, 1998, 2011, 2014*

Indicator	1998 *	2011 ** to 2014 *
Total population	15,366,672	22,671,331 *
Urban population (%)	42.5	51.7 *
Women of childbearing age	3,685,805	5,433,314
Annualized growth rate (%)	3.3	2.6 *
Crude birth rate (per 1 000 population)	40.6	35.7
Total fertility rate (live births per woman of child of childbearing)	5.4	4.8
Crude death rate (per 1 000 of the population)	14.2	12.9
Life expectancy at birth (years)	50.9	53.1
Not Ivorians / International Migrants in Proportion the Total Population (%)	2163644 / 14	Data not available

Sources: *INS figures based on Census General of Population and Households 1998 and 2014

** Demographic and Health on the Ivory Coast, 2011-2012.

Local level

The population of the department of Jacqueville is composite. It is made up of indigenous Akan, called lagoon Akan, including the Alladjans and Ahizis communities of all 60 ethnic groups in Côte d'Ivoire and a large number of foreign communities. Nationals of the countries of the West African subregion (Beninese, Togolese, Ghana, Burkina Faso etc.) represent the vast majority of these foreign communities.

According to the General Census of Population and Housing (RGPH) 2014, the department of Jacqueville has a population of 56,308 inhabitants, or 0.24% of the population of Côte d'Ivoire. The population of the department is estimated at nearly 56,308 inhabitants with an annual growth rate of about 3.8%.

The following table presents the distribution by gender in the local communities in the Project area, as well as their demographic weight compared to the population of the Jacqueville department.

Board 6.17 *Distribution by gender of the population by crossed by locality*

locality	population census	Sex	
		Men (%)	Women (%)
Taboth	801	50%	50%
Avagou	1695	51%	49%
Sassako-Benigni	1409	51%	49%
Abreby	945	47%	53%
Adoukro	194	56%	44%
N'djem	5165	53%	47%

Source: National Institute (INS), 2014

It should be noted that the parties consulted during the field mission all mentioned a strong increase in urban development and population in the department of Jacqueline since the existence of the Philippe Grégoire Yace bridge, known as the "Jacquville bridge" which was inaugurated in March 2015 and now facilitates road access from Abidjan. As a result, in 2018 it is highly likely that the population of the villages will be higher than what is indicated in the 2014 census. For example, in October 2017, the village of Sassako-Begnini chiefdom counted a population of 2,415 individuals in the village and attached camps, against 1,409 individuals according to the official census conducted in 2014.

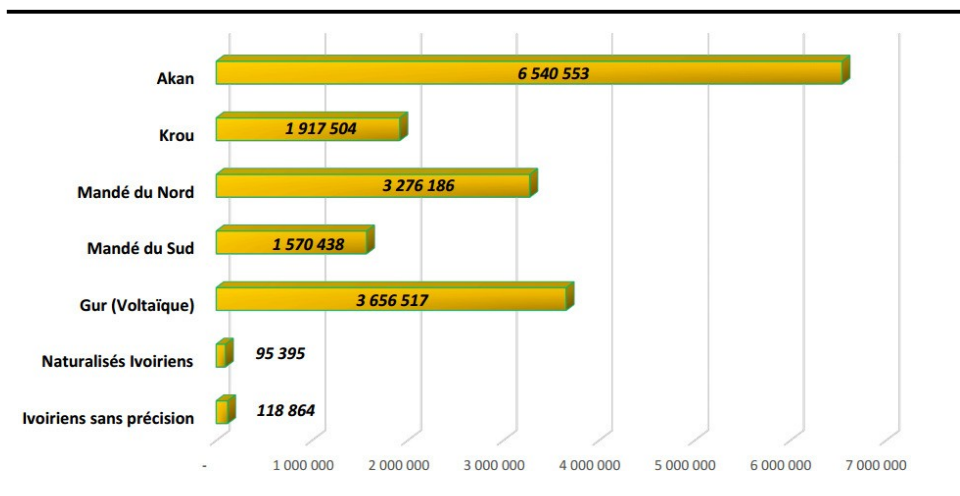
6.6.5 Migration and ethno-linguistic groups

National level

Côte d'Ivoire attracts a significant number of migrants. About 10% of the population is of foreign origin. The majority of foreigners are nationals of other African countries, mainly ECOWAS member states, with Burkina Faso and Mali having the most nationals.

The Akan ethnic group includes the largest Ivorian population in 2014, ahead of the Gur, Mandé North and South and Krou.

Figure 6.28 Population by ethnicity 2014



Source: RGP 2014, INS

Local level

The indigenous populations of the department of Jacqueline are Alladjans, Avikams and Ahizis. This constituency is characterized by a cosmopolitan population consisting of Ivorians including lagoon Akan, Krou and Mande and non-Ivorians including Burkinabes, Ghanaians, Togolese, Beninese, Malians, etc.

