Gabinete de Gestão do Pólo de Desenvolvimento

Turístico do Futungo de Belas e do Mussulo

Combined Environmental and Social Impact Study of Marginal da Corimba Project

FINAL REPORT

APRIL 2016

FEITO EM ANGOLA
A QUALIDADE DO QUE É NOSSO

HOLÍSTICOS
CONSULTORIA AMBIENTAL

<u>Technical Sheet:</u>

Title:

Combined Environmental and Social Impact Study of Marginal da Corimba Project.

Client:

Gabinete de Gestão do Pólo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION

This chapter presents the Combined Environmental and Social Impact Study (ESIS) for the Project of Marginal da Corimba (hereinafter the "Project") to be implemented by the Angolan Government under coordination of the Management Office for Tourism Development of Futungo de Belas. This Combined ESIS resulted from the need to provide information relating to the Project's compliance with certain requirements in order to be internationally funded as well as with regards to environmental legislation.

This section of the Combined ESIS report contains the presentation of the project proponent, the justification of the Combined ESIS, the objectives and scope of the proposed study. It sets out the areas of influence of the Project; describes the team involved with the ESIS; and presents the structure and content of the report.

1.1. OVERVIEW

The Marginal da Corimba Master Plan is an initiative of the Angolan Executive aimed at the construction of the coastal road that will connect the city centre and the southern part of Luanda which is currently booming. For this purpose a master plan was developed to explore the tourism potential of the region and provide new urbanized areas and existing infrastructure along the coast, valuing therefore all the land currently occupied by poor housing and informal markets.

The appreciation of cultural heritage and the *modus vivendi* of the region will be reworked in order to propose new spaces for leisure and contemplation over the 8.5 km route in perfect harmony with the different activities to be explored.

This initiative is aligned with the Luanda Metropolitan Master Plan (PDGML) as it responds to connectivity criteria and improvement of traffic flow from this area of the city with a four lanes road in both directions, broad walks and parking spaces, as well as 15 road intersections with the future secondary road named Marginal South-west which is also an initiative by the Angolan Government.

It is vital in this axis, which will be implemented the new corridor dedicated to public transportation, with sixteen safe stops for pedestrians in the course of about forty (40) minutes between the Port of Luanda and the area of Futungo de Belas.

The Marginal da Corimba road connects, from the Atlantic coast to the New City Centre of Luanda to Futungo de Belas, and can become the main entrance where visitors will discover the new motives of the development of Luanda. For this reason, the Marginal da Corimba is more than one road project. Will be the mirror of Angola in the future.

The Road of Marginal da Corimba to be built will be a flexible, and efficient tourism-focused road system, designed to offer access to the best of the local culture, and with state-of-the-art technology, for a safe, and attractive environment. It will also allow a better traffic flow between downtown Luanda, and areas such as Futungo, Talatona, Nova Vida, Benfica, etc. This Road is part of the Marginal da Corimba Master Plan that encompasses dredging activities for land reclamation, a road, a fishing harbour, allotments for various purposes, and the reconstruction of the entire network of infrastructures required for a project of this nature and dimension (see Chapter 2).

The Gabinete de Gestão do Pólo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo (Management Office of the Tourism Development Hub of Futungo de Belas and *Mussulo* area) is the entity responsible for the development of the current Environmental and Social Impact Study. This study is part of an environmental and social assessment of the actions implemented and associated with the Marginal da Corimba. It details its main characteristics, and the zone where it is located, describes the mitigation measures for the potential social and environmental impacts as a result of this project, and proposes adequate mitigation measures.

1.2. PROJECT PROPONENT

The construction of the Marginal da Corimba Project in the Luanda province is an initiative of the Angolan Executive while the coordination of the Environmental and Social Impact Study falls under the Gabinete de Gestão do Pólo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo. The company´s contacts are listed in Table 1.1.

Table 1.1: Developer´s Contacts.

Company	
Business Entity Name	Gabinete de Gestão do Polo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo
Business Registration Number	-
Taxpayer ID Number	[redacted]
Address	Ex-Complexo Presidencial do Futungo de Belas, Samba, Luanda
Telephone	[redacted]
E-mail	[redacted]@futungodebelas.gv.ao
Legal Representative	
Name	Rodrigo de Sousa Alves dos Santos
Address	Futungo de Belas
Cell phone	[redacted]
Email	[redacted]@futungodebelas.gv.ao

The **Gabinete de Gestão do Pólo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo** retained the services of **Holísticos – Serviços, Estudos & Consultoria, Lda**. to undertake the Combined Environmental and Social Impact Study (ESIS) of the Marginal da Corimba Project; which after the data collection in the field, consultations with the affected parties and stakeholders, review of the project's technical documentation, and correlated bibliography, developed this document.

Holísticos – Serviços, Estudos & Consultoria, Lda. is a Luanda-based environmental consultancy company established in 2006, registered with the Ministry of Environment.

Holísticos consists of a dynamic and multidisciplinary team of specialists with extensive work experience in environmental and social issues in Angola (the company´s info is detailed in Table 1.2).

Table 1.2: Contacts of the environmental consultancy company.

Company	
Business Entity Name	Holísticos – Serviços, Estudos & Consultoria, Lda
Business Registration Number	[redacted]
Environmental Consultancy Office Registration No. by the Ministry of Environment	001
Address	Urbanização Harmonia, Rua 60, Casa 559, Benfica, Luanda
Telephone/Fax	[redacted] 938; [redacted]
E-mail	w[redacted].
Legal Representative	
Name	[redacted], Managing Partner
Address	Rua 60, Casa 559, Urbanização Harmonia
Telephone/Fax	[redacted]
PO Box	[redacted]
E-mail	[redacted]

1.3. JUSTIFICATION FOR THE ESIS

Given the characteristics of the project, its location, nature, and size, some Environmental and Social Impacts are foreseen during the construction and operational phases of the new Marginal da Corimba. In accordance with the Appendix of Decree on Environmental Impact Assessment (Decree No. 51/04, 23 of July), this project is listed in item 6, paragraph g (Development Project for Urban Areas). Therefore, and according to the applicable legislation, the implementation of a project of this magnitude must be preceded by an Environmental Impact Study (EIS) that encompasses a:

- The Environmental Impact Report should address, but not be limited to, the following:
  - Project Description;
  - All technological alternatives and alternative locations for the Project, confronting them with the possibility of not executing the Project;
  - Systematic assessment and identification of the potential environmental and social impacts generated during the construction and operational phases of the activities anticipated for the project, including details of specific aspects of the functioning of the technologies adopted;
  - Definition of the boundaries of the geographical area to be directly or indirectly affected by the impacts, named the area of influence of the project, considering, in all cases, the human populations, and other living beings that inhabit there;
  - Other elements that given the characteristics and features of the project may be deemed pertinent, including their importance from an economic standpoint, and the development of the Luanda province, in particular the municipalities of Belas and of Luanda and the Urban District of Samba.

- Non-Technical Summary (NTS) of the Project to be used in consultation meetings and in the case of conducting a public consultation and information disclosure (including, at the very least, the objectives, scope, criteria, summary of the process, environmental characterization, mitigation measures proposed, findings, and recommendations), in a language easily understandable to the public.

1.4. OBJECTIVES OF THE ESIS

This Combined Environmental and Social Impact Study (ESIS) was developed in compliance with the environmental legislation in force in the country, given the need to implement the parts of Marginal da Corimba Project, with the following objectives in mind:

- Describe the project, inform the progress of its construction (including the land reclamation and dredging activities involving the stabilisation of a platform and the future construction of a fishing port) and operation, and review the social and environmental benefits associated with both phases of the Project;

- Propose mitigation measures, and provide information on the alternatives to avoid, mitigate, or reduce the potential negative impacts in the areas affected by the project, comparing the benefits and losses of each different option, and present the reasons why the preferred options were selected;

- Identify and describe elements of the population, the natural surroundings, and the man-made environment that may be affected by the implementation, or operation of the project, and may cause potentially adverse environmental and socioeconomic Impacts;

- Define an Environmental and Social Monitoring Plan for the construction and operational phases of the project.

This Combined ESIS follows Angolan legislation and takes into account recommendations proposed by multilateral environmental agreements ratified by Angola. It is also aligned with the International Finance Corporation Performance Standards (January, 2012) where applicable and with the recommendations of the Equator Principles (June 2013).

1.5. SCOPE OF THE ESIS

The following was defined as the scope of the study, in the context of this study, and taking into consideration its objectives:

- Identify significant social and environmental issues and effects caused by certain actions inherent in the construction and operational processes of Marginal da Corimba Project, in the Luanda and Belas Municipalities;

- Identify significant effects on the environment, the population of the surroundings, and the project workers, caused by environmental effects foreseen;

- Facilitate and consider contacting and obtaining information from the public potentially affected (whether residents of the surroundings, or workers), to understand their values as individuals, and as a community regarding the quality of the environment;

- Assess the concerns raised by the population of the surroundings, regarding the potential effects of the project, and determine how to proceed with the action;

- Define the limits of a desirable thorough review, and assessment, to optimize time and resources;

- Organize, focus, and communicate the potential impacts and concerns, to support a thorough review, and the decision-making process from a Project´s proponent.

It is important to highlight the activities that are an integral part of the scope of this Combined ESIS, since not all components of the Marginal da Corimba Project will be addressed in this study. Table 1.3 lists the project´s activities, and defines which activities are part of the scope of this Combined ESIS and those that are consistent with Phases 1, 3 and 4 of the project that are to be financed (see Figure 1.1). The main activities of this project are described in Chapter 2[1].

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[1] Although the Marginal da Corimba Project is divided into five phases this combined Environmental and Social Impact Study focuses only on phases 1, 3 and 4 as shown in Figure 1.1.

Table 1.3: Activities within the Scope of the ESIS.

Scope of the ESIS	Outside the Scope
Land reclamation of Marginal da Corimba (Phases 1, 3 and 4)	Allotments, construction and building of the allotted zone (commercial and housing) of Marginal da Corimba and recreational areas
Storm water drainage network including an extension of existing drainage ditches	Construction of Marginal da Corimba road, revitalisation of Rua da Samba, Construction of Marginal Southwest and potential decommissioning of existing infrastructure in the coastal zone
Coastal protection	Construction of Fishing Port and of artificial islands

Although not included within the description of this Combined ESIS in terms of the description of activities, of the reference situation characterisation and in the analysis of potential impacts to associated facilities[2], the following points are referred to in Chapter 2:

- Expansion of the Passenger Terminal (Capossoka), Civil Nautical Club and Military Nautical Club
- Construction of the Marginal da Corimba road, accesses and secondary roads
- Infrastructure to be developed under the Luanda General Metropolitan Master Plan that which serves the Project:
    - Wastewater Treatment Plant (WWTP)
    - Water Distribution Centre
    - Power Substation

[2] Facilities that are not funded as part of the project and would not have been built or expanded if the project did not exist and without which the project would not be viable are considered Associated Facilities as defined in Performance Standard 1 of the International Finance Corporation.

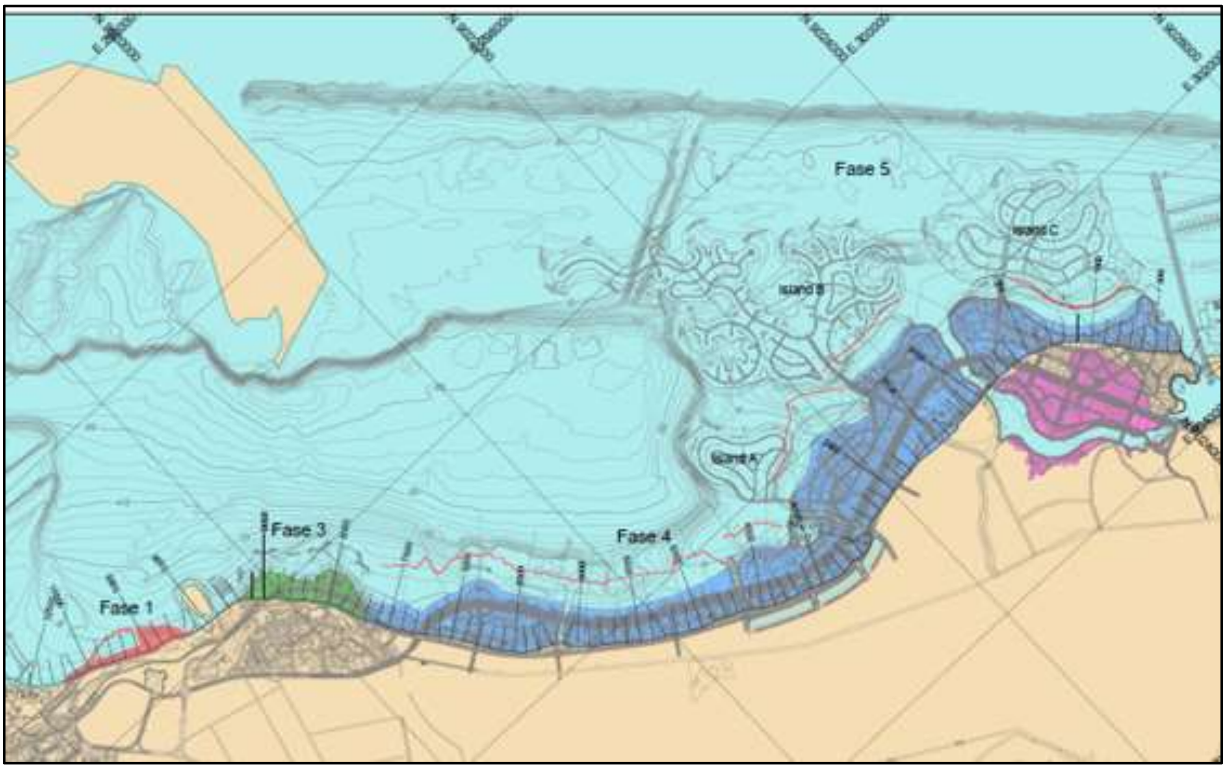

Figure 1.1: Project implementation area relating to phases 1, 3 and 4.

1.6. METHODOLOGY

The following actions were employed, as part of the data collection methodology, during the development of the Environmental Impact Study for the Urban Rehabilitation of Marginal Corimba, in the province of Luanda:

- Visits to the study area, to define its environmental and social characterization, including the identification of potential impacts, using the checklist method, and a summary of the impacts;

- Interviews with representatives of the project, and authorities of the municipality of Luanda (particularly the Administration of the District of Samba) and of Belas, consultations with the population that lives in the areas potentially affected by the actions of the project, aiming at obtaining information and contributions of the population on the location where the project should be implemented, as detailed in the socioeconomic section (see Chapter 4);

- Consultation of the relevant bibliography, to characterize the environment, and identify potential social and environmental impacts, particularly the legislation in force in the country.

The procedures performed in this study, and the field survey were undertaken combining techniques for quantitative (data) and qualitative (information) indicators, as well as direct observation, and image recording (photos). Field trips were also undertaken between October and November of 2014, where relevant environmental and social surveys were performed. Samples of water and sediment of benthic organisms were collected along the coast, between Corimba and Chicala, on the 30th of June, 1st, and 3rd of July of 2014, to complement the interpretation of the ecosystem´s health, and its environmental baseline.

Field work carried out under the First Environmental Monitoring Report of the Urban Requalification Project of the detached perimeter of Futungo de Belas in October 2015 as well as the Environmental Impact Studies carried out for the requalification of Futungo (December 2011 and June 2015) are also contributing to the preparation of the Combined ESIS. Additional field work in the area of Futungo and Corimba was also carried out between February and April 2016 in order to update any existing environmental and socioeconomic information.

Social surveys and stakeholder consultations of the potentially affected population were conducted during the month of May 2015 followed later by formal meetings during March 2016. The main recommendations and concerns raised during the more recent meetings are summarised in Chapter 4.

A public consultation organised by the Ministry of Environment was held in addition to the consultation meetings. A mandatory consultation with stakeholders is a regulatory requirement and is performed as part of the EIS process[3]. It is a requirement under Angolan legislation with regards to impact assessment and must be implemented after the EIS report has been submitted to the regulatory authorities (Decree No. 51/04). The National Directorate for Prevention and Environmental Impact Assessment (DNPAIA) is responsible for chairing the consultation, according to Executive Decree No. 87/12, which regulates public consultation for projects subject to the environmental impact evaluation process. To ensure the participation of stakeholders, this decree requires[4] that the consultation is published in the Jornal of Angola and by other relevant media entities (more detail provided in Chapter 3).

The conclusion of the EIS process does not indicate the end of the stakeholder involvement and consultation. The systematic involvement of stakeholders at all stages of the project will ensure that stakeholders have ongoing access to the project developer, including during the project implementation stages. With regards to this ESIS report in particular, a stakeholder mapping exercise was conducted in order to list all potential stakeholders that may have to be contacted, as needed, during project implementation.

In addition, the project sponsor developed a Public Consultation Plan, which will be used in order to involve internal and external stakeholders during all phases of the Project. The Plan incorporates measures that will facilitate the addressing of relevant stakeholders' concerns, providing engagement and communication protocols, as well as grievance mechanisms that will ensure stakeholders receive information about the project and have the opportunity to interact with the project promoter.

[3] Appendix A includes the announcement published in the Jornal de Angola and also in the newspaper "O País" for public consultation on 7th April, 2016. Appendix A also includes the minutes of the public consultation.

[4] The dissemination of the public consultation was also made through an announcement on the National Radio of Angola.

1.7. ENVIRONMENTAL AND SOCIAL IMPACT STUDY TEAM

Holísticos summoned a multidisciplinary team to undertake this Environmental Impact Study that became involved in the various activities of the Combined ESIS report, namely the field work, review of the biotic samples, and production of the final report. All experts and their areas of expertise are listed in Table 1.4.

Table 1.4: List of experts involved in the ESIS.

Name	Education	Role in the EIS	Electronic Signature
[redacted]	Master´s Degree in Environmental Education	Project Manager: Legislation; Review of the Project Description; Environmental Management Plan; Social Baseline	[redacted]
[redacted]	Biologist, Master´s Degree in Coastal Zones and Sea	Coordinator: Environmental Impacts; Mitigation Measures; Environmental Baseline	[redacted]
[redacted]	Geophysicist	Environmental Characterization	[redacted]
[redacted]	Sanitary and Environmental Eng. Master´s Degree in Enviro. Technologies	Environmental Expert: Project Description, Environmental Impacts; Mitigation Measures, and Social Baseline	[redacted]
[redacted]	Environment and Natural Resources Engineer	Environmental Expert: Environmental Impacts; Mitigation Measures	[redacted]
[redacted]	Environment and NR Engineer	Environmental Expert; Review of the Social Characterization	[redacted]
[redacted]	Environment and Natural Resources Engineer	Environmental Expert: Project Review	[redacted]
[redacted]	Environment and Natural Resources Engineer	Environmental Expert: Project Review	[redacted]

1.8. STRUCTURE OF THE ENVIRONMENTAL AND SOCIAL IMPACT STUDY

This Combined Environmental and Social Impact Study (ESIS) report is structured as follows:

- **Chapter I**

This chapter provides an overview of the development of Marginal da Corimba Project, in the province of Luanda. It also describes the Combined ESIS' goals, activities that are included within the scope of the study, methodology applied, and the multidisciplinary team involved in the Combined ESIS as well as stressing the Project's approach that to be financed by an international entity.

- **Chapter II**

This chapter introduces the project, provides general information about the location, describes the main characteristics of the project, a description of the equipment and construction methodologies, and other activities to be undertaken by the project in sufficient detail, to assess the potential environmental and socioeconomic impacts associated with the project activities, among other systems that will ensure the normal operation of the Marginal da Corimba Project.

- **Chapter III**

This chapter provides a summary of the Angolan legal and regulatory framework, and documents the Angolan social and environmental standards that should be complied by the project. This chapter includes the following subjects:

- ✓ Legal and administrative organization of Angola;

- ✓ Important Angolan environmental, and social laws and regulations applicable to urban development projects.
- ✓ Elements relating to requirements of the Performance Standards of the International Finance Corporation (IFC) and of the Equator Principles.

- **Chapter IV**

This chapter describes the social and environmental conditions that characterize the current status of the area where the project should be located, and are considered relevant to the project´s activities. This chapter will also provide information related to the entire study area, whenever required, and as a means to better contextualize the information. Emphasis is given to the Mussulo lagoon system.

- **Chapter V**

This chapter addresses the potential environmental and social impacts that may result from the project´s activities. One or more mitigation measures are identified for each potential impact, after which a simulation of their implementation is undertaken, resulting in residual impacts that will be listed in the same table; where applicable the cumulative impacts are shown.

- **Chapter VI**

This chapter describes the Environmental and Social Monitoring Plan (ESMP) for the sustainable development of the project. The project will implement and maintain this ESMP, to achieve the goal of complying with the internal regulations, institutional responsibilities, and other similar engagements. This chapter also highlights other instruments developed by the project's proponent and contractors, including the Environmental and Social Management System.

- **Chapters VII and VIII**

Chapter VII discloses the final findings of the report, and Chapter VIII provides the bibliography used during the preparation of the Combined ESIS.

1.9. INFORMATION GAPS

Much of the information relating to the environmental conditions of the Project insertion area was collected during the last five years through primary data collection campaigns and consulting relevant literature sources. This data is sufficient to permit an evaluation of the ecosystem's conditions, such as the definition of the existing habitat type in the Project insertion zone, taking into account the recommendations of the Performance Standard 6 of the International Finance Corporation.

It has been possible to obtain concrete data relating to the main phases of the project, particularly phases 1, 3 and 4 regarding dredging activities, the creation of land reclamation comprising of stabilising the continental shelf and of the design of the fishing port. Most of these phases have studies in place which include detailed descriptions of parts and designs that will enable proper identification, analysis and evaluation of potential risks and environmental and social impacts.

Technical documents were prepared by a number of entities including Urbinvest, Deltares, Mobility in Chain, BroadwayMalyan, Van Oord and Royal HaskoningDHV. All technical documents are available for consultation.

Despite all of this information collected during field work (described in Chapter 4) and produced during the preparation stage of the Marginal da Corimba Project (described in Chapter 2) there are still some key information gaps within the Combined ESIS, which, although do not represent risk to the project, should be addressed in the coming months. These gaps include the following:

- A Lack of information regarding the Environmental characterisation of the designated sand dredging site which is situated approximately 10 nautical miles offshore Luanda. Thus, the implementation of environmental surveys assessing the local fauna are recommended in future when carrying out geotechnical activities in order to confirm the potential of the area;

- The existence of a complete and updated register of fishing communities whose activities will be temporarily impacted during the dredging activities, highlighting the current fishing port area. Therefore, a registration with the fishermen and fishing cooperatives, in collaboration with local authorities in order to obtain updated data regarding the number of vessels in use in the area, ship owners, fishermen and fishmongers is recommended;

- Given the size of the project and its potential environmental and social impacts, there are a number of plans that were not completed during the preparation phase of this Combined Environmental and Social Impact Study but which are of vital importance to the proper management of environmental and social risks and impacts. A summary of these plans, which is currently in preparation, is included in the Environmental and Social Management System of this project and a list of them is presented in Chapter 6 of this document.

CHAPTER 2

PROJECT DESCRIPTION

2. PROJECT DESCRIPTION

The Gabinete de Gestão do Pólo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo is developing an integrated Project, with the prospect of revitalizing the Corimba area in the Province of Luanda, namely the Marginal da Corimba Project, which will revitalize the tourism, housing, and infrastructures in that area. It will also be associated with the tourism development project of Futungo de Belas and Mussulo on the basis of a scenario that anticipates changes in the current environmental and social conditions. This chapter aims to describe the initial stages of the Project of Marginal da Corimba, and its related structures.