The communities in the Project area have a mixed population of Ivorians and foreign ethnic groups, the main ones being Ahizis and Alladjans. The

population of Taboth is mainly of Ahizi origin while that of the villages of Avagou, Abreby and Sassako-Begnini is of Alladjan origin. The population of Ndjem villages is composed of nationals of the countries of the sub-region (Benin, Burkina Faso, Ghana, Togo, etc.). The population of Adoukro village is mostly Beninese.

The Ahizis and Alladjans are members of the Akan ethnolinguistic group and were traditionally fishermen and farmers.

The lagoons in question here are those of the indigenous ethnic communities mainly Ahizi, Alladian, Ebrié or Kyaman and Odjoukrou. They settled along the western basin of the Ebrié lagoon in southern Côte d'Ivoire. Their migratory movements on the maritime and lagoonal coastal strip gave rise to a long history of mixing populations and fishing, trade and agriculture activities.

It should be noted that two strains were at the origins of the mixing of populations: the Akan strain from the East including the Alladjan and Ahizi d'Allaba, Taboth, Atoutou, Nigui-Assoko, Abraniemmiembo, Téfrédji, and the strain Krou came from the West including the Ahizi of Abra, Nidz and Tchagba.

6.6.6 *Traditional power structure*

The chiefdom among the Alladjans and the Ahizis is due to a determined lineage. It is passed from brother to brother or maternal uncle to nephew. However, the succession happens from father to son. The appointment of the village chief is the business of all the families and more particularly of the royal family, all the elders of his maternal clan agree on a name by first examining the legitimate candidate. The heads of families, who do not fail to exercise their influence during preliminary consultations, are then summoned and informed of the identity of the elected leader.

The chief is helped by rod holders who assist him in his judicial functions. Each neighborhood of the village designates a representative by the voice of its head teachers. The chief is assisted in his administrative functions by the district chiefs. Within the age groups are chosen dignitaries to which are assigned specific attributions. Justice is a prerogative of the chieftaincy. Business, however, only reaches the chief in the last resort. Matrilineage and maternal clans represent intermediary jurisdictions responsible for settling disputes amicably. The chief and his staff are the court of appeal to which everyone can address at any time.

This socio-political organization has undergone enormous changes since the colonial period. Thus, nowadays, village chiefs are elected by universal suffrage. Youth associations are playing an increasingly important role in making decisions that affect the life of the community, sometimes to the detriment of traditional age groups.

6.6.7 *Religious beliefs*

National level

Across the country, almost a third of the population is Christian, another third is Muslim and the rest is atheist or animist (3.6%). It should be noted that the non-Ivorian population is predominantly Muslim (72.7%) and that the majority of animists are of Ivorian origin.

Table 6.18 *Population rate by religion*

Religion	Ivory Coast (%)	Non-Ivorians (%)	Together (%)
Catholic	18.5	13.0	17.2
Methodist	2.1	0.4	1.7
Evangelist	14.5	3.3	11.8
Celestial	0.5	0.2	0.4
Harrist	0.7	0.0	0.5
Other Christian religions	2.7	0.8	2.2
(Christians Ensemble)	39.1	17.7	33.9
Muslim	33.7	72.7	42.9
animist	4.4	0.9	3.6
other religions	0.6	0.2	0.5
Without religion	22.2	8.5	19.1
Total	100.0	100.0	100.0

SOURCE: RGPB 2014 Results Global INS

Religious marriages represent only 28.4% compared to 79.1% of customary marriages. Legal marriages remain marginal, with less than 1 in 10 marriages.

Local Level

The communities in the study area are composed of a predominantly Christian population cohabiting with a Muslim population often from neighboring countries.

The sacred sites seem to have been destroyed and have not been worshiped for at least a generation, with the exception of a sacred bridge in N'djem.

Almost all communities have their churches (a church by religious movement), and usually a mosque. Animist hotels can be found in some homes.

Figure 6.29 Church of Taboth



Source: Mission ERM / ENVAL, November 2018

The table below gives details of places of worship reported by the local population.

Table 6.19 Places of worship in localities

1

Locality	Religious sites
Taboth	5 churches, one mosque 2 cemeteries
Avagou	4 churches, 1 mosque graveyard
Sassako-Begnini	7 churches, 1 mosque
Abreby	4 churches, 1 mosque 2 cemeteries
Adoukro	No public worship places. At closest to N'djem. Presence of a fetish in an individual. 1 cemetery
N'djem	At least five churches, one mosque 1 sacred site (bridge) from Project impact area

Source: Mission ERM / ENVAL, November 2018

6.6.8 Economic activities

National level

Those in employment account for 93.1% of the workforce and 51.6% of the working-age population. This presents about 7.5 million people, 61.4% of whom are men. This population lives mostly in urban areas

(51.7% of which 22.10% in Abidjan), is relatively young (more than half, ie 55.8% are between 14 and 35 years old) and poorly educated (about 75.3% have at most the primary level).

The labor force includes employed and unemployed persons. The share of the population outside the labor force is relatively higher among women (61.4%) and persons without education (55.2%).

Table 6.20 *Distribution of the population of working age by demographic features*

Demographic Characteristics		Working Age		Workforce		Excluding labor	
		Number	%	Effective	%	Effective	Percentage
Together		14,506,521	62.8	8040947	55.4	6465574	44.6
Sex	M	7328084	50.5	4834013	60.1	2494071	38.6
	F	7178436	49.5	3206933	39.9	3971503	61.4
Residence	Abidjan	3065444	21.1	1911927	23.8	1153517	17.8
	other urban	4598713	31.7	2405705	29.9	2193007	33.9
	Rural	6842364	47.2	3723315	46.3	3119050	48.2
Age	14-35 years	9157005	63.1	4620926	57.5	4536079	70.2
	36 and more	5349516	36.9	3420021	42.5	1929495	29; 8
age 2	14-24 years	4515508	31.1	1598952	19.9	2916556	45.1
	25-35 years	4641four	32.0	3021974	37.6	1619523	25.1
	36-59 years	4307281	29.7	2990546	37.2	1316735	20.4
	60 and more	1042234	7.2	429475	5.3	612760	9.5
Level of education	ne	7880772	54.8	4339901	54.4	3540871	55.2
	Primary	2658338	18.5	1530827	19.2	1127512	17.6
	Secondary	3260696	22.7	1665640	20.9	1595056	24.9
	Superior	594375	4.1	444588	5.6	149787	2.3

* Persons who are at least 14 years Source: NSI, ENV 2015.

Local level

Fisheries and agriculture are the main livelihood activities of the communities in the Project area.

The main cash crops produced in terms of volumes in the Jacqueville department are coconut, palm and rubber trees and occupy the majority of the population. All the communities in the study area exploit village coconut groves in addition to the food crop.

Coconut plantations are present on the site of the CIPREL V plant and around both sides of the road leading to Jacquville. Coconut pulp is extracted locally and sold to commercial intermediaries or, more rarely, directly to the producers of grated coconut and coconut oil (SICOR). The layout of the line runs alongside a plantation of SICOR. This plantation is crossed in the case of alternatives to the lines of the line.

At the level of cocoa cultivation, current annual production is very low. This drop in cocoa production is explained by the abandonment of this crop in favor of emerging perennial crops in the department such as rubber, oil palm and teak. Industrial crops such as rubber and oil palm are practiced at the sub-prefecture of Attoutou.

In addition to these perennial crops, food crops such as plantain, rice, cassava and others are also produced in sufficient quantities. But the main one among them is cassava, which is used to make attiéké (cassava meal), the staple food of indigenous people.

Market gardening is practiced by foreign and non-native populations on small plots and mainly concerns aubergine, okra and tomato.

Fishing is also practiced in the lagoon, in the shallows during the rainy season and at sea. Fishing in the lagoon is the first economic activity of Taboth, Adoukro and Camp Mathieu. This activity is detailed in the following subsection.

The communities consulted along the coastal road fish in the shallows during the rainy season using traps, hooks and nets. In the dry season when the water is stagnant, fishing in the bottom becomes an activity led by the women of these villages.

Some Taboth fishermen use labor to cultivate their fields. This is also the case for fields far from the village, at the origin of encampments.

Uneaten harvests and processed products (attiéké, tofi ...) are sold on a roadside stand, from individuals to private individuals, or at the market (eg Abidjan, Jacquville, ...). This trade is generally practiced by women. Some women sell their products in Abidjan or Jacquville and buy condiments they sell on their return to the village. To move they rent a carrier by motorcycle or tricycle.

Tourist infrastructures are also developing in the Jacquville department, especially along the ocean (hotels, restaurants, privatized beaches, ...).

Finally, Peul herders use and cross the Project area to graze their livestock.

All the communities consulted noted a high rate of unemployment, particularly among young people.

The table below identifies the economic activities by gender identified with the consulted parties.