2.1. JUSTIFICATION FOR THE PROJECT AND THE LOCATION CHOSEN

The province of Luanda is currently home to nearly 6.9 million inhabitants, of which a little more than 2.1 million reside in the Municipality of Luanda[5]. This number is a result of the rural exodus, and the arrival of Angolans and foreigners to the province in the past thirty years. It is estimated that around 2030 Luanda province will have an estimated population of 12.9 million people[6].

In light of the National Development Plan (PND)[7] for the period of 2013-2017, the Policy for the Promotion of a Balanced Territorial Development aims to develop a qualified and sustainable urban network, from an environmental and social standpoint, comprised of efficient cities, with the modernization of the capitals of the provinces.

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[5] National Institute of Statistics, Preliminary Results: Census of Population and Housing – 2014, September of 2014.

[6] Luanda Metropolitan General Master Plan (PDGML), December 2015 (www.planoluanda.com).

[7] Ministry of Territorial Planning and Development, National Development Plan 2013-2017, Republic of Angola, December of 2012.

The Provincial Government of Luanda acknowledges the need to rehabilitate, modernize, and expand the centre of the city, to improve the living conditions of the population, as well as improve mobility, with the purpose of providing it with an urban integration of great quality[8]. The *Corimba* area is one of the urban spaces that are considered strategic for the development of a tourism project within the City of Luanda, given the required urban conditions[9]. On the other hand, this Project follows on from the ongoing project of the construction of the Marginal Sudoeste whose contracts have been approved by Presidential Decree No. 67/10 of May 17 (for the first stage of the Corimba-Praia do Bispo stretch) and by Presidential Order No. 49/14 of May 2 (for the second stage of the Praia do Bispo-Corimba stretch).

The Marginal da Corimba Project has recently been approved by Presidential Decree No. 9/16 of January 25 with the primary goal of ensuring the rehabilitation of the area together with its improvement and better preservation of the coastal zone. The same document, which approves the drafts of the contracts for dredging, land reclamation, coastal protection and road construction, indicates that this project will allow a significant improvement of accessibilities to the City of Luanda as it will contribute to a quick access to the city centre and easier flow of road traffic.

Furthermore, this Project is provided as part of Luanda Metropolitan General Master Plan (PDGML) that envisages an improvement of the urban environment by integrating a revitalized and comprehensive transport network, which may improve mobility between the city centre and the peripheral areas of Luanda.

The PDGML also provides for the improvement of drainage systems, sewage and integrated infrastructures for the supply of electricity, drinking water and waste management. Thus, the PDGML expects, by 2030, to achieve the following targets:

[8] Provincial Government of Luanda. Available at http://www.gpl.gv.ao/publica/MunicipioDistrito.aspx.

[9] Presidential Dispatch No. 100/13, 9 of October.

- Implement effective waste separation and recycling systems allowing the reduction of waste disposal in landfills.
- Make it possible for 80% of residents in the Luanda area to have access to sanitation systems.
- Make it possible for 95% of the population to have access to drinking water.

2.2. LOCATION

This project is located in the Municipalities of Luanda (Urban District of Samba) and Belas (see Figure 2.1), and will cover a distance of approximately 8.5 Km between the area of Agostinho Neto Memorial and the southern end of Phase 1 (Marina). The main boundaries of this Project are limited by the following areas (see Figure 2.2):

- **South:** at the southern end of Phase 1 (where the Futungo de Belas Marina will be set up), as shown in Figure 2.2.
- **East:** the present shoreline and there is no footprint left by the Project anywhere onshore while in most of its length the coastline is already changed due to the South-west Marginal project.
- **West:** the limits established by the areas reclaimed from the sea (landfill area) as shown in Figure 2.2 in different colours corresponding to the different phases of the Project.
- **North:** the northern limit of Phase 4 as shown in Figure 2.2.
- **Dredging areas:** there are two, namely the main area (in the Baía da Corimba and the Access Channel) and the secondary area (offshore of the Mussulo-Corimba-Chicala Complex), as shown in Figure 2.3.

Figure 2.1: Location of the Project of Marginal da Corimba and its Road in the Municipality of Luanda.

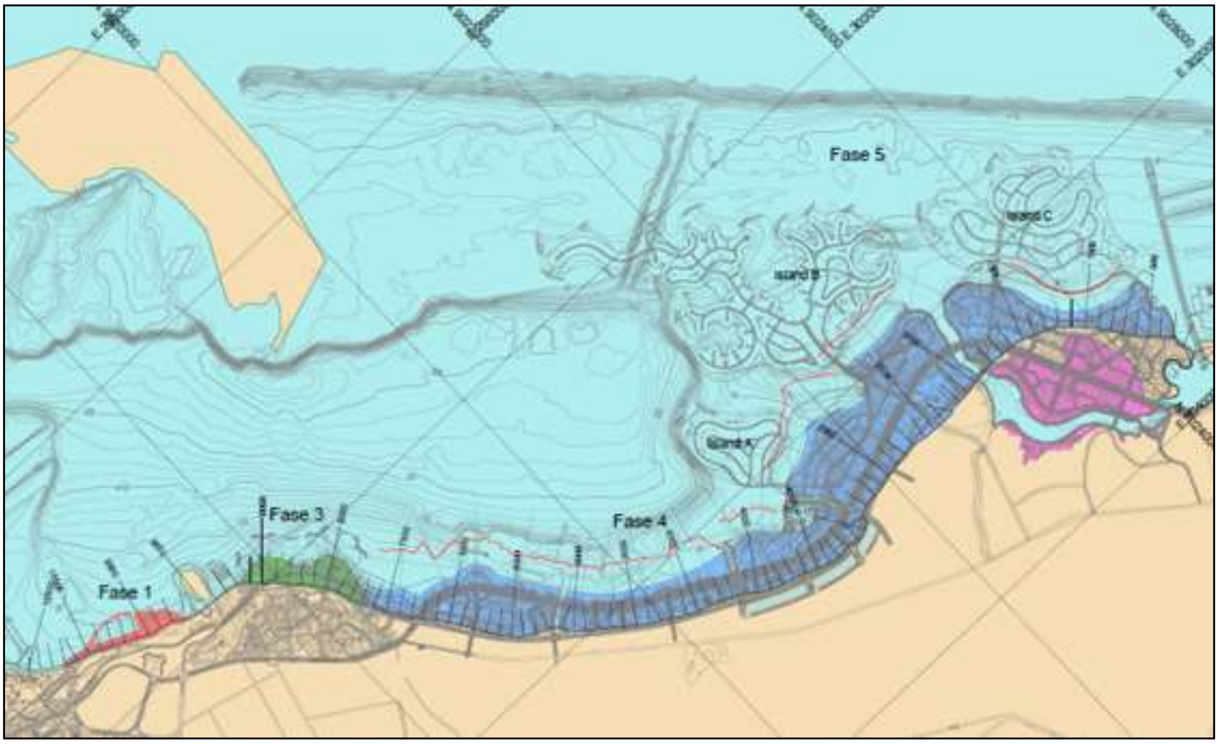

Figure 2.2: Project implementation area highlighting Phases 1, 3 and 4.

Figure 2.3: Areas suggested for the dredging activities (highlighted in orange).

2.3. OBJECTIVES OF THE PROJECT

The Marginal da Corimba Project aims to revitalize the area of Marginal da Corimba, with the purpose of turning the project area into a development hub for tourism, and the quality of life of the populations. The implementation of this Project is an integral part of the Luanda Metropolitan General Master Plan, and comprises the following objectives:

- Connect the centre and southern areas of the Municipality of Luanda and the Municipality of Belas;
- Connect the project area (coastal area) with Avenue 21 de Janeiro;
- Facilitate the traffic flow increasing road mobility and interconnection among the different road infrastructures;
- Increase mobility in the transportation of passengers through the Light Surface Railway;
- Boost tourism and recreation in Marginal da Corimba with the creation of approximately 6 km of beach;
- Create urban development areas including the construction of a Fishing port.

The activities to be developed in the nearly 8.5 kilometres extent planned for phases 1, 3 and 4 of the Project[10] are framed in its initial stage, as shown in Table 2.1.

These operations include dredging activities, land reclamation by stabilizing a platform (and construction of coastal protection) and prolonging the ditches as well as future construction of a Fishing Port and bases for the construction of the Marginal da Corimba Road.

[10] The overall Project includes five (5) phases and this Combined Environmental and Social Impact Study only focuses on Phases 1, 3 and 4.

Table 2.1: Activities included in each project phase.

Phase 1[11] – Marina Includes Macrozone 1 of the Futungo de Belas Project (Coastal Plain Area of the Mussulo bay)	**Phase 3 – Futungo de Belas** Includes Macrozone 1 of the Futungo de Belas Project (Coastal Plain Area of the Mussulo bay)	**Phase 4[12] – New Marginal** (Includes all the coastal area between the former Rotunda da Corimba and the Agostinho Neto Memorial)
Dredging activities	Dredging activities	Dredging activities
Land reclamation	Land reclamation	Land reclamation
Platform set up	Platform set up	Platform set up
Construction of the coastal protection	Construction of the coastal protection	Construction of the coastal protection
	Prolonging of the ditches	Prolonging of the ditches

2.4. DEFINITION OF THE AREA OF INFLUENCE

The definition of the areas of influence of a project allows the establishment of geographic boundaries of the areas that may be subject to positive or negative, direct or indirect, permanent or temporary changes; enabling the establishment of guidelines for the assessment of potential environmental and social impacts. Topographic, physiographic, climatic, and biological aspects, potential changes in the socioeconomic framework, and the quality of life of the populations located in areas directly and indirectly affected were considered, to define the areas of influence of this Project.

Given the project´s characteristics, and its location, and with the objective of clarifying the degree of impact of the Project regarding the environmental and social issues, three (3)

[11] Phases 1 and 3 were initially included in the Environmental Impact Study of the Master Plan Project of the Futungo de Belas Perimeter (June 2015).

[12] Phase 4 was initially included in the Environmental Impact Study of the Master Plan Project of the Marginal da Corimba (October 2015).

areas of influence of the project[13], were methodologically defined. **Figure 2.4** displays the two (2) areas of influence defined for this Project.

➢ Area Directly Affected

The Area Directly Affected (ADA) corresponds to the areas that may subjected to direct impacts, as a result of the construction phases of the project, set forth above (dredging activities, land reclamation by stabilizing a platform and prolonging the existing drainage ditches), which may be either positive or negative, including the implementation of physical structures and support infrastructures (such as the construction site). An adequate environmental and social monitoring program and mitigation measures will be developed for this area, to minimize and mitigate the potential environmental and socioeconomic impacts. Given this, it was considered that the strip of coastal land where the Marginal da Corimba Project is expected to be implemented, including all areas of Phases 1, 3 and 4 where the land reclamation, and dredging activities will be performed as shown by **Figure 2.3**. The coastal area between Phases 1 and 3, where there is nautical equipment (Passenger Sea Terminal of Capossoka, Civil Nautical Club, Military Nautical Club and a Draimar hydraulic landfill) , has also been considered.

➢ Area of Direct Influence

The surroundings within approximately 500-meter radius of the Project of Road of Marginal da Corimba, and where direct impacts will be identified as result of the construction and operational phases of the Project, were considered the Area of Direct Influence (ADI). This area will include all routes that give direct access to the local project either on land or at sea, and other sites in the surroundings that may undergo improvements to turn it into a

[13] These areas of influence are in accordance with the recommendations of Executive Decree No. 92/12 approving the Terms of Reference for the Environmental Impact Studies. These areas also consider the recommendations of Performance Standard 1 of the IFC.

functional and feasible Project. Mitigation measures will be developed for this area, and will be incorporated in the project´s Environmental Monitoring Plan.

➢ AREA OF INDIRECT INFLUENCE

Areas of Indirect influence (AII) are areas that are subject to indirect impacts from the Project, namely sites where raw materials are collected for the project´s construction activities (including third party quarries which will be used to obtain rock material for the coastal protection work and prolonging of drainage ditches), recruitment of workforce, the population that will benefit from the project, among others. Hence, due to the major importance of this project the province of Luanda was considered an AII, especially the municipalities of Luanda and Belas.

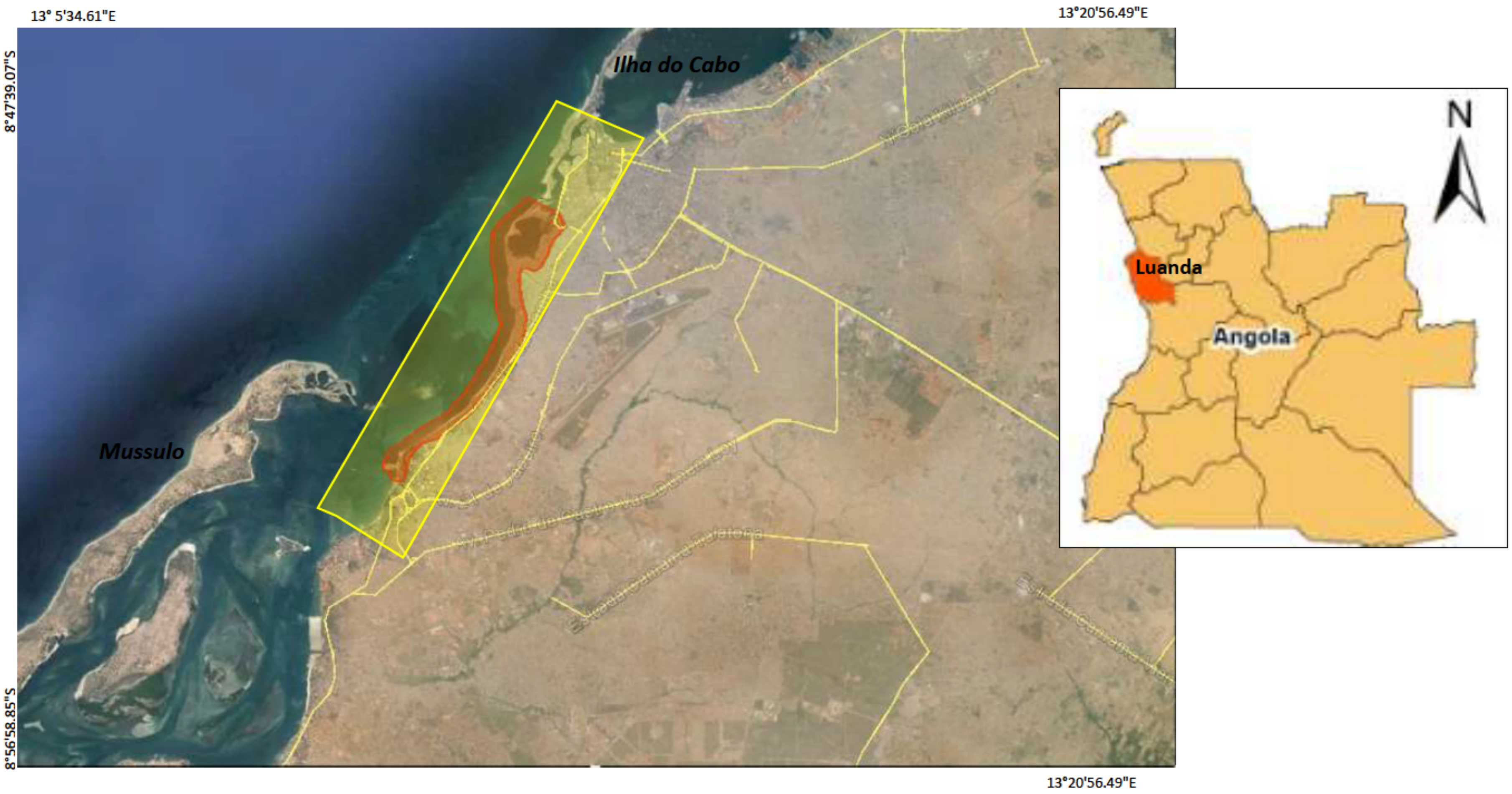

Figure 2.4: Boundary of the ADA (area highlighted in red), boundary of the ADI (area highlighted in yellow).

2.5. GENERAL CHARACTERISTICS OF THE PROJECT

The main characteristics of the Marginal da Corimba Project are detailed below.

2.5.1. DESCRIPTION OF THE PROJECT ACTIVITIES

The Project of Marginal da Corimba to be constructed will be approximately 8,5 km in length on a landfill which will be built and will follow the contour of the bay area 110 meters forward (please see its location in Figure 2.1 and Figure 2.5), and encompass a total area of 310 hectares. The result of the new urban design anticipated by the PDGML – Luanda General Metropolitan Master Plan, which includes Marginal da Corimba, can be viewed in Figure 2.5.

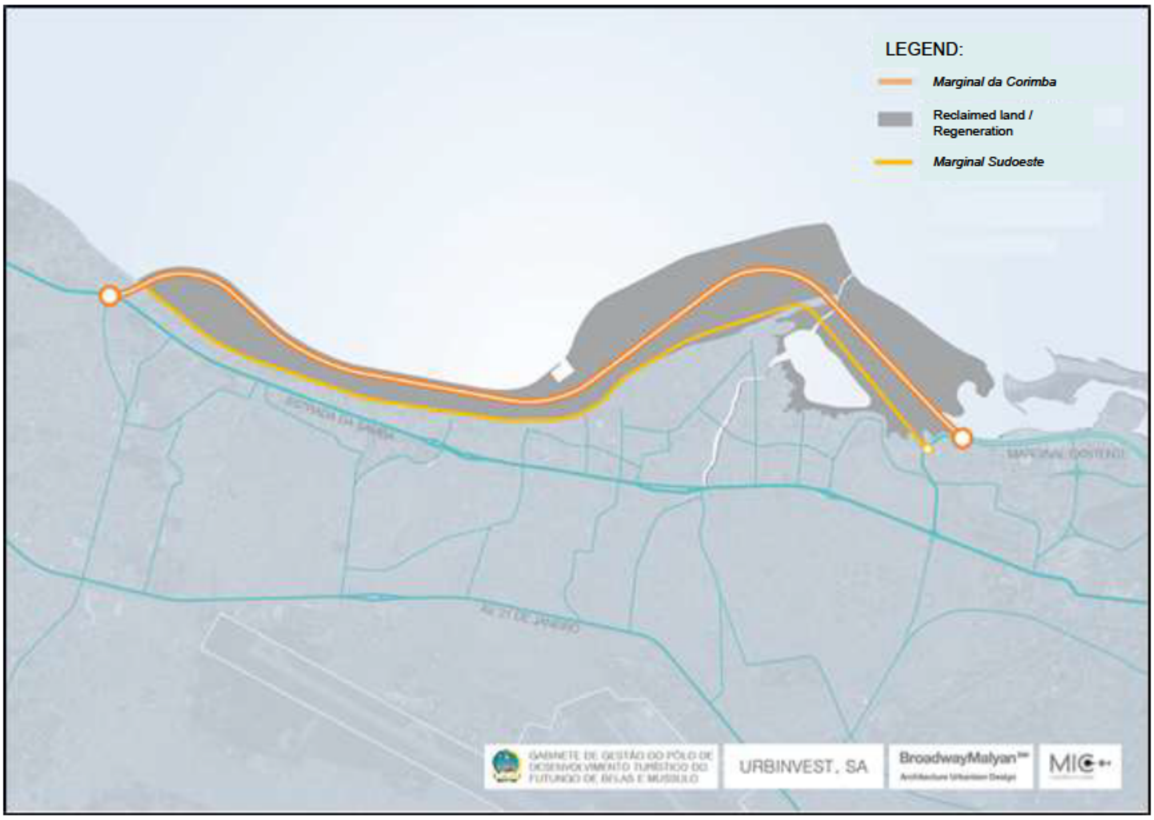

Figure 2.5: Top view of the land, and of the main access routes to the project.

The main activities of the Project include the following and will be described in the following sections:

- Dredging
- Landfill of the Marginal da Corimba area
- Prolonging of the existing drainage ditches
- Coastal protection and rock fill

The activities included in the scope of this Environmental and Social Impact Study and described above should be implemented in a period not exceeding two years, according to schedule shown in Table 2.2.

Table 2.2: Overall schedule of the work by phases.

Activity	Period
Dredging and landfill consolidation activities	
Phase 4	Week 1 up to Week 44
Phase 3	Week 45 up to Week 48
Phase 1	Week 49 up to Week 51
Prolonging of drainage ditches, coastal protection and rockfill work	
Phase 4	Week 4 up to Week 90
Phase 3	Week 91 up to Week 99
Phase 1	Not applicable

The activities described above will be developed with the purpose of creating a platform that enables the development of various urban development infrastructures including the Road of Marginal da Corimba and the Fishing Port, designed to improve mobility and road traffic between the city of Luanda and the southern area. The construction of the Marginal da Corimba and the Fishing Port will only start six months after the landfill conclusion and stabilization and it is expected that 25 months in total will be needed for the construction. The construction of the Marginal da Corimba should be carried out in about 690 days whereas the works of the Fishing Port should take about 500 days.

2.5.2. ROAD OF MARGINAL DA CORIMBA

The Road of Marginal da Corimba will have road connections and intersections with Marginal Sudoeste, Samba Road, and Avenue 21 de Janeiro (see Figure 2.6 and Figure 2.8). The road will relieve the existing road network, by providing a new flow capacity, such as four (4) parallel lanes in both directions, as an option to reduce traffic in these main expressways.

- Road of Marginal da Corimba: a four-lane expressway in both directions (4 + 4), with a bus lane (public transportation);
- Marginal Sudoeste: a two-lane secondary expressway in both directions (2 + 2);
- Samba Road: a two-lane expressway in both directions (2 + 2).

Figure 2.6: Partial view of the main access routes near the project area.

The routes of Marginal Southwest and Samba Road will converge on the former Rotunda da Corimba, and are connected to the Road of Golfo - Benfica / Avenue Pedro de Castro Van-Dúnen "Loy", while the Marginal route will continue to the Mussulo pier / Kapossoca, in the intersection with the New Maritime Terminal.

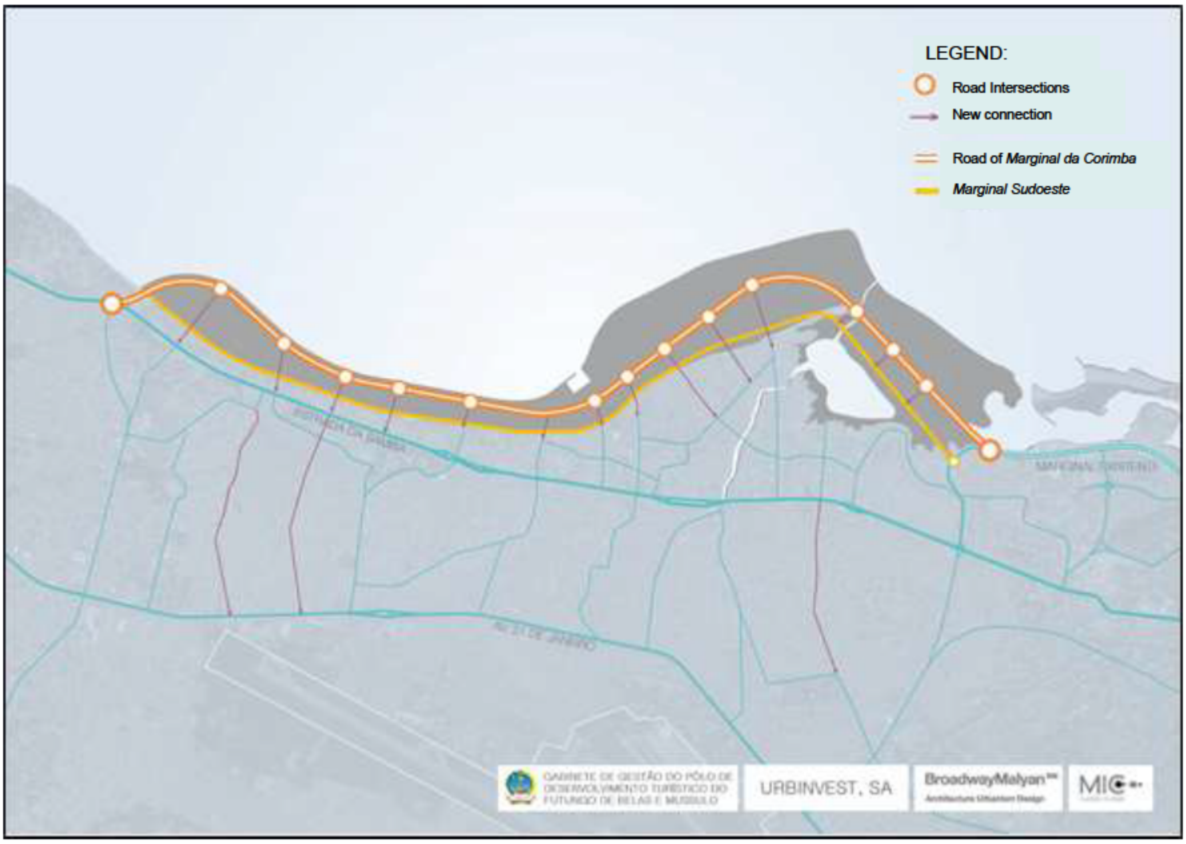

Figure 2.7: Intersections of Road of Marginal da Corimba with Marginal Sudoeste and Samba Road.

The main reason for this project is the need to improve accessibility to the city for the people and traffic, and create a high-quality residential and business zone along the coast that can also provide a pleasurable environment for tourists.

There are several restrictions that dictated the design of the Road of Marginal da Corimba, including the height of the embankment (3.5 m), the requirement to use the alignment of bridges and roads partially constructed, as well as the need to accommodate the increase in width of the drainage ditches, as part of the strategy to manage improved water on the surface. The concept design of the Road of Marginal da Corimba took into account the fact that it will connect a number of focal points of public interest, from a new business district to the fishing port.

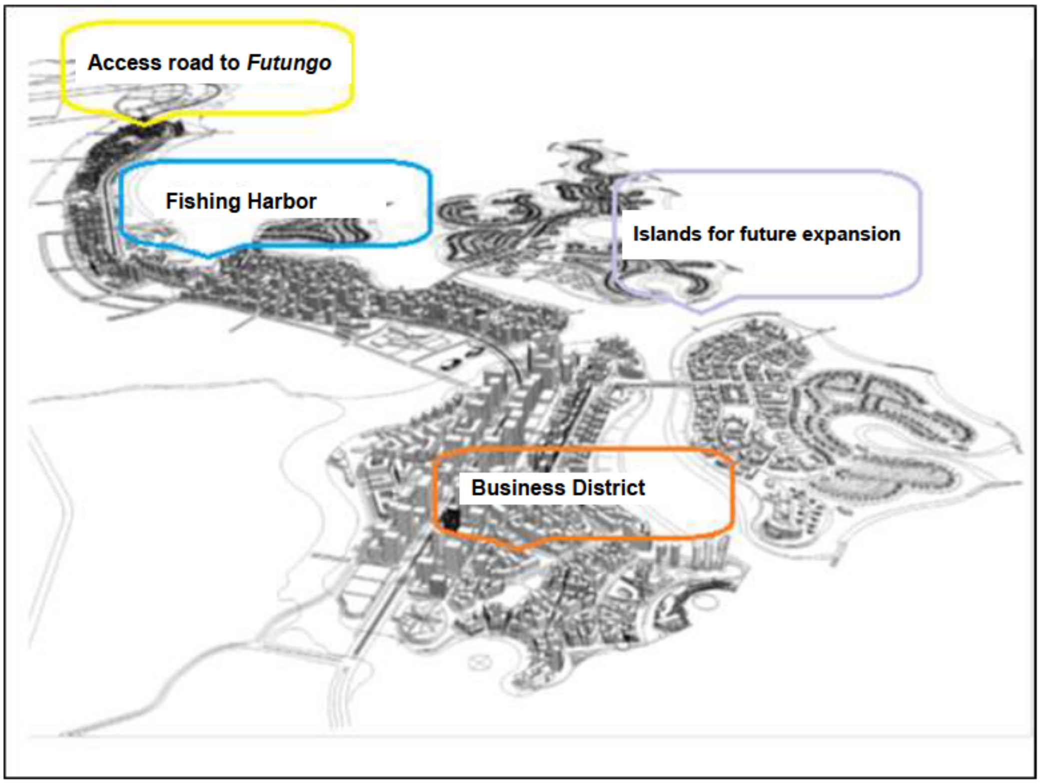

Figure 2.8: Concept design of the Road of Marginal da Corimba.

The typology of the new Road of Marginal da Corimba is displayed in Figure 2.9.

Figure 2.9: Typology of the new Road of Marginal da Corimba: A) waterfront and B) urban areas.

Support infrastructures are expected to be built in the reclaimed land of Marginal da Corimba (see Figure 2.10), such as:

- Fishing port (see Section 2.5.4)
- Part of the Corimba Lagoon included in the Central Business Centre and Park
- Potential future developments for:
    - Housing
    - Offices
    - Commerce
    - Leisure/entertainment
    - Public facilities, and schools

The Land Use and Occupation Plan was designed in order to be distributed accordingly to the accessibility of land, proximity to the centre of the city and its landscape features. Figure 2.10 shows the proposal for land use and occupation for Marginal da Corimba.

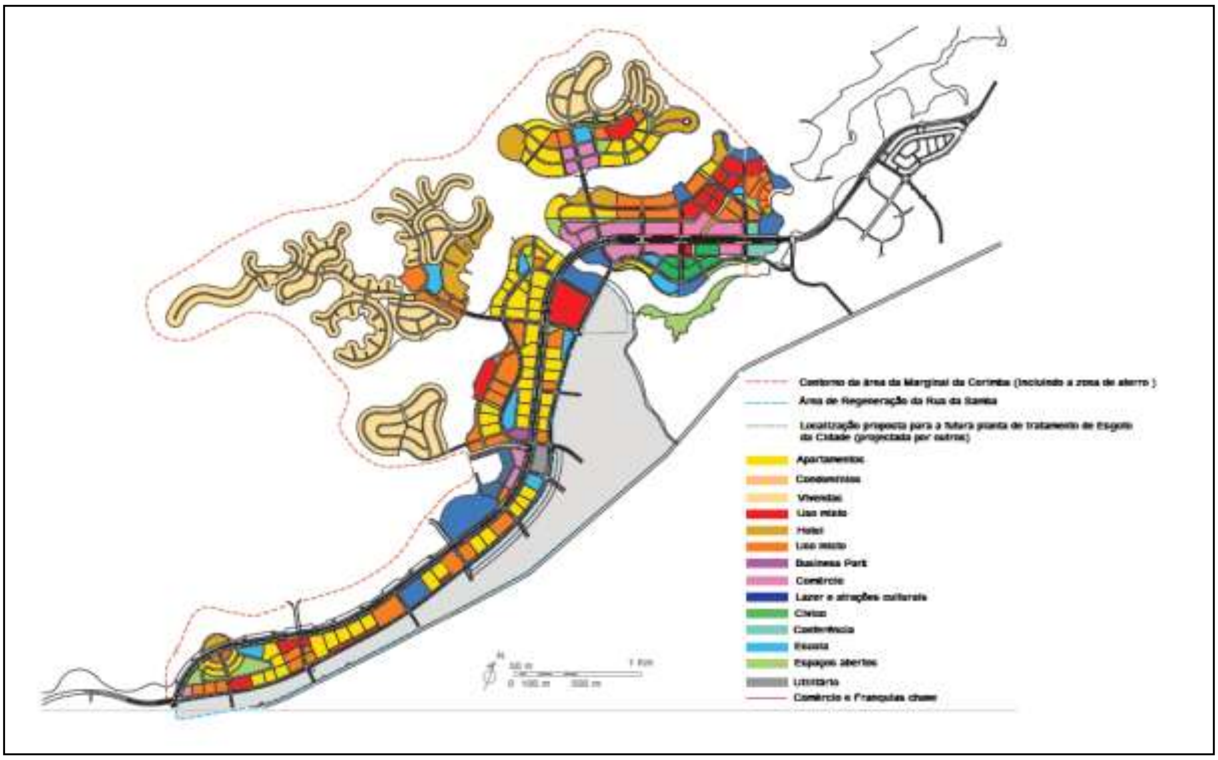

Figure 2.10: Proposal to occupy the zone of Marginal da Corimba.

The regeneration of the Corimba community was focused on the inclusion of new social facilities, combined with the construction of private housing blocks with an appropriate percentage of social homes. There is a wide intention to retain existing uses that demonstrate a positive economic function.

There was a planning on the maximum height of the buildings to create an organised landscape without conflicting with the current status. Overall, the occupation in the continental region is higher than that proposed for the islands, not interfering with the view to the sea. Commercial lots usually have more restrictions in height, while the buildings near the presidential palace area were reduced in height of 6 floors.

The distribution of density throughout the area of Marginal da Corimba was determined by dimension factors of plots and configuration, land use, construction type, accessibility, proximity of resources, existing views and soil load capacity. For example, the grounded area and the road corridor on the seafront may incorporate lots for the construction of buildings with mixed-use towers while the condominiums on the islands have a more flexible arrangement with buildings of 2 floors.

The construction of the Road of Marginal da Corimba is divided up into 5 macrozones, including the area of Samba Road being renewed (see Figure 2.11):

- **Macrozone 1 – Beach houses and palace**

This macrozone is part of the southern end of the location, and encompasses a narrow strip of land on the waterfront located west of the Samba Road. It is predominantly occupied by unfamiliar houses in major plots of land with exterior gardens and sea views overlooking the Atlantic. Most of the beach was renewed as a preparation for the expansion of Road Marginal Sudoeste.

- **Macrozone 2 – Community of Corimba**

Macrozone 2 includes the community of the existing Corimba, and encompasses a vast settlement area, predominantly of slums (*musseques*) spread over all the available area, and in between mixed developments, including hotels (2-5 stars), industrial buildings, and warehouses, a fishing port/dock, and a beach with a very busy local fish market. The fishing port dominates the area, and provides a much used facility for the processing, and distribution of fish in the city, and more distant zones. The smell of fish processing is in the air, while the urban section of the Samba Road occupied by population generates noise, and pollutant impact, as well as land separation on the east side.

- **Macrozone 3 – Samba Pequena Bay**

Macrozone 3 encompasses a shallow saltwater lagoon located southwest of the centre of the city. It is bordered to the north and west sides by the sand of the dunes of the Chicala peninsula, and to the south and east by the Corimba slum (*musseque*) that invaded the lagoon with informal residential shelters. The lagoon water flows slowly, and it is polluted through the sewage pipes of the drainage channel of Ditches 1, 1A, and 2.

- **Macrozone 4 – *Barra da Chicala***

This zone encompasses the peninsula of natural sand, and the Atlantic shallow waters of Barra da Chicala. The existing slum (musseque) invasion was recently removed from the area to pave the way for the ongoing construction work of expansion of Marginal Sudoeste, as determined by the Ministry of Construction.

- **Macrozone 5 – Samba Road, Regeneration area**

Macrozone 5 encompasses wide residential and combined areas, largely informal.

Figure 2.11: Division of the construction zones of the Road of Marginal da Corimba.

2.5.3. ROAD SYSTEM (MOBILITY)

It was planned to be develop a road network with simplified primary adjacent routes to the proposed Marginal da Corimba road in order to increase urban permeability and alleviate traffic congestion (see Figure 2.12).

Marginal da Corimba will be a central primary path, feeding a new system of secondary roads connecting every community cluster. Each cluster will have a dedicated network, a smaller network (secondary) and tertiary streets leading out of the area in question, including a cycle-pedestrian and routes that connect local transport stops to other transport networks.

The signage of the joints will be timed for optimal performance in the quality of pedestrian access, plus the planned system will be served by a global multimodal transport with bus services, Surface Light Rail (LRT) and sustainable transport.

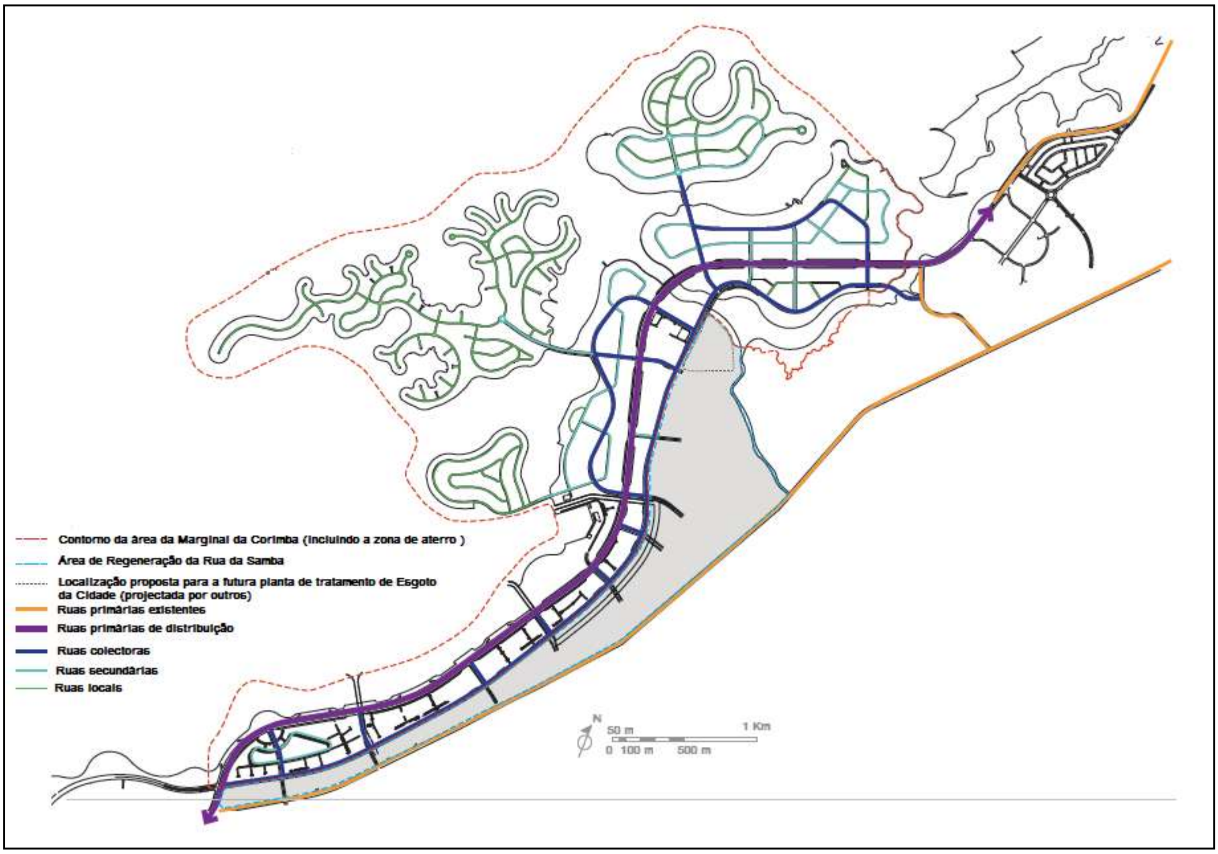

Figure 2.12: Proposed road system in the area of Marginal da Corimba.

2.5.4. FISHING PORT

A new Fishing Port is foreseen in the Marginal da Corimba Project, which will provide anchorages for the fishermen´s boats. It is expected that the maintenance and repair work of the boats be performed inside the harbour, hence it will be equipped with a ramp, and a workshop.

The port buildings incorporated in the initial design include an administrative building with offices and security cabins. In addition, some buildings were designed to accommodate fish trade (such as a building for fish processing, a storage area for frozen food, a fish market, and a building for restaurants).

The Fishing Port is also equipped with parking areas for employees, and market visitors (see layout in Figure 2.13). The access to the harbour by fishing boats is provided by an access channel that will be dredged. The harbour is separate from the Mussulo Bay by a breakwater (structure) that protects the boats from the force of the waves, and the rip tides (*calemas*).

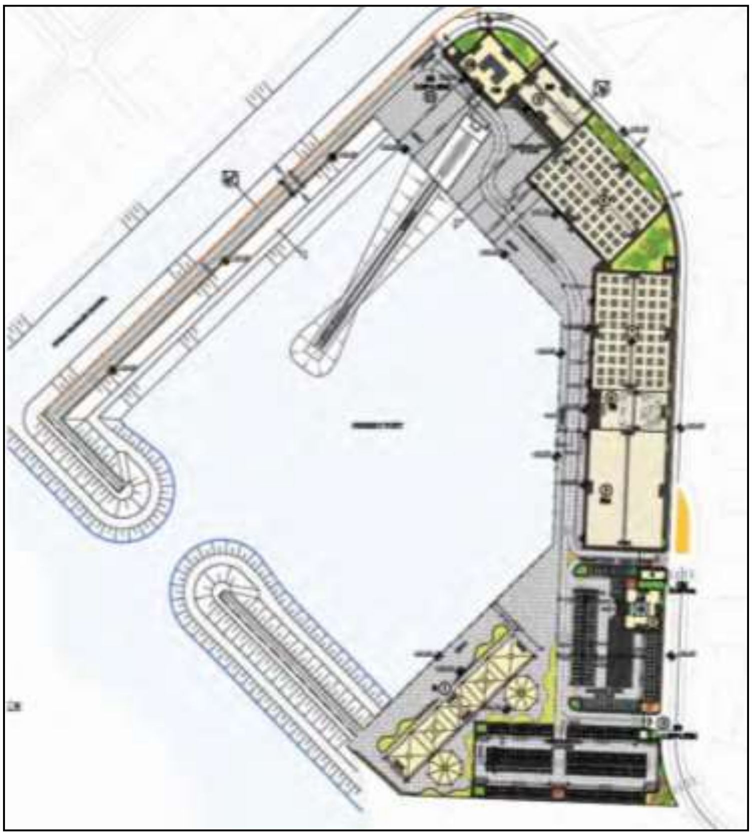

Figure 2.13: Layout of the fishing harbour.

The Fishing Port structures were designed for an operating lifetime of 50 years including sea structures and buildings.

The summary of the main elements of the Fishing port are shown below.

2.5.4.1. Breakwater and Access Channel

A thick rock wall structure was designed to separate the basin of the Fishing port from the Mussulo Bay, and one of the drainage channels (Ditch 3). The breakwater of the Fishing Port is provided with an access road with traffic lights, to allow the pedestrians to circulate along the breakwater promenade. A wide 40 m in length access channel will need to be dredged, to provide the fishing boats with sufficient inclination and depth to arrive to the Fishing Port.

2.5.4.2. Sea Wall and Mooring Facilities

The sea wall structure is projected along the Fishing port, to supply the fishing boats with anchorage to land the fish, and other fishing activities. The structure includes dock hardware, such as pile moorings, dock edging/bumpers, and ladders.

The anchorage area was designed to receive about 100 vessels, of which, about 50 may have less than 10 metres and 50 may be longer than 10 metres, and it may also receive other smaller vessels.

2.5.4.3. Launch Ramp

The launch ramp was designed to lift the boats from the dock to the maintenance and repair area. The ramp structure is 135 m in length, and is comprised of a 6 m in width reinforced concrete slab, anchorage rails that can be used to pull the boats outside the water by means of winches.

2.5.4.4. Buildings

The following buildings are expected inside the Fishing port:

- A Restaurant with a 2.000 sqm minimum cover;
- A 16 sqm office for the staff to control entries and exits
- A 360 sqm Administration building for the 12 Port workers;
- Security lodges to control entries and exits
- Fish market with a 2.400 sqm minimum cover which may accommodate approximately 200 salesmen;
- 700 sqm storage area for frozen food;
- Building for fish processing with a 2.400 sqm area which may accommodate approximately 200 salesmen;

- Boat repair shop with a 2.400 sqm area;
- Convenience store and supply store with a 600 sqm area;
- Office buildings and shops with a 690 sqm area which may accommodate up to 16 offices.

The buildings were designed with architectonic details, and all the required infrastructure, such as drinking water, sewage system, firefighting system, communication network and power system. The road network that gives access to the harbour was designed with two large parking areas, one for approximately 100 vehicles, and another small area for 10 vehicles.

2.6. LAND RECLAMATION AND DREDGING AREAS

Taking into account the local conditions, and the requirements of the project of Marginal da Corimba, a number of activities were planned, such as dredging, land reclamation, and landfill stabilization, including coastal protection and prolonging of the drainage ditches.

The main objective of the reclamation area is the provision of an adequate platform for future developments anticipated for Marginal da Corimba. The various structures in the coastal zone along the perimeter of the land reclamation should enable a smooth transition between the new landfill/reclaimed land and the Mussulo Bay, keeping in mind all the necessary purposes of Marginal da Corimba.

The conditions for the dredging and landfill also include coastal protection and shall have the following elements[14]:

[14] Details of all the components and procedures of the dredging and landfill implementation are included in the contractor´s document with the Specifications for the Coastal Reclamation and Protection.

- Project preparation (including preparation of the various procedures and methods related to the contractor's work, as well as all the preparation of documents required to obtain the necessary authorizations and licenses connected with the works and the imports of contractor's equipment).
- Mobilization and installation of staff and dredging equipment, earthmoving equipment and auxiliary equipment.
- Preparation of the work site that includes carrying out a joint pre-research (drilling) for preparation of the pipelines necessary for the hydraulic landfill.
- Implementation of the various stages of the work including the following:
  - Construction Phase 1 (recovery of a marina and seaside area for construction of a breakwater protection and ashore, digging/deepening of the marina and access).
  - Construction Phase 3 (recovery of the coastal area, construction of a breakwater protection and coastal protection).
  - Construction Phase 4 (recovery of sea and lagoon front, digging of the Fishing Port and access, earthmoving activities for the construction of ditches, coastline protection, construction of breakwater and various types of coastal protection, construction of ditches directed to the sea, construction of the Fishing port.
- Demobilization of equipment and cleaning of the work site.

2.6.1. ASSUMPTIONS OF THE LAND RECLAMATION

Based on the design elevation (3.5 m above sea level) and the seabed bathymetry, both previously researched, the amount of necessary filling material was estimated at about 32 million cubic meters of sand as shown in Table 2.3.

Table 2.3: Amount of material to be dredged.

Landfill Area	Volume (m^3)	Dredging Sites
Phase 1	660,989	Offshore (10 nm)
Phase 3	993,690	Offshore (10 nm)
Phase 4	30,123,371	Mussulo Bay (1 nm) and Access Chanel
Total	**31,778,049**	

The dredging sites are shown in Figure 2.14 in which for Phases 1 and 3 the dredged material will come from the farthest zone (10 nautical miles) and for Phase 1 the dredged material will come from the nearest zone (1 nautical mile) and the access channel.