Table 6.21 *Subsistence activities practiced by gender in the study area*

Locality	Livelihoods	
	Men	Women
Taboth	Fishing Coconut Cassava Food-producing cultures Chicken coop (2 farms between the site of the plant and Taboth) coconuts	Production of attiéké (made from cassava) Assistance in fields Trade of attiéké and condiments
Avagou (1 market weekly)	Cassava Food-producing cultures Sea fishing in dry season fishing in shallow in the rainy season Livestock	Production of attiéké (made from cassava) Assistance in fields Trade of attiéké and condiments
Sassako-Benigni	Agriculture Small shops in the Tourism Village Breeding Sea fishing Fishing in shallow rainy season Coconut hunting bushmeat	Shoal fishing in the dry season Marine salt production Attiéké production Field aid Attieke trade and condiments
Abreby	cassava Palms shallows fishing	Not available
Adoukro	Fishing Agriculture Breeding	Production and trade of gari (cassava-based) and tofi (made from coconuts)
N'djem (1 market daily)	Coconut Cassava Fishing in shallow in rainy season Small shops in the village	Not available
Camp BT	Cocotiers- Cassava Fagot	
Camp Mathieu	Fishing-	

Locality	Livelihoods	
	Men	Women
Camp Andrew	Agriculture-	
Camp Ahu Gideon	Breeding- Cutting wood in shallow Coconuts	
Camp Ambrose		

Source: Mission ERM / ENVAL, November 2018

The main socio-economic activities in the study area are shown below.

figure 6.30 Socioeconomic activities in the project area





Culture peppers (camp Ambrose) Sales



game

Fishing in lagoon

Fishing in the lagoon is the main livelihood activity of populations of Taboth, of Adoukro and Mathieu camp.

The social consultations revealed that certain fishing techniques are practiced in the direct vicinity of the lagoon between Taboth and Adoukro, which suggests that some of these activities could take place near the point planned for the thermal discharge of the Project (without however, be confined):

Arrangement of fishing nets on woods planted at the edge of the lagoon: Installation of the device in the evening and recovery of products at sunrise. The lagoon edges are informally registered as customary properties; thus the sites where the woods are planted for the laying of nets all have a customary user and are transmitted by inheritance. Fishermen operating in the Project area are likely to be from Taboth, Camp Mathieu or Adoukro, and will be identified as part of the Resettlement Action Plan (RAP) developed by the NDEB or in the framework of a complementary study if necessary. These nets have a variable length and generally reach about 100m long. Two types of meshes are preferred: one of 1.5cm on 1.5cm called "a finger tight" which allows to fish type fish sardines, and the other 3cm on 3cm known as "three fingers open" for the fishing carp.

- **Sekemi hand fishing:** Traditional collective fishing at the edge of the lagoon, practiced in all seasons, once or twice a week (Saturdays) and exclusively in Taboth. This fishing requires the mobilization of a group of about ten men. At the hottest hours of the day (favorable for catch), hand fishermen go by pirogue to the marshy edge of the lagoon and enter the water. They release the vegetation on the surface of the water by hand (by rolling it on itself) then blind the fish by stirring the sediments making the water turbid, which allows them to catch carp carpeted in the shade vegetation cover.

- **Manatee fishing (bygone):** this fishery was practiced on the edge of the lagoon before its prohibition. Some fishermen have been sanctioned for illegal manatee fishing, and since then it appears that the species is no longer being fished in the study area.

Other fishing techniques are used at the edge of the lagoon but close to the villages, so probably outside the project's heat-reject zone:

- **"bagbaloulou" traps :** used for fishing for crabs, shrimps, small fish. This trap is set in the evening and recovered the next morning. It is preferably used in the rainy season.
- **"Egle" hook fishing:** some Beninese women fish crab with the "egle" hook, in the morning and in the evening. Every Friday a woman from Abidjan goes to Taboth to buy the products of this fishery.
- **Classic hook fishing :** suitable for medium size fish, pike or captain type. This fishery is favored in the dry season.
- **Akadja Reserve :** An enclosure containing a few fish is installed in a lagoon over a period of about 3 to 6 months, on a variable surface of about 3m by 3m. The fish are fed about twice a week with cassava, rice or bread, for example.
- **Piero fishing :** shrimp fishing technique at the edge of the lagoon, practiced in the dry season or at low tide. The "piero" net needs to be carried by two fishermen who walk in very shallow water.

Finally, net fishing is also practiced off the lagoon, using nets thrown by one or two fishermen on small pirogues.

Fishing is generally an activity reserved for men, with the exception of hook fishing, which is sometimes carried out by women of Beninese origin according to the testimonies collected in Taboth.

The fishery product is consumed and the surplus is sold. However, a sharp decline in the fishery resources over the last ten years is noted by all the fishermen consulted, who then turn to agriculture as an alternative.

The main fishing tools in the lagoon are illustrated below.

Figure 6.31 Fishing in Ebrié lagoon



Net fishing in the lagoon



wood privatized



Mesh called a "finger tight" "Mesh called" three fingers open "



traps " bagbaloulou "Hook"



rule "



Fishing hook classical



Wide mesh for fishing for pike



Filet "Piero" Net for fishing



manatee

6.6.9

Land ownership

Under national law, the Ivorian State owns all the land in Côte d'Ivoire. However, customary land use rights should be recognized for communities in the Project study area. According to the legislation in Côte d'Ivoire, the customary land tenure of the plant's land will have to be purged according to the modalities set by Decree No. 2014-25 of 22 January 2014 on the general regulation of the purge of customary land rights for general interest.