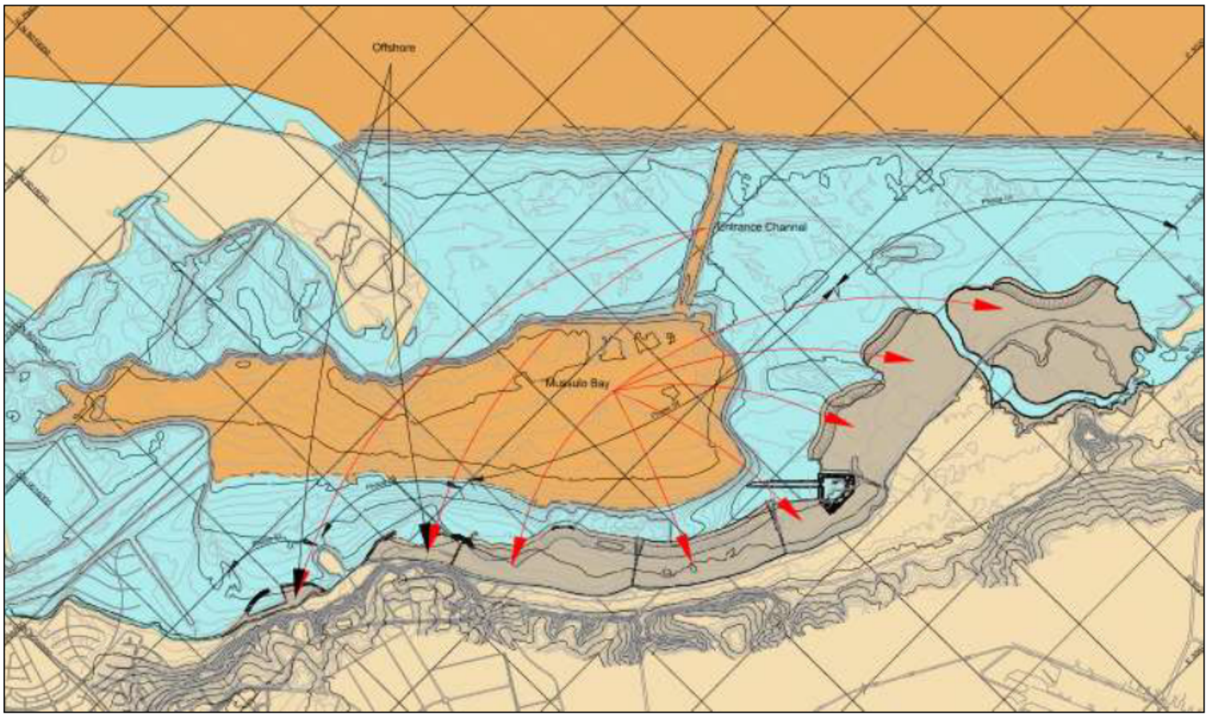

Figure 2.14: Layout of the collection sites of the borrow material for landfills.

The filling material for the landfill should come from the borrow areas shown in Figure 2.3, and its dredging should be authorized by local authorities. Taking into account the quantities of sand needed to the landfill of Phases 1 and 3 approximately 135 trips will be required between the offshore borrow site for Phase 1 and approximately 204 trips will be required between the offshore borrow site for Phase 3.

The materials resulting from dredging of borrow areas and which are considered suitable as filling material, should be placed in the areas of recovery for lines and levels shown in the drawings unless otherwise directed by the Project proponent.

For the dredging activity multiple equipment will be used, from marine equipment to earthmoving and landfill consolidation equipment (see Figure 2.15). During the dredging stage two suction dredgers, multiple vessels with distinct functions (e.g. drilling, transport, patrolling) will be used. Tractors and other scrolling equipment for sediment transport will also be used. Different types of tubes and pipelines will be used as well.

Figure 2.15: Marine equipment to be used during the dredging operations.

For the landfill stabilization activity several vessels will be used (for work and for inert transportation), cranes as well as trucks to unload inert material. Dredging activities will be in line with the Dredging Procedure established by the contractor responsible for this activity.

In terms of Health, Safety and Environment, the chosen contractor will carry out the works according to the contract requirements, the applicable law and the international guidelines and standards. Considering the potential risks for this kind of work, besides the procedures related to the Project, special attention will be given to the following:

- In order to organize, provide and maintain safe working systems for employees at all times:
    - Health, Safety and Environment (HSE) responsibility areas will be clearly defined;
    - Adequate and appropriate facilities, equipment and appliances will be made available and their proper use will be ensured;
    - Adequate training, instruction and information on HSE at the workplace as well as risks at workplace will be provided;
    - Incidents will be considered as avoidable and monitoring of HSE standards will be ensured.

- Construction personnel involved in the work will observe the following basic working rules:
    - Proper use of personal protective equipment (PPE).
    - PPE shall be worn at all times at the workplace, except for the areas considered to be safe and leisure, meals or office facilities.
    - Appropriate training will be provided as well as induction in the various roles for the type of activity.
- There will be supervision by experienced staff at the workplace at all times.

The working method of the dredging activities progression will be according to what is shown in Table 2.4 and should be examined together with Figure 2.16.

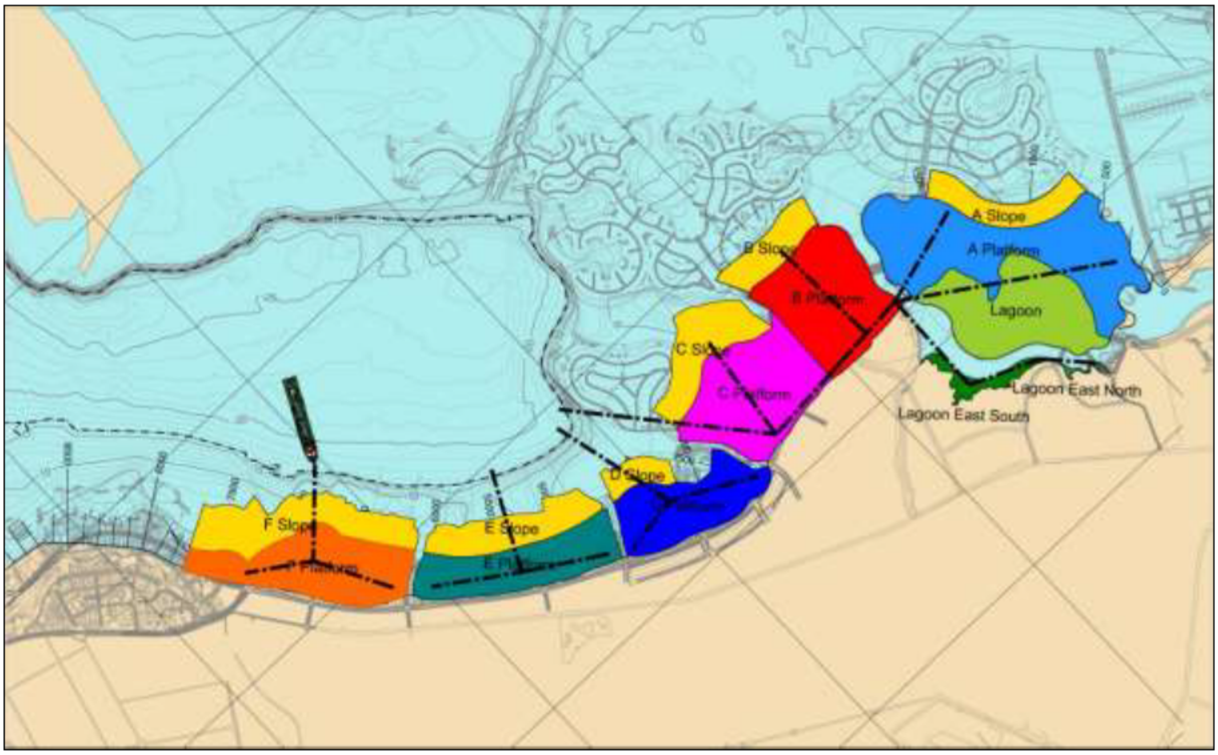

Figure 2.16: Landfill creation schedule layout.

Table 2.4: Overall schedule of the work by phases.

Activity	Period
Landfill dredging and consolidation activities	
Phase 4 – Area D	Week 1 up to Week 8
Phase 4 – Area B+C	Week 9 up to Week 16
Phase 4 – Area A	Week 17 up to Week 24
Lagoon	Week 25 up to Week 28
Phase 4 – Area E	Week 29 up to Week 36
Phase 4 – Area F	Week 37 up to Week 44
Phase 3	Week 45 up to Week 48
Phase 1	Week 49 up to Week 51
Prolonging of drainage ditches, coastal protection and rock fill work	
Phase 4 – Area D	Week 4 up to Week 11

Activity	Period
Phase 4 – Area B+C	Week 12 up to Week 34
Phase 4 – Area A	Week 35 up to Week 44
Chicala Lagoon	Week 45 up to Week 62
Phase 4 – Area E	Week 63 up to Week 72
Phase 4 – Area F	Week 73 up to Week 90
Phase 3	Week 91 up to Week 99
Phase 1	Not applicable

2.6.2. LANDFILL ASSUMPTIONS

The land reclamation level was planned keeping in mind the height of the neighbouring zones. The land must still be sufficiently elevated to avoid floods, and accommodate underground infrastructures above the level of the water table. This resulted in a final recovery level of 3.5 m. Landfill creation and consolidation must comply with the schedule set forth in Table 2.4.

Although this information is limited, no major infilling is anticipated, given the relatively favourable conditions of the soils, such as those surveyed along the existing coast. The properties of the land reclamation materials were specified, to ensure that the load capacity, and population meet the requirements.

Material should be placed in the recovery areas for the lines and levels presented in the detailed project unless otherwise directed by the Project proponent. Ancillary works, such as the construction of containment dams and drainage channels must be completed in accordance with the specified in the contract.

The contractor shall carry out operations at the water filling and discharge lines of the filling area without disturbing the existing works and structures and in accordance with methods approved by the proponent. The necessary piping for deposition of filling material should be the shortest possible length and placed along the routes and corridors approved by the proponent.

The contractor shall avoid spillage from pipes and must handle any spills that may occur as approved by contractor and in compliance with the law in force.

Material will be deposited so that the top surface is brought to the levels defined by the proponent and it is spread and levelled with his approval and according to the executive project. The contractor shall reprocess the material if necessary to meet the specification requirements.

The amount of rock needed for landfill stabilization and ditch prolonging is approximately 1,556,150 tons as per Table 2.5, which implies a need for transport of approximately 40,000 tons per week. Three potential rock suppliers have been identified, namely Mota Engil, Teixeira Duarte and Tecnovia but the exact origin (geographic location) is not yet defined. Additionally, around 145,657 m^2 of geotextile membrane will be necessary for the coast protection in Phase 1 (10,000 m^2) and Phase 4 (135,657 m^2).

Table 2.5: Amount of rock needed for the work.

Phase	Volume (Ton)
Phase 1	157,411
Phase 3	118,368
Phase 4	1,266,842
Total	**1,556,150**

The contractor shall transport rock from various quarries to the various temporary storage areas. All permits must be obtained for transportation, temporary storage, loading and unloading of those inert materials. Taking into account the amount of rock material required, the contractor shall identify the best ways to transport it, considering sea and land routes. Rock transportation by sea will be carried out with good seaworthy condition equipment. Rock transportation by land will be carried out according with the provisions of the Traffic Management Plan.

2.6.3. Beaches

The beaches were envisaged in several locations in the overall project design. A profile of the beach Praia Grande (60 m of horizontal width for a height of + 3.5 m, with a slope inclination for a depth of -1.5 m) where there is enough available space for recreation. The narrower horizontal beach (less than 60 m in width) was envisaged in locations where there is not enough available space. A coastal modelling work for the Marginal da Corimba Project is being performed, to assess the stability of the beaches proposed against worst case scenarios for waves and rip tides (*calemas*), and to identify future maintenance needs (i.e. periodic refilling of sand from the beaches).

2.6.4. Barriers and Breakwaters

The barriers and breakwaters of the slopes were projected in various locations in the overall project design where beaches are not feasible. These structures comprise a shielded layer of iron and rock. The stability of the shielded layer was calculated against extreme wave conditions (a 100-year scenario), and the structure was chosen to restrict the height of the crest of the wave below tolerable parameters during storm conditions. The barriers and breakwaters were also designed to have sufficient geotechnical stability, using the soil characteristics being considered. The location of the breakwaters and coastal protection structures are shown in Figure 2.17 for Phase 1 and Figure 2.18 for Phase 3.

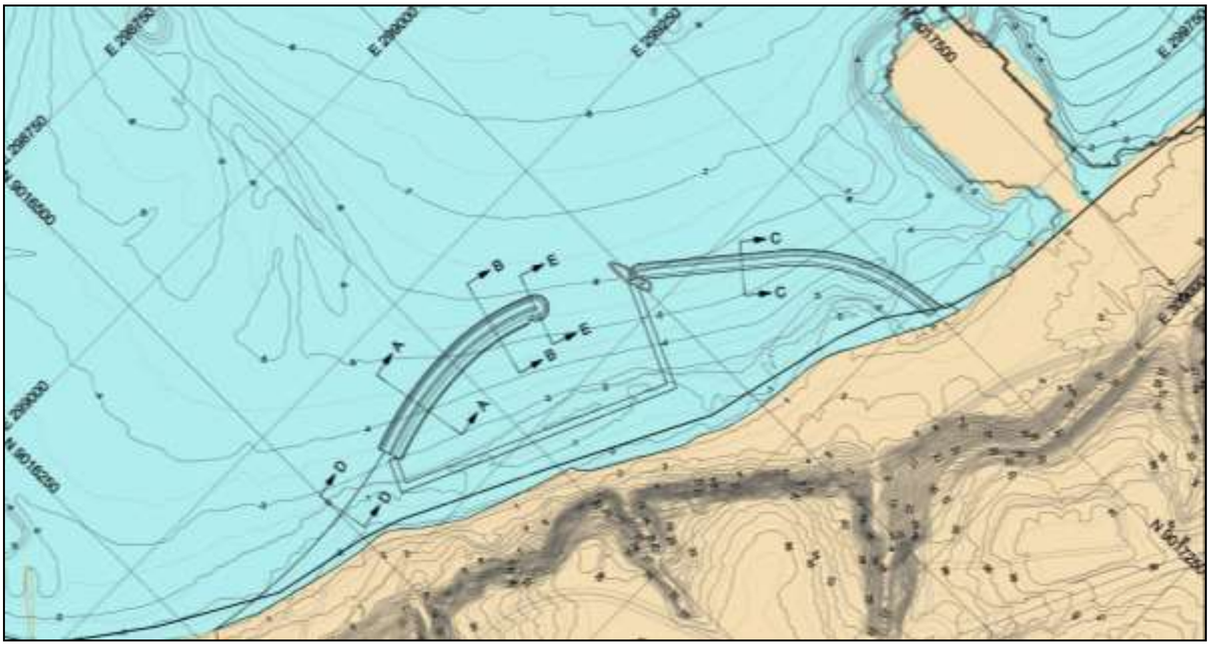

Figure 2.17: Projection of the breakwaters for Phase 1.

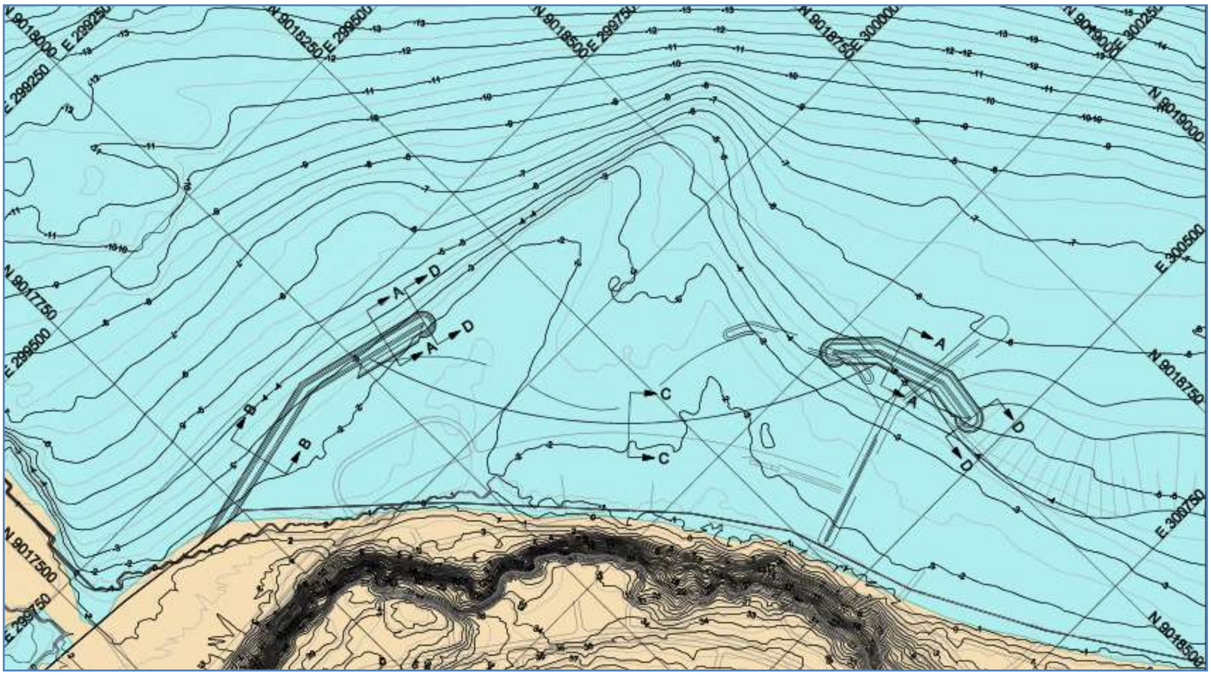

Figure 2.18: Projection of the breakwaters for Phase 3.

2.6.5. Pile Walls

Pile walls were designed as a coastal structure for specific locations in the overall project design. These will be interlocked sheet piles installed in sequence, and made of reinforced concrete to improve their appearance, and minimize steel corrosion. The sheet pile wall is provided with a capping beam of reinforced concrete, and inclined grout, with an anchorage system to ensure stability. The pile walls were designed, in the same manner as the barriers and breakwaters, using a soil profile specified for the project, which requires verification when the results of the offshore geotechnical survey become available.

2.6.6. Drainage Ditches

Several structures with drainpipes lying on interceptor ditches were designed along the coastal fringe of the reclaimed area of Marginal da Corimba. This discharge system comprises a channel lined with gravel, and projected out to the sea. The gravel will be subjected to the force of the waves (similar to the breakwaters and barriers), and to the high speed of the water current that result from the drainage of discharges into the sea. The bottom of the drainage ditches are provided with a “bedrock” (10-60 kg). The ditches are topped with concrete, along the beach towards Marginal Road, to provide the beach with an uninterrupted appearance.

2.6.7. Dredging of the Lagoon

The existing Chicala Lagoon, to the north of the project area, will be widely incorporated to the project, by means of land reclamation of part of the lagoon (see Figure 2.19). The lagoon will be cleaned before the onset of the land reclamation work.

Figure 2.19: Plan view for the future embankment of *Chicala* Lagoon.

2.7. SOLID WASTE MANAGEMENT

During the implementation phase of the Project Marginal da Corimba, the management of each and every waste is the responsibility of the contractor. During this phase most of the solid waste generated will result from the construction process (removal of any vegetation, earthworks, modelling of the soil), in addition to office waste, organic waste from the mess hall, among others activities. The contractor will develop an appropriate Waste Management Plan, in accordance with Presidential Decree No. 192/12. Apart from this Plan, there is already an Environmental and Social Management System for the Project which will guide the activities related to the management of waste from the work.

2.8. JOB OPPORTUNITIES

It is estimated that the execution of this contract work of the Project Road of Marginal da Corimba will employ 110 workers.

2.9. ALTERNATIVE LOCATION AND HYPOTHESIS OF NON-IMPLEMENTING THE PROJECT

Marginal da Corimba is an initiative of the Angolan Government and an integral part of two (2) Master Plans for the city of Luanda, namely the Urban Master Plan of Futungo de Belas, and the Luanda Metropolitan Master Plan (PDML). Its execution and the revitalization of the urban area in the surroundings is part of the national development policies, particularly the expansion of the city of Luanda which includes the construction of Marginal Corimba and Marginal Southwest, the requalification of the Samba area and improve the trafficability between the city centre and the south area of the city. Hence no alternative locations were considered since the project in itself (including the road) is already an alternative.

Thus, and so that in the future these infrastructures are implemented, there is a need for the development of the initial stage which includes dredging, creation and consolidation of a landfill and prolonging of the existing drainage ditches in the Project insertion area.

In addition, there is a deficit in the existing road infrastructure in the upgrading area and increasing in the search for new housing options, tourism and leisure, the latter, in full development, thus the implementation of the project contributes to the breakdown of seasonality of tourism in the region and the impact on the local economy.

On the other hand, the Corimba zone presents in general an urbanization pressure, but lacking overall planning and structural elements so as not to project implementation may be continuous chaotic growth and no rules, and as a result, for example: i) the disorderly occupation of natural spaces; ii) the implementation of built spaces with chronic structural problems; and iii) the disintegration of the local cultural identity. The weight of this context manifests in the settlement process without planning, advancing over areas of high ecological importance, such as hillsides and cliffs, margins beaches and ponds, reducing, distorting or even eliminating the function these ecosystems.

Another important aspect related to the project's implementation is the improvement of the Fishing port in a new location. The planed Fishing port will benefit the population with an organized site, clean, safe and with better conditions to the processing and selling of the fishery products.

A non-implementation of the project involves mainly a loss of business opportunities and tourism in the region, apart from not collecting taxes and fees from the activities that there would be developed. On the other hand, the non-implementation of the road component of the Marginal da Corimba Project will result in maintenance of the current difficulties of traffic between the city and the southern area with constant traffic jams, accidents and crimes towards Samba and Rocha Pinto. It is also important to note that non-implementation of it will continue the current scenario of degradation in the region.

CHAPTER 3

LEGAL AND INSTITUTIONAL FRAMEWORK

3. LEGAL AND INSTITUTIONAL FRAMEWORK

This chapter lists the State bodies of importance and authority in the subject-matters related to the Project of Marginal da Corimba, as well as the disposals of the national legislation and international legal instruments of relevance to the environmental and social impact study for the implementation of this Project. It also summarizes the environmental and social standards developed by the International Finance Corporation (IFC) and its application to this project.

The Marginal da Corimba Project is committed to ensuring compliance with Angolan statutory requirements and consistency with international standards, insofar as they are legal requirements in Angola. These include various international treaties, conventions and protocols on biodiversity, climate changes and marine pollution, as described in the following sections.

The Combined Environmental and Social Impact Study (ESIS) for this project was developed in compliance with Articles 10 and 16 of Law No. 5/98 (Environmental Framework Law), and more specifically, paragraphs 6/g ("of urban development projects"), and 6/j ("coastal areas to prevent erosion, and maritime work aimed at modifying the coast, e.g. construction of dams, piers, sea walls, and other prevention works against the action of the sea, excluding the maintenance and reconstruction of these infrastructures") of the Appendix from Decree No. 51/04, of July 23rd, on Environmental Impact Assessment (EIA), by reference to Article 4/2.

The Project was preceded by the Urban Growth Management Plan of Luanda, approved by Resolution No. 27/00 of November 24th as well as the Luanda Metropolitan General Master Plan (PDGML) approved in December 2015. This plan outlines the guiding principles which underpin a consolidated growth. The PDGML will be the basis of the major actions and objectives to be achieved by key Government institutions and Municipal departments.

Actions will be articulated through phased programs to be implemented over the next 15 years, until 2030.

3.1. INSTITUTIONAL FRAMEWORK

The implementation of projects whose activities may result in negative impacts on the environment, and the sustainability of the natural resources must be regulated by the Government, through various governmental institutions that compose its organic structure. The institutions concerned in the project in question are listed below.