The Project area of influence is as follows:

- the site of the CIPREL V plant and the connection station is located on the territory of the village of Taboth;
- the natural gas supply pipe and the quilting station are located in Avagou territory;
- the discharge of the water from the plant is done in a lagoon in an area potentially used by fishermen from Taboth, Camp Mathieu and Adoukro; and
- the route of the power line crosses lands of Taboth, Adoukro and potentially N'djem.

The village of Sassako-Begnini claims the territory crossed by the line which is administratively recognized in Adoukro. Adoukro is historically a camp of Sassako-Begnini which obtained the title of village. Adoukro is also claimed by Taboth.

The village of Taboth shares common borders with Akrou in the West, Avagou in the South (limit at the industrial plantation of SICOR), and

Adoukro in the East. Avagou contests the limit recognized by Taboth and claims a larger share of SICOR. However, this does not impact the site of the CIPREL V plant.

The site visit did not clearly identify the boundaries of the villages of N'djem and Abreby. It is reasonable to assume that the N'djem plantation lands are in the study area and that the Abreby lands are traversed only by the alternate routes of the line.

Alternative routes of power line cross Abreby lands.

The NDEB is in charge of the development of the Project Resettlement Action Plan. Also, the RAP will identify precisely the different land titles.

6.6.10 Education

Côte d'Ivoire's education system covers four levels: pre-school, primary, secondary and higher. The preschool level covers three sections (small section, medium section and large section).

Most of the communities crossed have at least one primary school or an opportunity to educate children at greater or lesser distances, usually to the main villages.

However, students must travel to Jacquville to continue their studies from high school, which usually requires a tutor.

According to the social surveys carried out during the ERM / ENVAL mission in November 2018, some children do not go to school due to lack of parents' means, particularly in the village of Abreby.

Moreover, in all the communities consulted, many children do not have a birth certificate (80% of the pupils according to the Taboth school director), which effectively prevents them from taking the official exams. at the end of primary school before going to college. For students without a birth certificate, the Ivorian state issues a supplementary judgment to allow them to sit for the exams.

All the parties consulted expressed the wish to have a school at a closer distance than Jacquville.

Figure 6.32 *Taboth primary school*



Source: Mission ERM / ENVAL, November 2018

The table below summarizes the information collected in the communities in the study area.

Table 6.22 *Access to education in the study area*

Localité	Accès to education
	Taboth Elementary School (195 students): 6classes
Avagou	1 Primary school (6 classes) 1 kindergarten
Sassako-Benigni	2 primary schools (12 classes) 1 kindergarten
Abreby	1 primary (6 classes)
Adoukro	1 primary private school. Public schools in N'djem
N'djem	4 schools

Source: Mission ERM / ENVAL, November 2018

6.6.11 *Health*

National level

Ivory Coast health system has three levels, primary, secondary and tertiary:

- primary level including first contact health facilities:
 - urban health centers; and
 - rural health centers;
- the secondary level constituted by primary health facilities:
 - general hospitals;

- regional hospitals; and
- hospital specialist centers;
- the tertiary level health facilities including the second and last resort:
 - 4 university hospitals;
 - Abidjan Heart Institute;
 - the Raoul Follereau Institute;
 - National Institute for Public Health Treichville;
 - the emergency medical assistance service in Abidjan; and
 - the National Public Health Institute of Abidjan.

These public health facilities are supported by medical offices, hospitals and private clinics.

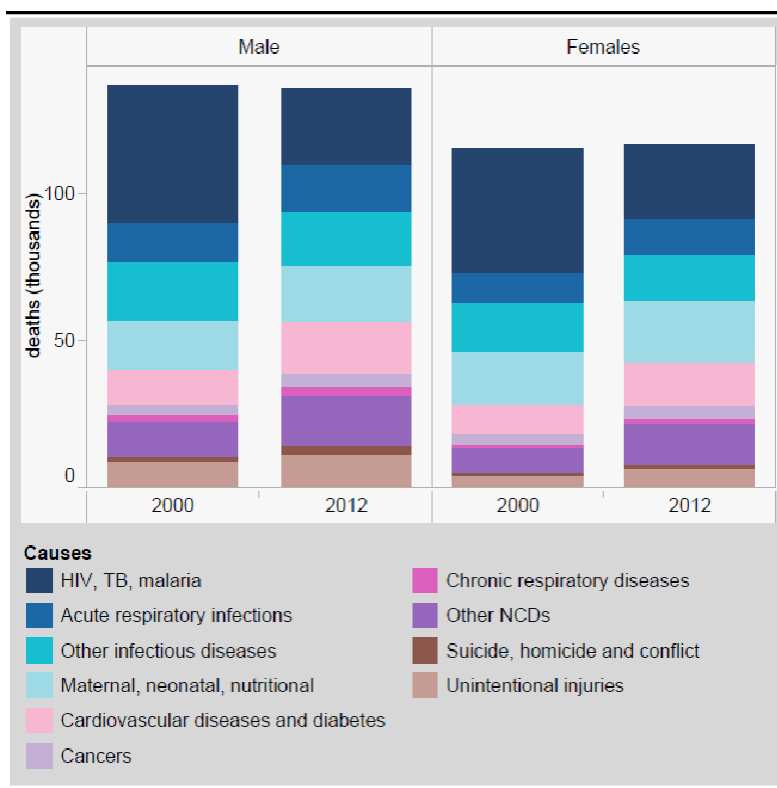
According to figures from the World Health Organization¹ HIV, tuberculosis and malaria are the leading causes of adult death in Côte d'Ivoire.

HIV is closely followed by lower respiratory tract infections (11.3% of deaths) as the leading cause of death². Further information on the causes of mortality according to WHO estimates is provided in the following figure.

¹ World Health Organization, Ivory Coast: WHO Statistical Profile <http://www.who.int/gho/countries/civ.pdf?ua=1> accessed 17 October 2016.

² WHO (2012) Ivory Coast: WHO statistical profile <http://www.who.int/gho/countries/civ.pdf?ua=1>.

Figure 6.33 Death by General Category of Causes, Côte d'Ivoire, 2000-2012



source: World Health Organization, Ivory Coast: WHO Statistical Profile

The following figures describe the statistics of various diseases and causes of death:

- the distribution of major causes of death of children under 5 years in Ivory Coast, in 2013;
- HIV prevalence by region; and
- the top 10 causes of death in Ivory Coast between 2000 and 2012.

Figure 6.34 Distribution of major causes of death of children under 5, Ivory Coast, 2013

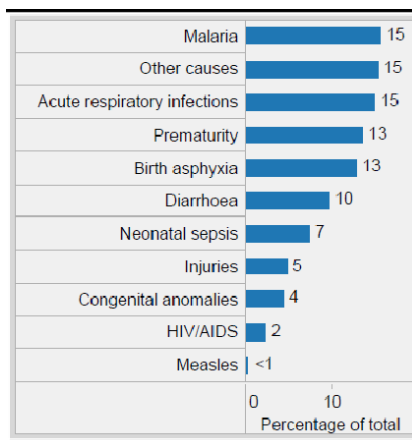
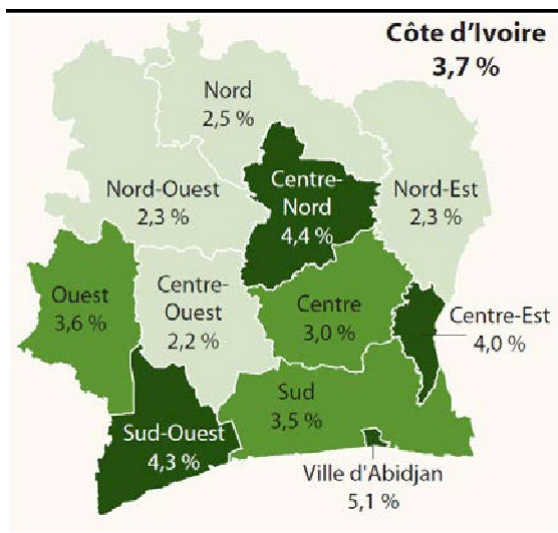


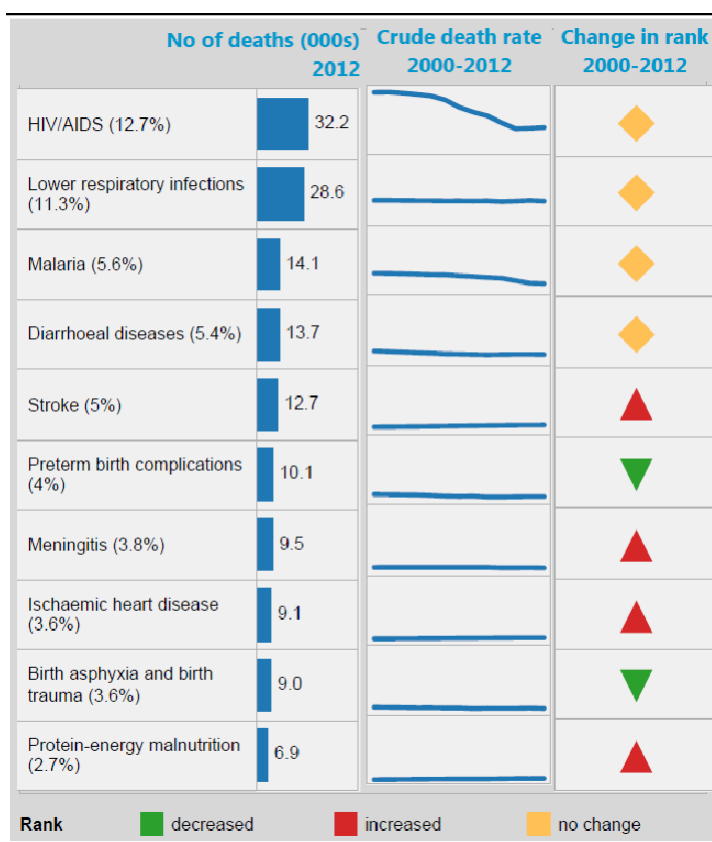
Figure 6.35 HIV prevalence by region, Ivory Coast, 2011-12