3.1.1. MINISTRY OF ENVIRONMENT

This government body was restructured as a result of the new Government´s organizational structure approved by the Council of Ministers through Presidential Decree No. 85/14 of April 24th. The Ministry of Environment, simply referred to as MINAMB, is the Ministry of the Angolan Government responsible for proposing the creation, development, implementation, and control of the environmental policies, as regards to the protection, preservation, and conservation of the environmental quality, pollution control, conservation areas, and safeguarding the natural heritage, as well as the preservation, and rational use of the natural resources.

The main responsibilities of MINAMB regarding the environment are, among others, as follows:

- Coordinate strategies and polices for the sustainable management of the natural resources, to ensure environmental sustainability;
- Coordinate national actions as a response to global environmental issues, namely through the implementation of conventions and international agreements;
- Environmental licensing of activities likely to cause significant social and environmental impacts;

- Develop and coordinate national programs for the conservation of natural ecosystems;
- Promote necessary measures to ensure biosafety and biodiversity safety, to ensure the protection of the environment and the quality of life;
- Promote programs for nature conservation areas, natural parks, areas of the biosphere, and the preservation and protection of the landscape;
- Promote training and awareness actions targeting consumers, and companies on environmental technologies and new talents; and
- Encourage companies to use eco-friendly technologies.

However, these responsibilities are assumed by its central executive services, namely the National Directorates of Environment; Biodiversity; Environmental Regulation and Technologies; and Prevention and Assessment of Environmental Impacts. The National Directorate for Prevention and Environmental Impact Assessment (DNPAIA) is responsible for reviewing the environmental impact studies, and the National Directorate of Environment (DNA) is responsible for creating and implementing urban management policies and strategies.

The Ministry of Environment is responsible for reviewing the Environmental Impact Studies (EIS) of projects with potential to cause environmental and social impacts. This assessment includes one or more public consultations[15] to disclose the Environmental Impact and Social Study report, and obtain their feedback.

In case of approval of the EIS, the Ministry of Environment must issue an Environmental Installation License on behalf of the project´s proponent, indicating which mitigation measures must be implemented, as well as its environmental monitoring program. The Environmental License is mandatory, given that the environmental installation license is required for the approval of the construction process for the Project, installation of its

[15] Public consultation of this project was held on April 7th, 2016. The minutes of said meeting is attached hereto (see Appendix A).

equipment, and an environmental operation license that will approve the normal operation of the Project.

The above-mentioned actions for the EIA procedure are conducted by the National Directorate for Prevention and Environmental Impact Assessment (DNPAIA) that executes the impact assessments, the licensing, and the environmental audits (Article 18/1). The Environmental Impact Assessment begins after the technical opinion of the government entity that governs the activity is issued, which in this Project is the Ministry of Urban Planning and Housing.

The Marginal da Corimba Project was registered with the Ministry of Environment on the 26th of August 2014, in accordance with the Terms of Reference for Environmental Impact Studies (Executive Decree No. 92/12, March 1st). In response, the Ministry of Environment alluded to the Terms of Reference that were used to develop this Environmental Impact and Social Study, and requested the submission of the following additional documentation[16]:

- Environmental Sanitation Plan, given the population density that this project will hold, and the precarious sanitation infrastructures;
- Resettlement report of the population[17];
- Public consultation plan, to be held with the populations of the surroundings, and the civil society.

In Figure 3.1 is a diagrammatic representation of the Environmental Impact Assessment process (in accordance with environmental legislation in the Republic of Angola).

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[16] These documents are being drawn up and will be finished before the beginning of the corresponding project activities.

[17] Since no rehousing for the population is being considered at this phase of the project, a Livelihood Restoration Plan is being prepared for the affected populations with emphasis on fishing communities.

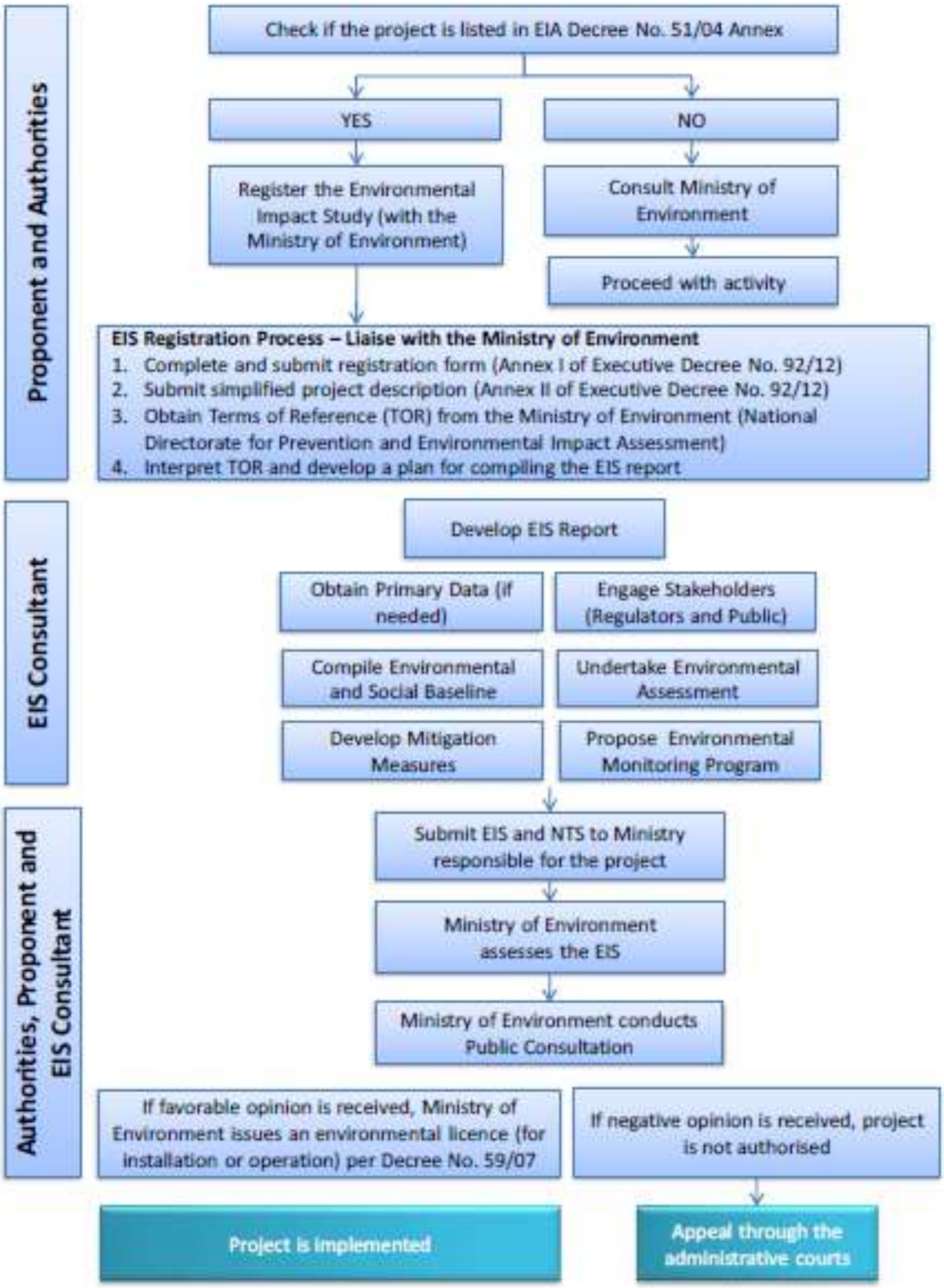


Figure 3.1: Environmental impact assessment process.

3.1.2. MINISTRY OF URBAN PLANNING AND HOUSING

This government body was restructured as a result of the new Government´s organizational structure approved by the Council of Ministers through Presidential Decree No. 104/14 of May 16th. The Ministry of Urban Planning and Housing, simply referred to as «MINUHA», is the Ministry of the Angolan Government responsible for developing, coordinating, executing, and overseeing the territorial planning, urban planning, and housing policies.

According to its organic statute, MINUHA, promotes *inter alia*, “in cooperation with the other bodies of the central and local administration, scientific and technological research on territorial planning, urban planning, and housing, and their registry”, “the revitalization of the urban and rural areas, and the environmental improvement of cities, as well as the monitoring of environmental variables in the urban area”, ensures the “implementation of housing policies”, guides “the implementation of policies for the management, transfer/concession, and conservation of the State´s historical heritage”, and promotes studies on the housing conditions, in order to formulate proposals for policies, legislation, and regulations (Article 2/1-3).

3.1.3. MINISTRY OF ENERGY AND WATER

This government body was restructured as a result of the new Government´s organizational structure through Presidential Decree No. 246/12 of December 11th. The Ministry of Energy and Water, simply referred to as «MINEA», is the Ministry of the Angolan Government responsible for proposing the formulation, conducting, executing, and controlling the Government policy for the energy and water sector.

According to its organic statute, MINEA promotes *inter alia* “the execution of the policies of the energy and water sectors”, “the electrification policy, and of general use of water resources, its protection and conservation; as well as the water supply and sanitation policies (Article 2).

The National Directorate of Water Supply and Sanitation promotes «the development of the national water supply and sanitation policies, and ensures their compliance, oversight, and systematic monitoring", "licenses water supply and wastewater sanitation activities", maintains the national registry of the water supply and wastewater sanitation network", and promotes «follow-up actions, oversight, and systematic monitoring of the operation of water supply and sanitation systems, ensuring its sustainability, Article 8".

The National Directorate of Electrical Energy participates *inter alia* in the organization of the tender processes for concessions, and issuance of production and distribution licenses, and develops "the norms, regulations, and technical specifications adequate for facilities and equipment that produce, transport, distribute, and use electrical energy, monitoring its compliance", it licenses the electric installations, maintaining their registry, certifies "professionals or entities responsible for electrical facilities", and issues quality certificates of electrical materials (Article 15 /2 of Presidential Decree No. 116/14 of May 30th).

3.1.4. MINISTRY OF FISHERIES

Due to the fishing activity and the presence of artisanal fishermen in the *Mussulo* lagoon, it becomes relevant to mention this Ministry. Therefore, the Ministry of Fisheries, commonly known as MINPESCAS, is the government body responsible for the development, execution, monitoring, and control of the policies related to the management and planning of the aquatic biological resources, and the fishing activities, aquaculture, and salt.

According to its organic statute (Presidential Decree No. 280/14 of September 30th) MINPESCAS, *inter alia* promotes, «the sustainable development of the sector and ensures, in cooperation with other competent entities, the implementation of preservation measures, and the sustainable management of the aquatic biological resources, and the aquatic environment. This Ministry will also be responsible for the management procedures of the new Fishing Port which will be built under this project.

3.1.5. LUANDA PROVINCIAL GOVERNMENT

The provincial governments, *inter alia*, monitor the execution of public investment plans and programs, and develop the provincial portfolio of projects to be included in the national portfolio, and the Public Investment Program (Law No. 17/10, Article 12/1/c, and 12/1/h).

Regarding urban development, and territorial planning, they develop the provincial territorial plans, develop and approve urban projects and the allotment process, authorize the establishment and transfer of land rights on urban lands, and oversee the compliance of the Law of the Land and Territorial Planning, and its regulations (Article 12/2).

Regarding the environment, they promote measures to defend and preserve the environment, and “protection measures for water resources, conservation of the soil and water, and natural attractions for tourism purposes, keeping in mind the sustainable development of tourism”. They also promote “sanitation and the environment, as well as the construction of urban equipment), promote the creation of green areas (cit. law, Article 12/6).

As for the social and cultural development, they contribute “to the awareness, preservation, and improvement of the existing historical-cultural heritage in the provinces, municipalities, and communes”, “the creation of infrastructures for museums, libraries, and cultural venues”, and promote the creation of recreational and sports infrastructures (Article 12/4).

In the areas of influence context this project is located in the Districts of Samba and Ingombota (Phase 4) and in the Municipality of Bela’s for the component of Futungo de Belas (Phases 1 and 3). The Government of Luanda Province is also responsible for the implementation of the Luanda Metropolitan General Master Plan.

3.1.6. ENVIRONMENTAL PROTECTION ASSOCIATION

The environmental protection associations are allowed to have access to all information *inter alia* regarding the EIS, and development plans for the fauna and forest resources, participate in administrative procedures, and take legal action in response to actions harmful to the environment (Law No. 3/06 of January 18th, Articles 6 and 8).

3.2. NATIONAL LEGAL FRAMEWORK

Article 21 of the Constitution of the Republic of Angola (dated February 5th of 2010) states that it is the fundamental duty of the Angolan State to promote, among others, the harmonious and sustainable development throughout the entire national territory, protecting the environment, the natural resources, and the national artistic, cultural, and historical heritage.

The need for environmental protection, and the requirements to achieve a sustainable development are based on all citizens' right of living in a healthy and unpolluted environment, as well as the duty to defend and preserve it, as established in Article 39/1 of the Constitution. The same article (Article 39/2) establishes that the State must adopt the necessary measures to protect the environment and the flora and fauna species throughout the entire national territory, to maintain the ecological equilibrium, in order to define the right location of the economic activities, and the rational utilization and exploration of all natural resources, ensuring the sustainable development, respecting the future generations, and preserving the different species.

The State must adopt the necessary measures to ensure that the citizens are able to exert their rights effectively (Constitution, Article 28/2). The norms on fundamental rights directly bind "public and private entities", having the citizens the right to appeal to the courts in the event of a violation of their constitutional rights, or otherwise foreseen in the legislation (Constitution of the Republic of Angola, Articles 29 and 56).

In the fundamental principles for the organization and regulation of economic activities, Article 89/1/d of the Constitution includes "the respect and protection of the private property and initiatives", Article 89/1/e, the principle of the "social role of property", and Article 89/1/f the "reduction of regional asymmetries, and social inequalities".

They law establishes "the territorial organization for economic, military, statistical, ecological, or similar purposes", as well as "the structure, designation, and progress of urban units, and settlements" (Article 5/4 and 5/5). On the other hand, the environmental licensing of activities with impact on the ecosystems, and on the quality of life of the population falls upon the Ministry of Environment.

In this context, and keeping in mind the need to prevent and mitigate the potential social and environmental impacts of projects that involve the construction of infrastructures, and the exploration of natural resources; the Government of Angola approved the Environmental Framework Law (Law No. 5/98, of June 19th). The Environmental Framework Law was also created to include environmental legislation in the national legal framework, and highlights the collective and individual responsibilities against the complexity of the environmental issues.

Given the nature of the project, namely the Construction of the Road of Marginal da Corimba and its operation, the legal requirements directly associated with this project are described below.

3.2.1. ENVIRONMENTAL FRAMEWORK LAW

The Environmental Framework Law (Law 5/98 of June 19th) sets out in its objectives, the need for measures, among others, to guarantee the mitigation of the environmental impacts, as a result of the actions required for the development of the Country, promote the implementation of environmental quality policies in all the productive sectors, and establish policies to defend the artistic, cultural, social, and natural heritage of the country (Article 5/c, g, and j). This Law specifies that the Government must ensure the environmental heritage, including the cultural, historical, and natural heritage.

This Law also establishes some environmental protection principles, of which the principle of equilibrium is emphasized in this project, and recommends that "the interrelation of the socioeconomic development policies with the principles of environmental preservation and conservation, and rational use of natural resources be ensured, to achieve the sustainable development goals" (Article 4/d).

The precautionary principle recommends that "all actions or conduct with immediate, or long term impact on the environment should be considered in advance, to eliminate or minimize potential harmful effects" (Article 4/c), and it is indispensable for this project. The use of the best available technology by it, and the enforcement of the mitigation measures proposed in this document should guarantee the practical implementation of this principle.

Article 15 of the Environmental Framework Law states that the "implementation in the national territory of infrastructures which, due to their size, nature, or location result in a significant negative impact on the natural or social environment, is dependent on an Environmental and Social Impact Assessment, in which its social, environmental, and economic feasibility are determined, as well as the methods for the neutralization or minimization of its effects". This report is based on this Article.

The Environmental Impact Assessment as an environmental management and administrative procedure must be activated prior to the authorization for the implementation of such project, and includes an assessment of its potential significant impacts on the environment (Article 16). This instrument is mandatory for all actions with implications for the social and environmental harmony and balance.

The Environmental Impact Assessments are duly regulated in the Decree on Environmental Impact Assessment (Decree No. 51/04, of July 23rd), and Decree on Environmental Licensing (Decree No. 59/07, of July 13th). Hence for a project to be implemented, the Ministry responsible for the environmental policies **has to issue the required environmental licenses**.

3.2.2. DECREE ON ENVIRONMENTAL IMPACT ASSESSMENT

The Decree on Environmental Impact Assessment (EIA – Decree No. 51/04, of July 23rd) establishes the EIA as one of the main instruments of environmental management. This Decree establishes a series of procedures that must be followed when drawing up an Environmental Impact Study.

According to Article 3/b, the Environmental Impact Assessment is "a preventive environmental management procedure that consists in the identification and prior qualitative and quantitative analysis of the beneficial and negative environmental effects of a proposed activity". This instrument aids the decision making processes, with the objective of preventing pollution, and protecting the fauna, flora, soil, water, air, climate, landscape, natural resources, and the cultural heritage.

The requirements for an ESIA for this project are defined in Article 4, in which it is stated that the licensing of tourism and housing projects, and infrastructures which by virtue of their nature, size, or location may have an impact on the environmental and social equilibrium and balance, are subjected to the development of an Environmental Impact Assessment".

According to the Decree, the installation, onset of an activity in breach of this Decree is qualified as an offense, and the offenders are punishable by a fine, graded from a minimum equivalent to $1,000.00 to a maximum equivalent to $1,000,000.00; depending on the seriousness of the case. Other penalties may be applied, such as seizure of machinery and equipment, and demolition of infrastructures already built (Articles 16 and 17).

3.2.3. Decree on Environmental Licensing

The Decree on Environmental Licensing (Decree No. 59/07, of July 13th) supplements Article 17 of the Environmental Framework Law, and introduces the administrative procedures for the environmental licensing, including the requirements for the environmental installation and operation licenses. This means that the project owner will be required to apply for the environmental license, through the entity that superintends its area of activity, to begin the earthworks, installation of equipment, construction, and implementation of the Marginal da Corimba Project.

Article 10 states that the construction, expansion, rehabilitation, recovery, modification, operation, and decommission of any activity that requires an Environmental Impact Assessment, must be subjected to an EIA prior to the request for an environmental licensing.

There are two (2) types of environmental licenses that are required for the activities listed in Article 4 of Decree No. 51/04, of July 23rd. The **Environmental Installation License** authorizes the implementation of the construction work or enterprise, in accordance with the specifications described in the project approved by the entity with authority over the activity. In this specific case the environmental installation license will permit the installation of equipment, and the construction work for the project. The **Environmental Operation License** is issued after the observance of all requirements laid down in the Environmental Impact Assessment. In this specific project it will give consent to the inception of the project´s operations.

According to Article 6, to obtain an environmental licensing it is necessary to submit an application to the administrative authorities that govern the environmental policies (Ministry of Environment), with the non-technical summary of the Environmental and Social Impact Assessment, the binding opinion of the entity with authority over the activity, and the environmental impact report attached. The decision will be informed within 90 days of receipt of the application (see Figure 3.1 in Section 3.1.1).

3.2.4. DECREE ON ENVIRONMENTAL LICENSING FEES

This Joint Executive Decree from the Ministry of Finance and the Ministry of Environment (Joint Executive Decree No. 96/09, of October 6th and No. 130/09, of November 26th) approves the fees to be paid for the environmental license issuing and renewal. It also provides a table with indicative fees to be paid for the environmental installation and operational licenses, registration of consultants, and the Environmental Impact Assessment costs, including the public consultation process. This decree also includes a table of the amounts calculated based on a percentage of the project´s investment value. This table was replaced by another in Ministerial Order No. 174/11, of March 11th, in which the fees are set out to be paid in Fiscal Correction Units (UCFs). Currently, each UCF corresponds to 88 Kwanzas.

According to this Decree the fee for an environmental installation license of a project with an investment value of more than 1.5 million dollars is calculated by multiplying the investment value by 0.18%, and in case of an environmental operation license the investment value is multiplied by 0.3%.

3.2.5. EXECUTIVE DECREE ON THE REGULATION OF PUBLIC CONSULTATIONS

The Executive Decree on the Regulation of Public Consultations on Projects Subject to Environmental Impact Assessment (EIA) (Executive Decree No. 87/12, of February 24th) has been set under Article 10 of the Decree on Environmental Impact Assessment (See *Section 3.2*). This article defines ''public consultation'' as the ''*procedure falling within the scope of public participation aimed at collecting opinions and suggestions of the stakeholders on projects subject to Environmental Impact Assessment*''.

The National Director of the National Directorate for the Prevention and Evaluation of Environmental Impacts (DNPAIA) takes the responsibility for chairing the consultation session (Article 4, Paragraph 3) and, so as to ensure the participation of the stakeholders, the Decree provides that the consultation is published in ‘’*Jornal de Angola*’’ as well as in other media outlets (Article 7). As a rule, public consultation starts with prior announcement of a Non-Technical Summary (NTS) (that is, description of the project and major effects that it may cause to environment) and proceeds with the intervention of the stakeholders. The questions raised and the opinions expressed during the public consultation are answered and taken into account in the process of decision-making by the DNPAIA.

3.2.6. PRESIDENTIAL DECREE ON ENVIRONMENTAL LIABILITY

Whoever causes damages to the environment is required to indemnify the State in strict liability (LBA, Article 28), and the individuals injured have their right to live in a healthy and unpolluted environment, and to be benefited by the rational use of the natural resources (LBA, Article 23), according to the general civil liability regime laid out in Article 483, and subsequent articles of the Civil Code. Whoever performs economic activities likely to cause damages to the environment, in particular activities categorized in the appendix of Decree No. 51/04 of July 23rd, must enter into civil liability insurance contracts (LBA, Article 27).

Presidential Decree Nr. 194/11 approves the Regulation Regarding Liability for Environmental Damage (RDA). The Regulation “is applicable to all activities likely to cause damages to the environment”, and “also environmental damages and/or imminent threats of these damages, even though they may result from incidents for which the liability or compensation is covered by the compensation scope of an International Convention” (Article 3/1-2). However, Article 3/3 restricts the environmental damages to which the regime of the Presidential Decree is applicable to those “environmental damages, or to the eminent threat of these damages, caused by diffuse pollution, whenever it is possible to establish a causal link between the damage, and the polluting activity of the operator”.

Article 4 also excludes from the regime of the decree environmental damages caused by “acts of armed conflict, hostilities, civil war, or insurrection”, and “natural phenomena occurring exceptionally, inevitably, or irresistible” (Article 4/1).

The Presidential Decree sets out strict liability for damages to the environment for operators (i.e. the “entity that performs an activity likely to cause damages to the environment”, Article 1), and subjective liability for all others (Articles 6/1 and 5/1).

The Presidential Decree ensures the right of the operators to limit their liability for environmental damages caused by pollution, in accordance with the national and international legislation (Article 4/2). The Appendix of the Presidential Decree, by reference to Article 17/1, establishes the upper and lower limits of the fines applicable to environmental violations that range from a minimum equivalent to $1,000.00 to a maximum equivalent to $100,000.00 (No. 7 of the aforesaid appendix). Article 17/4 of the Presidential Decree establishes the criteria for setting the fines: “a fine calculated as half of the amount of the” “remedy, prevention, and compensation” measure.

It is the responsibility of the Ministry of Environment to begin the investigation process for environmental liability in pollution cases (Articles 17, 19), and Appendices, and to establish the compensation amount (Articles 5/3-4, 13 and 17). This regime does not preclude the injured citizens from taking legal action due to the violation of their fundamental rights of living in a healthy and unpolluted environment (Articles 5/2 and 19/1).

The Ministry of Environment “may assign or request third parties to execute the required prevention or remedy measures” in terms of environmental liability for pollution (Article 17/2). The aforementioned Presidential Decree also establishes that the beneficiary of the civil liability insurance described in Article 27 of the LBA is the “Competent Authority”, currently the Ministry of Environment (Appendix No. 8 of Presidential Decree No. 194/11).

The special liability regime for damages to the aquatic environment and biological resources is detailed below.

Regarding this Project, there is some legislation that governs activities that are within the scope of the abovementioned duties. When it does not exist or it is incomplete, particularly when considering technical specifications, the Project promoters may resort to international instruments regarding good practices on relevant areas, or adequate policies in force in other countries, selecting as such compliance alternatives for some aspects of the generic duty of protection of the environment and the quality of life.

3.2.7. ADMINISTRATIVE TRANSGRESSIONS LAW

The Administrative Transgressions Law (Law No. 12/11, of February 16th) establishes the general framework applicable to administrative transgressions, encompassing those committed individually or collectively, by individual citizens, or public or private collective entities. According to Article 9, transgressions against the environment and territorial planning endanger the environment and territorial planning, and whoever acts as follows commits an administrative transgression:

- Pollute the environment;
- Unduly use of the natural resources;
- Contribute to the emission of pollutants, and damages to the quality of life;
- Attempt against biodiversity, or the conservation, reproduction, quality and quantity of biological resources, of current or potential use or value;
- Deforest unauthorized areas (any activities);
- Disposal of waste on the riverbeds, sea, lakes, or lagoons;
- Occupy a land, without a prior authorization from the competent authority.

According to Article 10, all of the following are considered transgressions against hygiene and public health; namely the discharge of waste/dump, and other residues outside the locations/sites, or outside the hours stipulated for the purpose, discharge, store, or accumulate dump/trash, dirty water, pollutant substances, or other wastes, of similar nature on the public way, rivers, beaches, territorial waters, indoor gardens, and other sites not appropriate, among others. Natural and legal persons, who, by action or omission, commit an administrative transgression, are subject to administrative fines (Article 11).

3.2.8. LAW ON TERRITORIAL AND URBAN PLANNING

Overall, according to Law No. 3/04 of July 25th, the Law on Territorial and Urban Planning (LOTU) the use of the land should obey the territorial regulation. The Marginal Corimba Project falls as an Urban Plan (Article 32). The «urban plans has as a special content the definition of evolution models of human occupation and the organization of urban systems, namely the classification of urban land and definition of perimeters, the programming of road networks and transport of collective equipment and fixing in the appropriate scale, the parameters of urban land use, distribution of economic and social activities, public and private facilities, housing shortages and even mandatory rates of green areas, as well as afforestation of urban roads that contribute to a better quality of the urban environment».

Individuals have right of access to the information as much content as the changes of territorial plans and both in the preparation phase, guaranteed to prior disclosure of their projects for approval, and after its publication, and may consult the respective process and obtain copies and certificates of documentary parts of the plans (Article 53, paragraph 1), matters regulated in Article 11 of Decree No. 2/06, of 23 January (General Regulation of the Territorial Urban and Rural Plan, REPTUR) .

3.2.8.1. PRINCIPLES OF TERRITORIAL PLANNING

All Territorial Planning activities, including the development and implementation of territorial plans, and the operations required for their implementation, including urban operations detailed in Article 41 of LOTU, such as the case in this Project, should be performed by the State, and “other collective public entities”, must obey the principles established in Article 6 of the Law, of which the following are highlighted: principles of "respect and accomplishment of the fundamental rights, freedom and guarantees" (Article 6/1/c), and the development (Article 6/1/m), of the "improvement of the quality of life of the populations" (Article 6/1/n) and, in addition:

- "Protect the environment, the rural, landscape, historical, cultural, urban, and architectural values"; being ordered the "occupation of the territorial space, so as to preserve the environment, the quality and organization of the rural and urban areas, the rural and urban community life, landscape, historical and cultural, urban, and architectural values" (Articles 6/2/a and 14);
- "Rational use of the natural resources", "a sustainable use": thus, "the policies on the occupation, use and exploitation of the soils should prevent their contamination and erosion", and "(…) the coastal fringe, the forests, and other natural resources, with particular interest in the conservation of nature, including those within reserved lands, are protected in a manner compatible with the normal fruition of their potentialities by the population" (Articles 6/2/b and 15);
- "Equity and fair distribution of the soil, and balanced distribution of the spaces", which includes "the fair distribution of the costs, and benefits from the implementation of territorial and urban plans", including conditions for the implementation of "policies on land concessions that ensure equity regarding access to infrastructures, and an equitable and fair distribution of the soil, as well as a balanced distribution of the production, work, housing, cultural, and recreational roles" (Articles 6/2/c, 6/2/d and 16);
- "Intergenerational solidarity and sustainability": the "policies and management of the territorial space" must ensure "a legacy for the future generations of a territory, and natural, populated, built-up rural and urban correctly planned". (Article 6/2/e 17);
- «Public Participation»: Article 21 validates this principle stating that it integrates the right to participation and information. Article 5 establishes the duty of the autarchies to participate in the planning of their areas of jurisdiction, the duty of the individual

or legal persons "to cooperate (...) in the promotion of the Territorial Planning" and the right of the rural communities to participate in the planning, particularly in the development of the territorial plans.

- "The private individuals have the right to information, and its content, and the modifications in the territorial plans, during the development phase, being ensured of the prior disclosure of the projects for approval, as well as after their publication; being able to read their process, and obtain copies and certificates of documents of the plans" (Articles 6/2/i, 21 and 53);
- "Coordination and compatibility": the institutional integration to be accomplished by the various territorial plans must be vertical and horizontal, and requires "the public and private interests at issue being taken into consideration" (Articles 6/2/j and 22, see also Article 4/d and 4/e of LBA);
- "Responsibility and Contractual Arrangements": Article 23/2 validates the principle of integration, when making reference to the institutional coordination for "contractual models of consultation between the public and private sectors", for the implementation of territorial plans. Article 23/1 validates the principle of responsibility, when requiring the "prior consideration of the territorial impact" of the measures described in the territorial plans, and the duty to compensate for environmental damages (Articles 6/2/k and 23);
- "Legal Protection": "the Territorial Planning activity must respect the rights, freedom and guarantees, and create conditions for the occupation and use of the territorial space, which contribute to the accomplishment of such fundamental rights", including the "land rights that are specific to the lands, without prejudice to the underlying social role of these rights, and the purposes of the Territorial Planning of general and public interest, within the fair boundaries and terms set out by the Law of the Land, by the other principles defined in the aforesaid Law, and the general applicable legislation". Thus, "the development, implementation, and modification of the Territorial Planning instruments must guarantee the stability of the legal regimes, and the respect for the rights and situations validly established". The individuals can

dispute planning acts that infringe their rights, and also have the right to complain to the Public Prosecutor, and the Ombudsman (Articles 6/2/l, 9/2, 10, 24 and 54).

These principles are validated in LOTU, and in REPTUR.

3.2.8.2. DEVELOPMENT AND IMPLEMENTATION OF TERRITORIAL PLANS

This Project can be characterized as an urban detailed plan (LOTU, Article 32/2/c), or even a special recovery plan for deteriorated urban areas or illegal occupation" (Article 32/2/d), which will be included in the future municipal master plan for the municipality of Belas. Its implementation considers the achievement of planning operations (Article 35º/2) as "urban operations", as set out in Article 41º of LOTU, namely:

- Recovery or reconstruction of deteriorated areas or illegal occupation" (Article 41/1/g);
- "Creation of (…) recreational and sports zones" (Article 41/1/p);
- "Allotment" and "definition of the urban perimeters" (Article 41/1/a, b).

The Urban Master Plan of Futungo de Belas (PDUFB) integrates two (2) plans (Urban Development Master Plan, and Settlement Normative Master Plan), and two (2) projects (Urban Project and Infrastructures of Phase I, and Urban Project of Phases II and III).

Territorial plans have a hierarchy, as mentioned above, the low-level plans must conform to the high-level ones (LOTU, Articles 52/1 and 32/3, REPTUR, Article 9/2-3). However, LOTU foresees that, until the main Territorial Planning options are not be approved, the "territorial plans that guide the actions coordinated by the Public Administration bodies that, however, must take into account the norms, and the material and procedural principles of this Law" may be adopted by the Government, and that they will be "temporary and transitory" (Article 55/2).

Article 32/1 of LOTU establishes the content of the urban plans, "the definition of progress models of human occupation, and the organization of urban systems" with, "namely" the:

- Classification of the urban lots, and definition of their perimeters;
- Program for the road networks and transportation;
- Program for the public equipment;
- "Setting, in the adequate scale, parameters of urban land use, distribution of socioeconomic activities, private and public services and equipment, shortage of housing, and mandatory green area index, as well as the afforestation of the urban streets, whilst contributing to an urban environment of better quality".

All territorial plans must contain "in a rational, clear and explicit manner, the scientific and technical fundamentals of their diagnoses, forecasts, guidelines, and recommendations for the spatial occupation of the territory, and use of the soil" (REPTUR, Article 7/1). They should also include the following elements (Articles 7/2 and 16/1):

- "The physical, morphological, and ecological characteristics of the territory incorporated in its territorial scope";
- "Identification of the natural resources, the natural spaces protected, and the rural, landscape, archaeological, and urban-architectural heritage", including "the structure of lands totally or partially reserved";
- "Characteristics of the demographic distribution in the territory, and the migratory dynamics of the territorial area covered";
- "Identification and characterization of the infrastructures, and urban public equipment, expressways, and other access routes to those infrastructures", including "educational and cultural structures";
- "Characterization of the social, cultural, and economic conditions, their degree of development, and regional asymmetries recorded in the territorial area covered";
- "Areas that hold, or are destined for economic activities".

Regarding the elements of the natural and ecological system that must be included in the territorial plans, Article 17/1 of REPTUR makes reference to, and specifically for this Project:

- "Fauna resources and protected areas";
- Types of green cover of the area covered by the plan, including the existing forest resources;
- Types of soils, and their capabilities (Article 97/3, for the urban plans);
- Hydrographic, lake, river resources, and others;
- Demographic rates on the occupation and use of the soil;
- Total reserves for nature protection.

The special and detailed plans should include the measures of preferential, prohibited, or conditional use, imposing criteria of nature conservation and protection compatible with the rights of use and fruition of the populations" (REPTUR, Article 17/4). In the reserved land, the urban plans should still include, namely (REPTUR, Articles 20 and 96/1):

- "Total reserves of land for nature protection purposes, defense and safety, protection of historical places or monuments, promotion of settlements or resettlements, and for other community purposes, or of public interest";
- «Strips of land in the coastline, offshore, including the beaches, riverside areas»;
- «Strips of land along the highways, roads, and public bridges»;
- «Strips of land along facilities, and aerial bundled cables, exposed, underground/buried, and submarine cables, for power, water, and other products, gas, and oil»;
- «Strips of land adjacent to tourist facilities, and resorts»;
- «Strips of land surrounding port facilities, and antennas, and weather and telecommunications stations»;
- "Indexes and criteria for the use of urban soils that ensure a better quality of life".

The content of the detailed plans is established in Article 107 of REPTUR. Article 108 describes the documents that must be attached to the plan, of which the following are highlighted:

- “Report of the legal and technical justification, and adopted solutions”;
- “… Further written and drawn documents that support the operations of land transformation foreseen, namely for the purposes of land registry”;
- “Regulation comprising implementation norms for the plan, and its integration with further municipal plans”;
- “Implementation program for the construction works and actions planned, and funding sources”.

During the development phase of the plan the compatibility between the different territorial plans must be ensured as set out in Article 29 of REPTUR.

The urban lands will be, as a result of the classification operations, categorized as urbanized (whose specific purposes are defined in detailed plans), for construction (considered for an approved land division operation), building lots (classified as urban reserve for expansion), and not considered a building lot (lands with “special protection due to their value, and for other uses”), (REPTUR, Article 97/2). The land division operations and the other urban operations are as follows (Article 97/3).

It is also during the development phase that “the lands must be assessed and set” that need to be expropriated, and the municipal plans should “expressly declare the benefit of the expropriation to the public (Article 87).

The implementation of the territorial plans comply with the principles of a planned implementation (REPTUR, Article 129), and a coordinated implementation (Article 130), as well as the rules set out in Articles 131 to 153 of REPTUR.

The land division operations are regulated in Decree No. 80/06, Regulation of the Licensing of Land Division Operations, Urban Works and Construction Works, that in Article 10 establishes the classification of the plots of land/lots.

The construction of buildings for the facilities foreseen in the Project, as well as the resettlement of the dislocated population, must comply with Decree No. 13/07 (General Regulation of Urban Buildings), in particular the norms foreseen in Articles 14 and subsequent of the Regulation.

3.2.8.3. LAW ON CULTURAL HERITAGE

Law No. 14/05, of October 7th (Law on Cultural Heritage) defines cultural heritage as «all the material and immaterial assets that given their recognized value, should be under the guardianship of the law" (Article 2/1). These include the «paleontological, archaeological, and architectonic evidences» with «memory, seniority, authenticity, originality, rarity, exemplarity, singularity» value, and others (Article 3/1). The immovable cultural assets comprise, *inter alia*, locations, and places of "historical, archaeological, artistic, scientific, or social interest" (Article 6/1/c). The immovable cultural assets can be classified as of local, regional, national, or international interest (Article 7/3).

The movable cultural assets include, among others, those that represent "the evolution of nature or technique", including those which are "buried or submerged, or are found in places of archaeological, historical, and ethnological interest, and in other locations" (Law No. 14/05, Article 6/2/a).

The Law establishes the duty of all citizens "to preserve, protect, and value the cultural heritage", and the duty of all "public and private entities", to "promote the safeguard and valuation" of this heritage (Article 14/1-2). Whoever "found, or finds (...) any archaeological evidence", in a public or private land, or submerged, must communicate it to the local authorities (Article 35/1).

The offences against the cultural heritage are punishable with the penalties set out in Article 56 of Law No. 14/05.

It will also be necessary to investigate if there are any assets classified as cultural or natural heritage in the Project area, in accordance with the terms of articles 6 to 23 of Law No. 14/05. With effect, in the event of being a classified asset, its demolition or destruction can only take place after the opinion of the Ministry of Culture (cit. law, Article 13/1).

3.2.9. LAW OF THE LAND

The Law of the Land Territorial Planning, establishes the principle of subordination of any land use, including the "Constitution or transfer of land rights", including what is established in the Territorial Planning instruments, in particular regarding the objectives aimed for by these instruments (Article 15).

"The occupation, the use, and usufruct of the land is subject to the rules on environmental protection, namely those related to the protection of the landscape, and the species of flora and fauna, preservation of the ecological balance, and the citizens' rights to an healthy, and unpolluted environment" (Article 16).

The lands considered in the Project may be owned by holders of land rights granted by the State, and holders of private property rights.

In the event of a land under concession, expropriation will be necessary by public utility, and the payment of a fair compensation, in accordance with the terms of Article 12 of the Law No. 9/04 (Law of the Land), of Articles 21 and 132 of the General Regulation on Land Concessions, and the abovementioned constitutional, and Territorial Planning rules. This is also applicable if the land is private property.

As it was abovementioned the Law of the Land foresees the creation of partial reserves for specific purposes. In addition to the partial reserves of the coastal fringe, the Law also contemplates partial reserves of interest for the Project (Article 27/7):

- "The lands occupied by four-lane roads, and by facilities, power cables, and water, telecommunications, oil and gas conductors" that will have "a 30-meter adjoining strip of land on each side";
- "The lands occupied by secondary and municipal roads, with a 15-meter adjoining strip of land";
- "The 100-meter strip of land with military facilities, and other defense and security facilities.

3.2.10. REGULATION ON WASTE MANAGEMENT

Presidential Decree No. 190/12, of August 24th, approves the Regulation on Waste Management. According to Article 6 of this decree, the assessment of waste management plans for hazardous and non-hazardous wastes is the competency of the Ministry of Environment.

Article 7 of this Decree establishes that all public and private entities who produce waste, or carry out activities associated with waste management must, before commencing their activities, prepare a Waste Management Plan (WMP) containing at least all information required and listed in Appendix I and/or Appendix II of this document, whichever the case, of a landfill or other waste management operation, respectively. In paragraph 2 of the same article it is established that the WMP must be submitted to the Minister of Environment for approval, within a period of no more than 60 days, from its date of reception.

Article 7/3 states that the Waste Management Plan shall be valid for a period of four (4) years, starting from the date of its approval. The Waste Management Plan cited in the preceding paragraph must be updated and submitted to the Minister of Environment by the latest 90 days before expiry of its validity, and whenever substantial alterations are made to the previously submitted plan (Article 7/4).

Article 9 of this decree establishes that the entities who produce or manage wastes must, among others:

- Minimize the production and hazardousness of any category of waste;
- Ensure the treatment of wastes before their final disposal;
- Ensure the protection of all workers directly handling the waste against accidents or diseases resulting from exposure thereto;
- Ensure that all wastes to be transported carry a minimum risk of contamination for workers, as well as for the public in general, and the environment;
- Build the capacity of its workers on Health, Safety, and Environment;
- Ensure that the waste disposal within and outside the place of production does not have a negative impact on the environment, or on public health;
- Keep a detailed annual record of the origin, quantities, and types of waste handled, transported, treated, transformed, or disposed, and retain it for five years after its recording.

As for hazardous wastes, Article 17 enforces that they be segregated according to their classes, and each producer or managing entity thereof must have at least the technical conditions for their packaging, and subsequent disposal.

Therefore, the collection of hazardous wastes is the sole responsibility of the producer (article 19/1). At the moment of the collection, a Manifest must be completed, in accordance with the terms of the template included in Appendix II of this decree, where the quantities, quality, and destination of the collected waste are declared (Article 19/3). However, paragraph 4 of the same Article states that the producer of the waste must submit a copy of the Manifest cited in Article 19/3 to the Ministry of Environment, and retain a copy for themselves and for others, respectively, such as the carrier and recipient of the waste.

The producer or the holder, the carrier, and the recipient of the wastes, must keep its copies of the Manifesto referred to in the previous paragraphs, during a (five) 5-year period (Article 19/5).

The hazardous wastes, in accordance with Article 21, can only be moved and/or transported outside the facilities by producers, and carriers previously certified by the Ministry of Environment for such purpose.

3.2.11. Regulation on Public Water Supply and Wastewater Sanitation

This Decree (Presidential Decree No. 83/14, of April 22nd) defines the regime of public water supply and wastewater sanitation activities. According to Article 5, the public water supply and wastewater sanitation systems aim essentially to:

a) Contribute to the promotion of the quality of life of the population, and reduce poverty;
b) Contribute to the promotion of the socioeconomic and industrial development, and the preservation of the environment;
c) Provide comfort and well-being to the population, and facilitate cleanliness and public hygiene.

3.2.12. Terms of Reference for the Development of Environmental Impact Studies

Executive Decree No. 92/12, of March 1st, that approves the Terms of Reference (ToR) for the Development of Environmental Impact Studies, establishes the guidelines to be followed during the mandatory development of Environmental Impact Studies of specific projects, to assess their environmental feasibility.

According to Article 2, the Environmental Impact Study must be developed according to the legislation on Environmental Impact Assessment, and fully comply with the Terms of Reference approved by the Ministry of Environment that guides their development in accordance with the specificity of each project.

This Study was developed in accordance with the Terms of Reference N/Refª1537/02-02/DNPAIA.MINAMB/14, of September 25th of 2014 provided by the Ministry of Environment and is in line with the recommendations of the International Finance Corporation Performance Standards.

3.2.13. BIOLOGICAL AQUATIC RESOURCES LAW

The Biological Aquatic Resources Law (Law No. 6-A/04 of October 8th, LRBA) is the only law in Angola that establishes a link between the ecosystem and the management of resources. It regulates the use of marine biological resources and freshwater. As a consequence, in addition to the norms that regulate the fishing activities, the law includes norms on the protection of resources according to their different purposes, the protection of the aquatic habitats, and the marine environment, and also sets out the creation of aquatic conservation areas.

There are general principles for the use and management of aquatic biological resources, among others, principles of sustainable development, the “conservation and optimal use of the aquatic biological resources”, of prevention, safeguard, integration, defense of the interests of the fishing communities”, and the “participation of all interested parties in the management of the resources (LRBA, Article 6/3). Article 65 lists a set of measures to protect the resources, In addition to the measures for sustainable and responsible fishing activities, of which the following are emphasized:

- The identification of deteriorated marine or aquatic areas, and the definition of rehabilitation measures, including the prohibition against fishing, or others activities in these areas;
- The definition of protection areas in the sea or continental waters, to preserve the resources and aquatic ecosystems, or for recreational purposes;
- The identification of pollutant activities, and the adoption of measures destined for the prevention of the pollution in the aquatic environment;
- The definition of fishing gear and methods that may be used in each type of fishing activity;
- The adoption of procedures that ensure the participation of the interested parties, including non-governmental organizations, fishing companies, and coastal and riverside communities;
- The adequate coordination between the central and local administration bodies of the Government, aiming at the integrated management, and the adoption of preservation measures of various natural resources, and compatible environments.

Articles 66 and 67 establish the obligations of the State and the Ministry of Fisheries regarding the protection of the fishing resources. Article 68 establishes the rights and obligations of the citizens and fishing companies in this respect.

3.2.13.1. PROTECTION OF SPECIES

Regarding the Project, LRBA establishes a classification of species (rare, endangered, or threatened species, or species whose number is reduced as a result of the implementation of the Project), based on the threats to their sustainability, and measures that must be taken regarding these species under those circumstances (Articles 69 and 71).

They are listed as protected species, subjected to a “special protection regime”, and without prejudice to the special regime of rare or endangered species (Article 70), “all reptiles and marine mammals”, “all species of lobster or crab with size smaller than the legal parameters, or during the spawning season", and the "highly migratory species" and anadromous fish (Article 71/4-5). It is the responsibility of the Ministers of Fisheries and Environment to establish jointly this special regime, and adopt the appropriate measures of "conservation and regeneration *in situ* and *ex situ*" of these species (Article 71/1-3). However, Article 75/1 prohibits "the ownership, transportation, storage, transformation, exhibition, and sale" of any of these species. In case of bycatch of aquatic mammals or reptiles, the fisherman has the obligation to reintroduce them in the environment (Article 74/6).

Article 75/2 prohibits the introduction of exotic species and organisms genetically modified in the aquatic environment without authorization from the Ministers of Fisheries, and Energy and Water.

Disrespecting these prohibitions is a fishing infraction (Article 234/o and 236/1/f). The ESIA must identify the species of marine fauna and flora that will be affected by the Project, in particular rare, endangered, and threatened species, or species whose number is reduced as a result of the implementation of the Project, and sets out adequate measures for their conservation, taking into consideration not only the legislation on ESIAs, but also the principle "of conservation and optimal use of aquatic biological resources" established in Article 6/3/c of LRBA, and in the National Strategy and Action Plan for Biodiversity.

3.2.13.2. Marine Pollution

The Biological Aquatic Resources Law prohibits (Article 92/1):

a) "The introduction in the marine environment of banned substances, and/or outside the limits set out in the MARPOL Convention 73/78, and its annexes, without prejudice to the discharges of effluents, and other permitted substances, according to the terms of the legislation on prevention and control of pollution from petroleum activities;

b) The introduction in the aquatic, coastal and riverside environment of any other substances, or a large quantity of these substances, from any sources, that cause damages to the aquatic biological environment or resources, in accordance with the terms to be defined in decree, and without prejudice to the applicable environmental legislation on natural resources;

c) The performance of activities that involve, or may involve danger of pollution, or degradation of the aquatic environment, except in case of a joint authorization, according to the terms to be defined in regulation by the competent Minister, and the Minister that superintends the environmental policies. In the case of continental waters, of the Minister that superintends the water resources sector, and without prejudice to the legislation on other natural resources, or to the environmental protection, or maritime and waterway transportation".