Source: Ivory Coast Demographic and Health Survey 2011-2012.

¹ World Health Organization, Ivory Coast: WHO Statistical Profile. <http://www.who.int/gho/countries/civ.pdf?ua=1> accessed 17 October 2016.

figure 6.36 Top 10 causes of death, Ivory Coast, 2000-2012



Source: World Health Organization, Ivory Coast, WHO Statistical Profile ¹.

Local level

The department of Jacqueline has 14 health facilities distributed including one (01) General Hospital, two (02) rural dispensaries, nine (09) rural health center and two (02) private health facilities.

In 2015 the rate of health care staff at the Jacqueline department level in the public sector is as follows.

Table 6.23 Staff split and ratio in the department Jacqueline

Gynecologists doctors	02	1 doctor / 11,705 inhabitants
pediatricians	01	
General practitioners	06	
pharmacists	03	1/27,310 inhabitants

¹ <http://www.who.int/gho/countries/civ.pdf?ua=1> accessed 17 October 2016.

Dentist	02	1/10,170 habitats
State Graduate Nurses (IDE)	30	1 IDE / 2,731 inhabitants
Midwives (SF)	20	SF 1/1 017 inhabitants

SOURCE: Departmental Directorate of Health Jacqueville, 2015

Note: NA: Not Available

The dominant pathologies in the department of Jacqueville remain since 2004 malaria, acute respiratory infections, diarrheal diseases, trauma, anemia.

Although the incidence of malaria fell by 27% between 2014 and 2015, malaria remains the leading cause of curative consultations in health facilities in Jacqueville; and is the leading cause of death.

Acute respiratory infections are the second leading cause of consultations in health facilities. The number of cases with sexually transmitted diseases (STDs) is increasing. This has increased from 576 cases in 2014 to 621 cases in 2015. During the same period, the number of AIDS patients has increased from 40 to 158.

Some of the communities in the study area have a basic clinic. The best equipped medical centers near the Project are located in Jacqueville and Songon. The table below summarizes the health infrastructures of certain localities.

Table 6.24 *Summary of health infrastructure in the places visited*

Locality	Health Infrastructure
Taboth	No health center
Avagou	1 clinic (1 nurse and 1 caregiver) 1 maternity clinic (1 midwife)
Sassako-Benigni	1 health center 1 maternity clinic
Abreby	1 health center currently without electricity or water
Adoukro	No health center
N'djem	1 health center

Source: Mission ERM / ENVAL, November 2018

It should be noted that local communities have commonly used medicinal plants, cultivated or gathered in fallows and shallows.

Taboth not having health center, people can rent in case of emergency the services of a private transportation by motorcycle or tricycle to reach a health center. It was mentioned during the consultations that this solution is limited at night and when the village access track is flooded in the rainy season.

Fire safety Taboth

During the site visit in November 2018 villagers in Taboth mentioned the existence of a field showing the presence of hydrocarbons on the surface, at the southern limit of the village, about 1 km from the plant. According to testimonials, when the field is flooded in the rainy season a layer of hydrocarbons can be observed on the surface. In the dry season the field easily takes fire, if a butt is inadvertently abandoned for example. An oil company has prospected the area.

Figure 6.37 *Location of the presence of surface oil*



Source: GoogleEarth

Figure 6.38 *Photomarker showing the presence of surface oil*



Source: Mission ERM / ENVAL November 2018

6.6.12 *Public Infrastructure*

Government Investment Strategy and Development Projects in the Study Area

The government of Côte d'Ivoire has adopted a National Development Plan for 2016-2020 including major structural reforms of the economy to achieve inclusive and sustainable growth driven by the private sector (1). It included in this National Development Plan significant investments in infrastructure, especially roads, bridges and port extensions.

The Great Bridges region has undergone a growing pace of development in recent years and large-scale projects to come. The Urban Master Plan of Greater Abidjan (SDUGA, 2015) provides, in particular, for the Jacquelineville department:

- a social housing program;
- a tourist center;
- a coastal highway; and
- construction Jacquelineville bridge (now in service).