Article 93 establishes that all those "that perform activities that cause pollution of the aquatic environment are obliged to apply, at their sole expense, the measures to prevent and mitigate the pollution that may be defined in regulation". Moreover, "Whoever pollutes the aquatic environment, in particular by introducing banned substances in this environment, or outside the permitted limits, consists in the obligation to, at its sole expense, reconstitute the previous situation to the action, omission of pollution that was the cause of the pollution".

The State must adopt "appropriate prevention, warning, and rescue systems for pollution" in the event of accidents" (Article 94/3). The General Fishing Regulation (Decree No. 64/05) considers polluting activities, among others (Article 23/1):

- the "discharge of industrial and domestic effluents into the aquatic environment, without previously cleaning the polluted waters";
- the "discharge of industrial and domestic waste, into the aquatic environment, without previously cleaning the wastewater";

- the "discharge of ballast water, and the washing of the fuel tanks from the boats/ships**"**;
- "harbours and facilities for the docking of ships without any equipment to clean the tanks".

The Regulation prohibits *inter alia* (Articles 38 and 39):

- the introduction in the maritime waters and hydrographic basins of "any toxic substances or objects likely to infect, poison, or destroy the fishing resources, the seaweed, and any species of the aquatic flora";
- the discharge into maritime waters, by "institutions, factories, or companies", of "wastewater that result from their industrial or commercial operations, or from ducts or discharge facilities, if such waters are likely to stun, poison, or cause the destruction of the living resources".

The EIS must, therefore, list the potential sources of water pollution. The environmental license will indicate the threshold values for the emissions of pollutant substances (Decree No. 59/07, Article 14/b).

3.2.13.3. AQUATIC CONSERVATION AREAS

LRBA requires that the following protected ecosystems be established as conservation areas: "wetlands and mangroves", lagoons, reefs, and the "spawning areas of biological resources" (Article 86), but do not specify of which type.

The types of conservation areas in the LRBA are:

- Aquatic integral natural reserves;
- National aquatic parks;
- Aquatic natural reserves;

- Partial reserves;
- Natural monuments.

Since the ecosystems (e.g. mangroves) and the aquatic biological resources are likely to be affected, it could be necessary, eventually, and depending on the EIA, to create total or partial aquatic natural reserves, for the “sustainable regeneration and renewal” of species, in particular those protected that will be affected by the Project (LRBA, Article 82). Such measures must be included in the EIS.

In addition, the LRBA recognizes the unit among the aquatic and land-based areas of conservation, and among conservation areas, and surrounding zones, it is anticipated, *inter alia*, that the National Assembly or the Government, respectively, must decide “in a reasonable timeframe”, on the expansion of the statute of the onshore areas, to the “surrounding marine zones”, and the current integral natural reserves, and national parks (Articles 80/5 and 81/7).

This issue is very important in this Project, given the existence of the Integral Natural Reserve of Ilha dos Pássaros. As a consequence, the impacts of the Project on the Reserve and surrounding water will have to be acknowledged in EIS, and the appropriate statute of the surrounding sea water. In addition, Article 82/7 states that the bays and estuaries of the rivers will have, without prejudice to its reclassification, the statute of aquatic reserves.

3.2.13.4. LIABILITY

The LRBA establishes the administrative, civil, and criminal liability in the event of damages to the environment, and to the aquatic resources in Articles 231 and 268. The LRBA establishes a regime of objective civil liability in favour of the State, or of injured individuals, for damages caused to the biological resources, and aquatic environment (Article 266). But if it is not necessary to occur an illicit act for the civil liability for damages to the aquatic resources and environment, the LRBA still anticipates administrative and criminal responsibility for breach of duties related with the sustainable use of these resources (Articles 234, 236, and 262, respectively).

3.2.14. Water Law

The provisions of the Water Law (Law No. 6/02 of June 21st), applicable to the freshwater, of interest for this Project makes reference to the principle of "complementarity of the water supply with the wastewater sanitation" (Article 9/1/i), and the intention to supply the "populations with uninterrupted and sufficient drinking water, for the satisfaction of their domestic needs and hygiene", to ensure the "adequate wastewater sanitation", and regulation of the "discharge of effluents" (Article 10/2), and to ensure the right to have access to water from other individuals for household purposes, and the performance of economic activities (Article 9/1/a).

The Law prohibits water pollution, particularly activities that accumulate "solid waste, waste, or any substances in locations, and conditions that contaminate, or endanger the contamination of waters" (Article 67/b).

The suppliers of water for consumption must ensure that "the facilities used and the water supplied is in compliance with the requirements set up by law" (Article 70/1). The water pollution by any means, including the discharge of any type of effluent is prohibited, being authorized by the managing entity of the basin (Water Law, Article 68). The EIS must, therefore, be concerned about the discharges of wastewater and potential effluents.

3.2.15. The Coastline

The Urban Master Plan of Futungo de Belas sets out "Environmental Protection Zones" (ZPA) that include "beaches, slopes of cliffs, and areas of natural draining, where it becomes necessary to recover, and environmental protection". Construction work is not allowed in these partial reserves.

It still remains in force, even though with the appropriate modifications in subsequent legislation on territorial planning, particularly those published in Presidential Decree No. 31/11, of February 9th, which establishes the alienation regime of public lands, within the perimeter of the coastline of Luanda. By virtue of its Article 8, this Decree revokes Decree No. 4/01, on Coastal Area Management Plans (POOC), with regards to the coastline of the province of Luanda, where this project is located. In accordance with this Presidential Decree (Article 2/2) the alienated land includes the maritime domain, and the strip of land under protection with a maximum width of 500 meters of the Province of Luanda.

Since Presidential Decree No. 31/11 does not set out any rules on environmental protection of the coastline of Luanda, it may have an interest in mitigation measures or prevention of negative social and environmental impacts, the EIS take into consideration some of the protection measures, particularly of beaches, as set out in Decree No. 4/01. The coastal fringe, “beaches and the marine-terrestrial zone”, is a public domain asset (Article 95/1/f,) and as such “inalienable, imprescriptible, and unseizable”, being defined in the law its regime, and the conditions for its alienation (Article 95/2-3).

The Law of the Land establishes that the “coastal strip, and the contour of islets, bays, and estuaries, observing a protected strip inland”, constitutes a partial reserve (Article 27/7/c) where “all types of occupation and land use are permitted, if they do not collide with the purposes set out in the legislation” (Article 27/6).

3.2.16. Regime of Ilhéu dos Pássaros Reserve

The regime of terrestrial conservation areas in force dates back to the colonial period, and it is considered obsolete. The flora and fauna “protection zones” in Angola during the colonial period (Decree No. 40:040, Articles 31 and 53, this by reference to Article 31) were categorized as National Park, Integral Nature Reserve, Partial Reserve, and Special Reserve, in which Forest Reserves are included (Article 31).

There is an inland integral nature reserve in the Mussulo Bay. This means, in terms of the legal regime for its use, that it is an area “subject to the public oversight and administration, in which it is strictly prohibited to hunt, fish, undergo mining exploration, forestry or farming activities, perform surveys, prospections, research, earthworks, or any construction work that may modify its landscape or vegetation, practice acts that may harm or disturb the flora or fauna, introduce species of the fauna and flora, either alien or native, wild or domesticated, and where it is, it is forbidden to enter, circulate, set up camp, and undergo scientific investigations without a special license from the competent authorities” (Decree No. 40,040, Article 31/para. 2).

The Law of the Land only makes a distinction between integral reserves and partial reserves (Article 27/3). It includes the conservation areas in the integral reserves (Article 27/4-5). The Territorial and Urban Planning Law establishes special territorial plans for conservation areas (Article 28/3/a). As abovementioned, the coastal strip where the islets (*Ilheus*) are located is a partial reserve, under the terms of Article 27/7/c of the Law of the Land. According to the definition of Appendix 1 of Decree 4/01, «*maritime protection zone”* – is an offshore area under the competency of the Coastal State under the jurisdiction of the port or maritime authorities, with the exclusive right to monitor the maritime protection zone, for military purposes, or for economic, fiscal, sanitary, environmental, or any other purpose» (No. 1/c).

3.3. INTERNATIONAL LEGAL FRAMEWORK

In addition to the compliance with the requirements under Angolan legislation, the Project will also be consistent with international guidelines of which Angola is a signatory. According to Article 13 of the Angolan Constitution dated February 2010, approved or ratified international treaties and agreements are in force in the Angolan legal system after their official publication.

There are also international instruments that, although not being mandatory, establish guidelines to which the countries must obey, particularly when there are projects funded by international financial institutions such as the World Bank (WB), and the International Finance Corporation (IFC). This section provides a summary of the main Angolan and international standards relevant to the Project.

3.3.1. MANDATORY LEGAL INSTRUMENTS

The following are a summary of the provisions of some Mandatory International Legal Instruments (Treaties) of relevance to the Project in which Angola is a Member State.

3.3.2. CONVENTION ON BIOLOGICAL DIVERSITY

The Convention on Biological Diversity (CBD) requires Contracting Parties to identify, and conserve the terrestrial, marine, and aquatic resources, and their diversity (Article 6), a requirement validated in the aforementioned Angolan legislation. Overall, each Contracting Party shall promote the "protection of ecosystems, natural habitats, and the maintenance of viable populations of species in natural surroundings" (Article 8/d), and *inter alia* (Article 8):

- "Regulate or manage biological resources important for the conservation of biological diversity, whether within or outside protected areas,", *inter alia*, developing or maintaining "necessary legislation and/or other regulatory provisions for the protection of threatened species and populations";
- Endeavour to provide "the conditions needed for compatibility between present uses and the conservation of biological diversity, and the sustainable use of its components", and even implement legislation, or management measures of "relevant processes and categories of activities", in the event of negative environmental impacts, and "minimize adverse impacts" relating to the use of biological resources on biological diversity;
- Enter into cooperation agreements with social partners "to ensure that the environmental consequences of its programmes and policies are duly taken into account" (Article 14/1/b);

- Promote public participation in the EIA procedures (Article 14/1/a).

CBD also sets out the obligation of each Contracting Party to establish “a system of protected areas or areas where special measures need to be taken to conserve biological diversity”; developing, where necessary, guidelines for their selection, establishment, and management, and promoting the “environmentally sound and sustainable development in areas adjacent to protected areas” (Article 8/a-b and 8/e). The identification and measures for conservation of the biological resources that will be affected must, therefore, be set out in the EIS.

3.3.3. CONVENTION ON THE LAW OF THE SEA AND THE SADC PROTOCOL

The Convention on the Law of the Sea (UNCLOS) establishes, as regards to this Project, rules on the protection and preservation of the marine environment, and the pollution of the marine environment, particularly from land-based sources. In addition to the fishing regulations in the Exclusive Economic Zone, particularly the regime of TACs, UNCLOS establishes rights and duties of the Coastal State regarding the protection of certain species:

- «Prohibit, limit or regulate the exploitation of marine mammals» (Article 65);
- States should cooperate directly «with a view to ensuring conservation and promoting the objective of optimum utilization» of highly migratory species, «both within and beyond the exclusive economic zone».

Regarding the protection and preservation of the marine environment, it establishes the general obligation of the States «to protect and preserve the marine environment» (Article 192), and take, individually or jointly as appropriate, all measures consistent with this Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavour to harmonize their policies in this connection (UNCLOS, Article 194/1).

States should also «take all measures necessary» to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment, and that pollution arising from incidents or activities under their jurisdiction or control does not spread beyond the areas where they exercise sovereign rights in accordance with this Convention. (UNCLOS, Article 194/2). The States should, *inter alia*, «minimize to the fullest possible extent» (Article 194/3):

- The “release of toxic, harmful or noxious substances, especially those which are persistent, from land-based sources, from or through the atmosphere or by dumping”;
- “Pollution from vessels”, in particular “measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea, preventing intentional and unintentional discharges”;
- “Pollution from installations and devices used in exploration or exploitation of the natural resources of the seabed and subsoil, in particular measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea”, and in addition take measures to prevent, reduce or control such pollution;
- Pollution from other installations and devices operating in the marine environment;
- Pollution from or through the atmosphere, applicable to the air space under their sovereignty, and to vessels flying their flag, or vessels or aircraft of their registry; and
- Pollution resulting from the use of new technologies, or the intentional or “accidental introduction of species, alien or new, to a particular part of the marine environment”, which “may cause significant and harmful changes thereto” (Article 196/1).

The States should also adopt the “necessary measures to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life” (Article 194/5).

According to the SADC Protocol on Fisheries, each State Party shall adopt the necessary “legislative and administrative measures to prevent pollution of waters by inland, coastal or offshore activities”, including the use of energy efficient and clean technologies in the fishing and aquaculture (Articles 14/3 and 14/10).

The State Parties, taking into account “the best scientific evidence available” shall, through proper conservation and management measures ensure that aquatic living resources in the areas under their national jurisdiction are not endangered by over exploitation” (Article 5/5). They shall also coordinate the establishment of inland and marine protected areas, with particular reference to endangered species, especially migratory species in transboundary areas” (Article 14/7).

Each State Party shall “in close cooperation with SADC institutions, and relevant international agencies” take concerted action to protect endangered living aquatic species, and their habitats. They should also compile a list of endangered species, promote broad awareness of all stakeholders” of the need for protection of the species and their habitats, and progressively replace fishing gear and other technologies which are hazardous to the species (Article 14).

In addition to the abovementioned measures, and regarding the migratory species, the Protocol sets out that the State Parties shall take due account of the environmental impact and migrations of aquatic species, and endeavour to provide suitable fish passages (Article 14/9).

In the biosafety context, the introduction of exotic species or "genetically modified species to shared aquatic ecosystems, including the full extent of the river basin, unless the affected State Parties agree to the introduction" (Article 13/7).

It is thus necessary that the EIS identifies the sources of pollution at sea from the coast, and are foreseen measures to minimize, even if the migratory species were taken into duly consideration.

3.3.4. Ramsar Convention

Given the existence of mangroves in the coastline, the Convention on Wetlands of International Importance, particularly as a Habitat of Waterfowls (Ramsar, 1971, with the changes to the Protocol of 1982, and the Amendments of 1987) may eventually be applicable to the Project.

According to the Ramsar Convention wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters.

All Contracting Parties have the duty to maintain the List of Wetlands of International Importance (Articles 8, 2/1-2 and 2/5). Each Contracting Party is essentially responsible for adopting special measures for the conservation of the wetlands it included in the List. All Contracting Parties shall:

- Establish "nature reserves" on wetlands, to promote the conservation of wetlands, whether they are included in the List or not (Article 4/1);
- Formulate and implement their planning so as to promote the conservation of the wetlands, and as far as possible "the wise use" of wetlands (Article 3/1);

Ensure the «conservation, management and wise use of migratory stocks of waterfowl», and endeavour to increase waterfowl populations on appropriate wetlands» (Articles 2/6 e 4/4).

3.3.5. BONN CONVENTION

The Convention on the Conservation of Migratory Species of Wild Animals requires the Range States to identify these species, and «prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species» (Article 3)

In the event the migratory species become affected as a result of the Project, the EIS must suggest measures to prevent, or mitigate the adverse effects of the Project in these species.

3.3.6. NON-COMPULSORY LEGAL INSTRUMENTS

In the non-compulsory instruments that at least constitute moral obligations of the interested parties, particularly the States, the declarations are emphasized within the scope of the global conferences organized by UN Habitat; Agenda 21 that is still under development, and was confirmed in the Johannesburg World Summit on Sustainable Development.

3.3.6.1. DECLARATIONS OF THE UN-HABITAT CONFERENCE

A. Vancouver Declaration on Human Settlements

The Vancouver Declaration on Human Settlements (1976), approved during the United Nations Conference on Human Settlements emphasizes the relationship between the international instruments on the environment, and the quality of life of all people, as well as the enforcement of the economic, social, and cultural rights, and the organization, and management of human settlements (Preamble).

It establishes the principles and guidelines to which the Land-use Planning must comply regarding human settlements, and approves the Action Plan. From the guidelines (Part III) to be enforced by the States in their actions related to principles of human settlements, the following are highlighted:

- Adopting policies and physical planning strategies (No. 2 and 15);
- Integration of the economic, social, and protection of the environmental aspects, and the natural resources (No. 3), taking into consideration the social and environmental impacts (No. 22);
- Reduction of disparities between rural and urban areas, and priority to improving the rural habitat conditions (No. 4 and 14);
- Basic rights of human dignity (No. 10);
- Give priority to satisfy the basic human needs (No. 5,6, 8, and 9);
- Respect the cultural rights, including the preservation of the cultural heritage (No. 17);
- Preservation of the identities of individuals, families, and social groups (No. 16);
- Equitable share of the benefits of the planning actions, including those which result in an increase of the land prices, due to investments accomplished in one given area (No. 13);
- Participation of the interested parties in the preparation of the actions for urban settlements (No. 11).

B. Istanbul Declaration on Human Settlements

The Istanbul Declaration on Human Settlements (1996) was approved during the United Nations Conference on Human Settlements (Habitat II), under the motto «adequate shelter for all and sustainable human settlements development in an urbanizing world». The

Declaration reaffirmed the principles of the Rio Conferences on Environment and Development (1992), as well as of Vancouver. The Habitat II Conference adopted some guidelines, of which the following are highlighted:

- As human beings are at the centre of our concern for sustainable development, they are the basis for our actions as in implementing the Habitat Agenda; as a consequence, we shall intensify our efforts *inter alia* to eradicate poverty, and to provide for basic needs, particularly adequate housing, promote all human rights and fundamental freedoms, and the particular needs of women, children, youth, and the homeless (No. 7);
- Priority consideration to the tendency towards excessive population concentration (No. 4);
- Rural and urban development are interdependent; the urban habitat needs to improve, however, we must also work to extend adequate infrastructure, public services and employment opportunities to rural areas in order to enhance their attractiveness, and minimize rural-to-urban migration; small- and medium-sized towns need special focus (No. 6);
- To improve the quality of living in the cities there is a need to intensify our efforts to combat the deterioration of conditions, and improve the living conditions in the cities, towns and villages; «our cities must be places where human beings lead fulfilling lives in dignity, good health, safety, happiness and hope» (No. 5);
- The right to adequate housing as provided for in international instruments should be achieved in full and progressively, and for such end, the active participation of our public, private, and non-governmental partners should be seek *inter alia*; to ensure legal security of tenure, protection from discrimination and equal access to affordable, adequate housing for all persons and their families; to that end, it is necessary to expand the supply of affordable housing, by enabling markets to perform efficiently and in a socially and environmentally responsible manner, enhancing access to land and credit and assisting those who are unable to participate in housing markets (No. 8 and 9);

- To improve the quality of living in our human settlements, the Countries commit themselves to (No. 10 and 11):
    - Apply the precautionary principle;
    - Adopt sustainable patterns of production, consumption, transportation and settlements development;
    - Respect for the carrying capacity of ecosystems;
    - Pollution prevention;
    - Provision of adequate quantities of safe water;
    - Effective management of waste;
    - Promote the conservation, rehabilitation and maintenance of buildings, monuments, open spaces, landscapes and settlement patterns of historical, cultural, architectural, natural, religious and spiritual value;
    - Promote decentralization through democratic local authorities, work to strengthen their financial and institutional capacities, while ensuring their transparency, accountability and responsiveness to the needs of people.

C. Resolution S25/2 (ONU-AG, 2001), Declaration on Cities and Other Human Settlements in the New Millennium

This resolution of the General Assembly of the UN confirmed the guidelines of the Declaration of Istanbul. Agenda 21 is a programme adopted during the Rio Summit in 1992, and is still in force, since it was confirmed by the Johannesburg Summit in 2002.

Chapter VII of the Agenda addresses the human settlement and land-use planning, and establishes the objectives and actions to be developed, to ensure all rights to housing and quality of life, a sustainable management of the urban and rural areas, and land-use. The Agenda essentially applies the guidelines established in the abovementioned global declarations.

Chapter XVII addresses the protection of the oceans, all kinds of seas, coastal areas, small islands and their resources. It establishes the periodic development of EIAs, and the adoption of land-use planning, in the event of emergency situations caused by natural disasters or pollution, the need for integrated plans of infrastructures, in particular the treatment and disposal of sewage, solid wastes, and industrial effluents, and integration of sectorial programmes of different economic activities to be undertaken.

It also considers the conservation and restoration of altered critical habitats, maintenance measures for the marine biodiversity, and the productivity of the marine and coastal species and habitats, as well as its recording, the creation and maintenance of conservation areas, and the dissemination of sustainable technologies and practices.

3.3.6.2. GUIDELINES OF THE WORLD BANK

The World Bank requires the development of environmental impact assessments in the construction projects that it funds, and that are Category A and Category B projects in accordance with the Equator Principles, since the 90s.

A. Equator Principles

In 2003, the Equator Principles (EPs) have been announced by a group of 10 of the largest international banks, starting the assessment normalization process of ‘’relevant impacts and social and environmental risks’’ of proposals for major projects in the private sector. Besides being technically and economically feasible, projects should be environmentally and socially viable too, and the feasibility study shall also document these aspects. There have been two updates to the EPs, with the latest effective one (known as EPIII) dated June 4th 2013.

The EPs have established voluntary principles including adherence to IFC Performance Standards, to address the risks and environmental and social issues in global project financing operations. Equator Principles Financial Institutions (EPFIs) are now more than 60 and collectively control over 80% of the global project financing market.

The Equator Principles categorize the projects in A, B, or C, based on social and environmental impacts:

- **Category A** – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented.

- **Category B** – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and

- **Category C** – Projects with minimal or no adverse environmental and social risks and/or impacts.

The Principles will require the development of an EIA for the abovementioned projects (A & B). The EIA must address the issues described in the Principles, which include social aspects, and the identification of the main risks of the projects. According to the Principles, the project owner must commit to complying with an environmental management plan that will be based on the findings of EIA. The EPs have been designed to be used as a reference for the financial industry to manage social and environmental issues in project financing. The principles are:

1. Review and Categorization of the Project;
2. Environmental and Social Assessment;
3. Applicable Social and Environmental Standards;
4. Environmental and Social Management System and Equator Principles Action Plan;
5. Involvement of Stakeholders;
6. Complaints Mechanism;

7. Independent Review;
8. Agreements (disbursement conditions);
9. Independent Monitoring and Reports;
10. Dissemination of Information and Transparency.

The functional effect of the EPs was to align the main assessment policies of the private sector financing projects with those of the IFIs. This was a great step in promoting compliance with the best international practices with regard to reduction or elimination of project environmental and social impacts. There was an assessment made to the alignment of the Equator Principles with the ESIS report to allow any alignment error to be taken into account.

3.3.6.3. GUIDELINES OF THE INTERNATIONAL FINANCE CORPORATION

The International Finance Corporation (IFC) developed throughout the years Performance Standards on environmental and social sustainability that serve as reference for projects with impact on the environment and the quality of life of people. The present standards dated of January 2012 are listed in Table 3.1.

Table 3.1: IFC Performance Standards.