The subdivision projects illustrated below were identified during the ERM / ENVAL site visit in November 2018.

1 Information on the World Bank on the Ivory Coast available at: <http://www.worldbank.org/en/pays/Côteivoire/overview> accessed 25 October 2016.

The subdivision of Adoukro is disputed by the village of Sassako claiming part of the land, crossed by the route of the line CIPREL.

Figure 6.39 Subdivision projects in the Projects area



Access to drinking water

In the local communities of the Project area, access to drinking water is provided by water towers, with the exception of the village of Adoukro. Single well water is generally used for cleaning or exceptionally for drinking water in case of failure.

It should be noted that the Project proponent commissioned a hydrogeological study to assess the availability of the water resource.

Figure 6.40 *Water tower of Taboth*



Table 6.25 *Access to water in places visited*

Localité	Access to the water
Taboth	1 hand pump drilling from 1978 Ten wells can dry up in dry season (for washing and if drink if the pump breaks) 1 water tower manual traction
Avagou	The village has drinking water by hydraulic villagers improved. well there in the village
Sassako-Begnini1	water tower, wells for washing, some private wells Abreby
Adoukro	Water tower in the village, but difficult to use well there in the village The village does not enjoy drinking water supply well there (for drinking, washing dishes, laundry)
N'djem	About 25% have access to the water tower Existence wells in the village

Electricity and energy sources

All local communities have access to electricity with the exception of Adoukro, and power cuts are common.

Table 6.26 *Access to the electrical network of local communities*

LocalitéStatut	
Taboth	Electrified for public lighting and private connections to some homes.
Avagou	Electrified
Sassako-Begnini	Electrified
Abreby	Electrified
Adoukro	Not electrified (some people are connecting from the village of Ndjem)
N'djem	Electrified

Source: Mission ERM / ENVAL, November 2018

Waste from coconut plantations (branches, hulls, ...), coconut charcoal and fagots from wetlands are commonly used as fuel for heating in the Project area.

Waste management and sanitation

Several cities in Côte d'Ivoire are facing the challenges of household waste management. The results of public consultations show that wastes are usually dumped directly into the wild without prior treatment. Garbage is sometimes piled up in open dumps and burned.

Figure 6.41 Photo of a depot area in Adoukro



None of the villages consulted have public latrines. With rare exceptions, some households have installed private latrines at home. Villagers use private latrines overlooking the lagoon.

Figure 6.42 Photo of latrines on the lagoon Adoukro



Telecommunications

The Project area has a mobile phone connection. The telephone reception is relatively good and all major communication providers (ie Orange, MTN and Moov) are active. Internet access is largely facilitated through mobile phone modems or 3G connectivity.

Waste water and rainwater management

Rainwater and wastewater are discharged to drainage canals, lost wells, or directly into the lagoon without being treated¹. Many open storm drains are clogged with solid waste. None of the villages consulted benefit from a municipal wastewater collection system.

6.6.13 *Paleontology, archeology and cultural heritage*

Little information is available on cultural heritage at the regional and local levels in Côte d'Ivoire, as very little systematic archaeological work has been done. It is clear, however, that the Ébrié Lagoon formed the basis of the social and economic development of Abidjan (which dates back to the 15th and 18th centuries).

Along the route of the line, the consultations confirmed the presence of several places of worship, cemeteries and a sacred natural site.

This ESIA does not include a detailed and systematic inventory of places of worship and sacred sites throughout the project footprint. The absence of sacred sites instead of the location of the transformer station, the corridor of the line and the access tracks to be developed will have to be verified before the start of the works, particularly in the framework of the activities of RAP (resettlement action plan).

Among the local customs, the following have been identified:

- **The dance called "mapouka"**. This traditional dance is said to originate from the Ahizis of Taboth and internationally recognized. It was invented around 1997 and is danced at festivals. During the ERM / ENVAL field mission, it was observed that many little girls are playing in the style of Mapouka, thus testifying to the intangible heritage still alive of this dance in Taboth.

¹ UNEP (2015) Environmental Assessment Post-conflict Côte d'Ivoire available at: http://postconflict.unep.ch/publications/Côte%20d'Ivoire/UNEP_CDI_PCEA_EN.pdf accessed 14 October 2016.

- **Benin voodoo dance called "ghost dance"**. The majority of Benin's population practices voodoo dance Adoukro called "Phantom", orchestrated by insiders.
- **Fishing with hand sekemi**. This fishing technique seems to originate with the Ahizis. It is described in Section 6.6.8.

Furthermore, a "barrel" (actually a metal barrel filled with cement, which was probably having served as topographical marker) located in Taboth, dates from the colonial period, according to various testimonies. The term "Sasif" is inscribed in the cement on the top of the barrel. It is located on the oil field, described in Section 6.6.11.

Figure 6.43 Photo of the barrel in Taboth