Performance Standards	Objectives
Performance Standard 1 - Assessment and Management of Environmental and Social Risks and Impacts: underscores the importance of managing environmental and social performance throughout the life of a project (any commercial activity is subject to an evaluation and management)	• Identification and Evaluation of Impact. To identify and evaluate social and environmental impacts, adverse or beneficial to the project or the area of influence; • Mitigation. To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for the adverse impacts on workers, affected communities, and the environment; • Commitment from the Stakeholders. To ensure that the affected communities are adequately engaged

Performance Standards	Objectives
	on issues that could potentially affect them; • Effective Management. To promote improved environmental and social performance of the companies through the effective use of management systems.
Performance Standard 2 - Labour and Working Conditions: recognizes that pursuit of economic growth through employment creation, and income generation should be accompanied by the protection of the fundamental rights of workers.	• To establish, maintain, and improve the worker-management relationship; • To promote the fair treatment, non-discrimination, and equal opportunity of workers, and compliance with national employment and labour laws; • To protect the workforce, reporting child labour and forced labour; and • To promote safe and healthy working conditions, and the health of workers
Performance Standard 3 - Resource Efficiency and Pollution Prevention: recognizes that increased industrial activity and urbanization often generate increased levels of pollution to, water, and land in a manner that may threaten the community, and the environment at the local, regional, and global levels.	• To avoid or to minimize adverse impacts on human health and the environment, by avoiding or minimizing pollution from project activities; • To promote the reduction of emissions that contribute to climate change
Performance Standard 4 - Community Health, Safety, and Security: recognizes that project activities, equipment, and infrastructures bring many times benefits to the communities, including labour, services, and opportunities for economic development.	• To prevent or minimize risks and impacts on the health and safety of the local community, during the project´s life-cycle, from both routine and non-routine circumstances; and • To ensure that the safeguarding of personnel and property is carried out in accordance with legitimate measures, to avoid or minimize risks to the safety of the community.
Performance Standard 5 - Land Acquisition and Involuntary Resettlement: underscores that the involuntary resettlement refers both to physical displacement (relocation or loss of shelter), and to economic displacement (loss of assets or access to assets that lead to loss of	• To avoid or minimize displacement by exploring alternative project designs; • To avoid forced eviction; • To anticipate, avoid and minimize adverse social and economic impacts from land acquisition or restrictions on land;

Performance Standards	Objectives
income sources, or other means of livelihood) as a result of project-related land acquisition.	• To improve or restore the livelihoods and standards of living of displaced persons.
Performance Standard 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources: recognizes that protecting and conserving biodiversity - the variety of life in all its forms, including genetic, species and ecosystem diversity - and its ability to develop, are fundamental to sustainable development.	• To protect and conserve biodiversity; and • To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities
Performance Standard 7 - Indigenous Peoples: recognizes that Indigenous Peoples, as social groups, with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population.	• To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples; • To avoid adverse impacts of the project on communities of Indigenous Peoples, or when avoidance is not possible, to minimize, mitigate, or compensate for such impacts, and provide opportunities for development benefits, in a culturally appropriate manner. • To establish and maintain an ongoing relationship with the Indigenous Peoples affected by the project throughout the project's life-cycle; • To promote the negotiation of good faith with the informed participation of the Indigenous Peoples, when the projects are located in traditional or usual lands used by the Indigenous People; • To respect and preserve the culture, knowledge and practices of the Indigenous Peoples.
Performance Standard 8 - Cultural Heritage: recognizes the importance of cultural heritage for current and future generations.	• To protect cultural heritage from the adverse impacts of project activities, and support its preservation; and • To promote the equitable sharing of benefits from the use of cultural heritage in the commercial activities.

Performance Standards highlight the importance of management of social and environmental issues related to health throughout the lifetime of a project. They identify the need for an effective social and environmental management system which is dynamic and continuous and ''involves communication between the customer, its workers and local communities directly affected by the project. They also require that ''on the basis of business management process elements set as 'planning, doing, checking and acting', the Environmental and Social Management Systems imply a methodological approach for risks and environmental and social impact management in a structured way on an ongoing basis'' (IFC, 2012).

Performance Standards reinforce the importance of community involvement through the dissemination of information related to the project and consultation of local communities on issues that directly affect them. Through the Performance Standards, the IFC requires customers to get involved with the affected communities through the dissemination of information, consultation and informed participation, in proportion to the risks and impacts on affected communities.

Due to the nature of the project location, Performance Standards 7 and 8 do not apply to this project (see Table 3.2). Another Performance Standard which has a limited application due to the fact that this project will not involve any land acquisition or involuntary resettlement is Performance Standard 5. Nevertheless, Environmental and Safety Guidelines of the World Bank Group/IFC (IFC, 2007a) as well as Environmental and Safety Guidelines for Ports and Terminals (IFC, 2007b) have been adopted as a set of minimum standards for the Marginal da Corimba Project and should be used as guidance at phases 1, 3 and 4.

There has been an alignment assessment of the IFC Performance Standards with the Combined ESIS report to allow any alignment error to be taken into account and a summary of its results is included in Table 3.2.

Table 3.2. Applicability of the IFC Performance Standards to the Project.

Performance Standards	Applicability and Initial Assessment
Risks and Environmental and Social Impact Assessment and Management **Performance Standard 1 highlights the importance of the social and environmental performance management throughout the lifetime of a project (any commercial activity subject to assessment and management).**	The Marginal de Corimba Project has carried out an impact identification and assessment on environmental and social aspects (see Chapter 5). For the identified impacts there are proposed mitigation measures and an Environmental and Social Management Plan is presented in Chapter 6. So far, the Project and its partners have been involved with the government leadership at national level, local administrative entities and the potentially affected community. A mapping of the stakeholders has been developed to inform about those future commitments with the potentially affected communities. A complaint mechanism on awareness programs and communication activities has also been developed in order to manage complaints and claims related to the project activities. An integrated Environmental and Social Management System will be developed to take into account the applicable standards of the International Finance Corporation and the Equator Principle. Several HSE documents have been designed which will be implemented by the project proponent and contractors during the construction phases planned in this Combined ESIS.
Working Conditions **Performance Standard recognizes that the pursuit of economic growth through job creation and revenue source should be balanced with the protection of the basic rights of workers.**	All the Proponent's activities in Angola and hired contractors are and will be in accordance with the Angolan Labour Law and no child labour, forced labour and discrimination will be allowed. Workers' rights will be clearly mentioned in their contracts and they will be regularly disseminated through internal activities and procedures. All working conditions at the proponent's office and contractors' construction sites will comply with the same policies and procedures to promote safe and healthy working conditions. For the dredging works, Van Oord has developed a policy on human resources and sub-contracting in line with this Performance Standard.
Resource Efficiency and Pollution Prevention **Performance Standard 3 recognizes that increased economic and industrial activity and urbanization**	Activities suggested to be carried out by the Project have been planned and designed to avoid or minimize adverse impacts in the corresponding activities insofar as possible. Integrated measures will be implemented (by law) as well as mitigation measures as described in Chapter 6. International standards set by the

Performance Standards	Applicability and Initial Assessment
often originate increased air, water and land pollution levels which may threaten people and the environment at local, regional and global level.	international convention and IFC Performance Standards will be adopted throughout the execution of the project activities. This will include the protection of sea water, sea bed and living organisms such as birdlife, fish populations and marine species) as well as programs to reduce emissions of greenhouse gases resulting from emissions of vessels and vehicles used for work. IFC standards regarding sound levels are also adopted by the Project. An integrated Environmental and Social Management Plan will be developed to take into account the applicable EPFI standards. The landfill dredging and consolidation techniques as well as infrastructure construction will comply with the best practices in the industry including those described in the environment, health and safety guidelines for ports and terminals.
Community Health and Safety **Performance Standard 4 recognizes that project activities, equipment and infrastructure often bring benefits to communities including jobs and opportunities for economic development.**	The contractor responsible for dredging and landfill has a Health, Safety and Environment Manual which applies to all his employees and subcontractors and which will be used to reduce and minimize the risks of potential impact on workers and communities living in the project influence area. He also has a document which sets the general purchasing and contracting conditions as well as an Emergency Response Plan (e.g. fires, work accidents, medical evacuation, environmental). Opportunities for economic development should be approved by the areas of Corporate Social Responsibility of the proponent and contractors. There will be great contact with local communities (egg. fishing communities and fishing companies) since impacts on fishing boats anchoring and landing of fish are expected along the coast. The Fishing Port and the new bathing areas will bring important benefits to the population of the Corimba area.
Land Acquisition and Involuntary Resettlement **Performance Standard 5 describes that involuntary resettlement refers**	The Marginal da Corimba Project will have most of its activities at sea and, therefore, neither land acquisition nor involuntary settlement will be needed. Thus, it is not expected that this project will cause any restrictions in terms of using the land where physical

Performance Standards	Applicability and Initial Assessment
both to physical displacement (change or loss of shelter) and economic displacement (loss of assets or access to assets which leads to loss of income sources or means of livelihood) as a result of the project related to land acquisition.	structures are built. However some impacts are expected on activities which will result in loss of access to assets and effects on income sources and livelihood of local communities depending upon fishing and fishing companies. These impacts will affect mainly the activities taking place along the coast, namely vessel anchoring, landing of fish and access to sea in general. All these aspects will be taken into account in the Lifestyle Restoration Plan to be developed by the Project's proponent and contractors as well as the Public Consultation Plan.
Biodiversity Preservation and Sustainability Management of Living Natural Sources **Performance Standard 6 recognizes that protecting and preserving biodiversity- the variety of life in all its forms, including genetic, species diversity, and ecosystem is fundamental for sustainable development.**	The Marginal da Corimba Project has conducted a series of environmental surveys in the study area except for the offshore area where an amount of sand will be dredged to the landfill. Based on such elements and on the analysis of the habitat type in the area it has been classified as a mixture of natural and modified habitat as described in Chapter 6. Either way an Environmental and Social Monitoring Plan has been developed to help protect biodiversity in the Project insertion area (see Chapter 6). The outlined activities have also been planned to minimize impacts on biodiversity sources in the ecosystem services provided by the Mussulo lagoon. Regular awareness programs are included in the Project Environmental and Social Management System to ensure minimal impact on biodiversity and natural resources. These activities are in line with local legislation on biodiversity and best international practices for similar projects. An environmental baseline survey will be conducted in order to determine the biodiversity and sensitivity of the receiving environment at the place where the dredging will take place, 10 miles off the coast. As a result of this survey, the Project's proponent will implement appropriate mitigation measures.
Indigenous Peoples **Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are**	The Marginal da Corimba Project will take place in the Corimba area in the Samba District which is an area where there are no indigenous peoples. There are also no groups of indigenous peoples in the project activities influence areas described in Chapter. Thus, this

Performance Standards	Applicability and Initial Assessment
distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population.	Performance Standard is not considered to be applicable.
Cultural Heritage **Performance Standard 8 recognizes the importance of cultural heritage for current and future generations.**	The Marginal da Corimba Project will take place in the Corimba area in the Samba District which is an area with plenty of anthropic modification and where there is no evidence of tangible cultural heritage as defined in Performance Standard 8. Thus, this Performance Standard is not considered to be applicable.

CHAPTER 4

ENVIRONMENTAL AND SOCIAL BASELINE

4. ENVIRONMENTAL AND SOCIAL BASELINE

Between 2011 and 2012 there have been baseline campaigns of the reference area for the EIS of the Futungo de Belas Master Plan which in the context of this Project includes Phases 1 and 3. For the said EIS an extensive bibliographic research has been carried out in order to obtain preliminary data on environmental and socio-economic issues, with special emphasis on climatology, geology and lithology, soils, physical, chemical and biological oceanography, biotic component in general and local human development as well as environmental. In parallel, field work has been developed so as to verify and improve the information gathered.

In 2015, additional data collection campaigns were conducted to update some information, namely water quality and sediment analysis. However, considering the few changes recorded in the study area, particularly in the coastal area, no changes have been verified that would indicate the need to carry out more specific studies.

Between 2014 and 2015 fieldworks were carried out to obtain data for the EIS of the Marginal da Corimba Project which in the context of this Project includes Phase 4. Furthermore, in the period between February and April 2016 field activities were conducted to obtain further socio-economic information. This chapter also uses environmental-oriented information gathered during the preparation of the Marginal da Corimba Project highlighting the bathymetric information, current and sediment dynamics within the Mussulo Bay and its surroundings.

The study area includes the para-lagoon of Corimba (also described as the sub-basin of Corimba), and the system of Praia do Bispo. It is located in the coastal strip, south of Ilha do Cabo, City of Luanda, and extends along approximately 8.5 km of coastline.

The physiographic complex is comprised by the sub-basin, and Praia do Bispo is in constant evolution. It encompasses an extensive submerged sandy shoreline parallel to the coastline

(South-Southwest-North-Northwest, Guilcher *et al*., 1974). Its existence and variability is due to the action of the swell (South-Southwest), and sedimentary transportation (South-North). The sediment that supplies the sandy shoreline is originated by the great volumes of sand from the Kwanza and Longa Rivers (Abecasis, 1961, 2000; Guilcher *et al*., 1974). The system of Praia do Bispo was originally comprised of sandy shores that formed small basins. This system was modulated by the processes already described.

The Baseline of the area of reference of the project in this chapter included an extensive bibliographic research, with the aim to obtain preliminary data on environmental and socioeconomic issues, particularly climatology, geology, soils, physical, chemical, and biological oceanography; in addition to the overall biotic component, and the local and surrounding human development.

Field work was also undertaken during the development of this Combined ESIS, for the collection of key information on the environment, and the socioeconomy. To be noted that the acquisition of information from interviews with resident members, and workers in the study area was part of the field work, associated with the social component for the ESIS of the construction of Marginal da Corimba Road. The methodological details are described in each aspect of the situation of reference, for the different descriptors that comprise the Baseline of the area from an environmental and social standpoint.

4.1. CLIMATE

For the climate Baseline, a 30-year database published and referenced in numerous documents of the Mussulo Basin, the Complex of Praia do Bispo, and the Luanda region was reviewed, in addition to the bibliography of reference.

According to the Thornthwaite classification the zone under study is located in an arid (E), and semi-arid region (D) of the Angolan coast; being characterized by a megathermal climate (Diniz, 1974). In terms of the climate (Koppen), the zone is set in a region with a dry (steppe), and very warm climate (BSh') (Diniz, 1974). It exhibits high values of relative humidity throughout the year, reaching maximum values in the dry season (*cacimbo*). During the rainy season, precipitation is characterized by a high spatial variability, and may reach mean values of 350 mm (Diniz, 1974). The mean atmospheric temperature is slightly inferior to 25° C, with extreme dryness conditions, and low degree of insolation (Diniz, 1974) (see Figure 4.1).

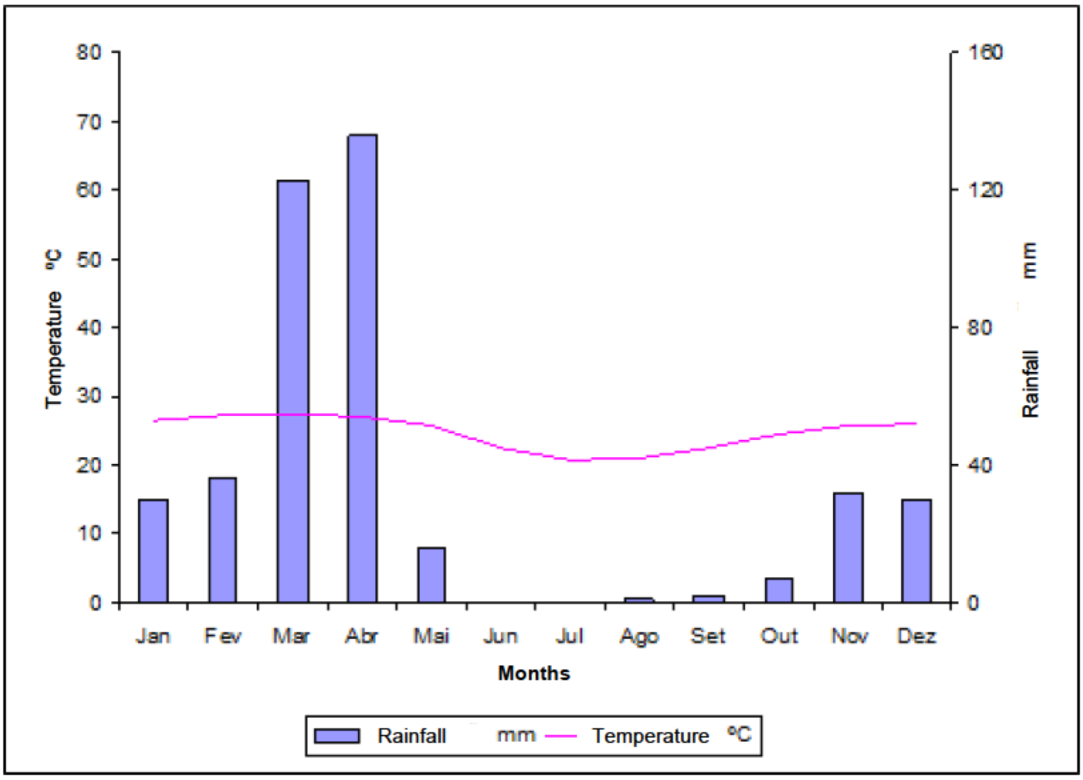


Figure 4.1: Ombrothermic graph of the Luanda region displaying a long period of dryness throughout the year. The graph was developed based on the data referenced in Azevedo, *et al.*, 1972.

The annual mean temperature is approximately 24.8ºC, being February, March, and April the warmer months (average of 27.3ºC), and July and August the coldest months (average of 20.9ºC), as shown in Table 4.1. The lowest mean temperatures vary between 18.1ºC and 24.3ºC, with an annual average of 21.9ºC. The maximum mean temperatures vary between 23.5ºC and 30.6ºC, with an annual average of 27.6ºC.

Table 4.1: Monthly and annual mean temperatures in the Luanda region.

Mean temperatures (°C) (1941-70)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
26.6	27.2	27.4	27.1	25.7	22.6	20.8	20.9	22.5	24.4	25.8	26.0	24.8
Minimum mean temperatures (°C) (1941-70)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
23.6	24.1	24.3	23.9	22.8	19.8	18.1	18.2	19.7	21.8	23.1	23.2	21.9
Maximum mean temperatures (°C) (1941-70)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
29.5	30.3	30.6	30.2	28.6	25.5	23.5	23.6	25.2	27.1	28.5	28.9	27.6

During the rainy season, the precipitation is characterized by a high spatial variability, and can reach average values of 350 mm (Diniz, 1974). The precipitation has an irregular distribution, and steep fluctuations throughout the years, being the higher concentrations in March/April (70% of the annual average), as shown in Table 4.2.

Table 4.2: Monthly and annual mean precipitation in the coastal region of Luanda in millimetres (mm).

Precipitation (mm) (1941-70)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
30	36	123	136	16	0	0	1	2	7	32	30	413

The relative humidity is very high and uniform throughout the year in Luanda, being lower during the months of January and February (77% and 76% respectively), and higher during the months of July and August (83% and 84%) (see Table 4.3).

Table 4.3: Monthly and annual average relative humidity in the Luanda region.

Relative Humidity (%) (1941-70)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
77	76	79	82	81	80	83	84	81	80	79	78	80

The potential evapotranspiration (calculated using the Thornthwaite classification) is 1,362 mm per year, with a maximum gradient of 140 mm between the months of January and April. The Piche evaporation is about 780 mm per year (see Table 4.4).

Table 4.4: Average values of the Piche evaporation and the calculated potential evapotranspiration in millimetres (mm).

Piche Evaporation (mm) (1941-65)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
81	81	78	62	48	57	53	47	52	72	74	75	780
Calculated Potential Evapotranspiration (mm) (Thornthwaite) (1941-70)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
147	135	150	139	125	80	63	65	80	110	130	138	1362

In the annual wind regime, the wind blows predominantly (22.1%) to the Southwest (SW); 21.8% to the West; 14.6% to the Northwest (NW); and 14.4% to the South. The average speed of the most predominant winds ranges between 10 and 20 km per hour, corresponding to 63.5% of the recordings, followed by less frequent winds of 10 km per hour (16.4%), and finally stronger winds of 20 km per hour (12%). The wind regime which is usually soft and constant is occasionally disturbed by rainstorms that are originated by the movement of a squall line from the inland region that crosses the coast towards the sea. These disturbances only occur during the rainy season, between October and May, being more frequent during the months of March and April, with intense opposite winds, from various quadrants, with gusts of wind.

The annual average wind speed, 2 meters above ground, is estimated at 5.7 Km/h, with a predominant direction from Southwest (SW) to Northwest (NE), influenced by the sea breeze. The months of October and November may be considered the windiest (6.4 Km/h), and the months of July and August (4.8 Km/h) less windy (see Table 4.5).

Table 4.5: Average wind speeds in the coast of Luanda.

Average Wind Speed 2 m above ground level (km/h)(1951-65)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
5.7	6.3	6.2	5.6	5.5	5.4	5.0	4.8	5.4	6.6	6.4	5.7	5.7

The annual mean temperature of the soil 0.5 m is 28.8º C, with high mean values of approximately 31ºC between January and April, and lower values of 24.8ºC in August.

4.2. GEOMORPHOLOGY, GEOLOGY, LITHOLOGY, AND SOILS

The geomorphologic, geologic, lithologic, and soil Baseline comprised a bibliographic research, which included the collection of bibliographic data from previous studies, cartographic and geological material. Photographic interpretation was also undertaken, and encompassed the analysis of satellite images, which were interpreted jointly with data from geomorphologic, topographic, and geologic maps, and of soils and risks, produced in previous studies.

Moreover, field surveys were conducted, which have stressed on observations about the relief forms as to the origin, gradient, rock types, potential sediment sources, silting and erosion prone areas.

The combination of identification of lithologic units and features intrinsically associated with sedimentological and geomorphological processes, made it possible to gather the basically necessary information to delimit and define the relief units, also establishing the influence of each unit in the dynamics of geomorphological-sedimentological processes of the study area – its erosive potential as well as a source of sediment and mass movements.

4.2.1. GEOMORPHOLOGY

One of the main geomorphologic characteristics of the Western African coast, particularly the Angolan coast, is the existence of sandy shores, and coastal lagoons (Abecasis, 1961; Abecasis, 2001; Guilcher *et al*., 1974). Its formation and variation over time is due to a combination of tectonic, and eustatic factors, sediment flows, and other modelling actions (Abecasis, 1961; Abecasis, 2001; Guilcher et al., 1974; Seyve *et al*., 2000). These following factors are highlighted:

- Coastal orientation;
- Source of great volumes of sediment (Kwanza River);

- Orientation of the swell;
- Superficial currents;
- Action of the local winds (fetch);
- Sediment drift originated from South-North;

According to various authors (Abecasis, 1961, 2001; Guilcher *et al*., 1974; Seyve *et al*., 2000), the main component of the formation and evolution of the system comprised by the sandbank (Restinga)/Mussulo Lagoon, the sub-basin of Corimba (or para-lagoon), and the sandy shores of Praia do Bispo system, is the predominant characteristics of the swell that reaches the Angolan coast (a swell with a constant Southwestern orientation). The characteristics of the swell (direction, frequency, and significant height) are controlled by the Anticyclone of the South Atlantic (SA). The seasonal variability of the SA, e.g. the southern and longitudinal migrations of the centre position of high pressures, essentially control the frequency and quantity of energy that reaches the coast (the direction is the same) (Abecasis, 1961; Abecasis, 2001; Guilcher *et al*., 1974).

From the characteristics of the swell briefly described, and the favourable orientation of the coast, results the permanent coastal sediment transportation to South-North (Abecasis, 1961; Abecasis, 2001; Guilcher *et al*., 1974). This transportation of sediment results from the great volumes of sediment originated from the Kwanza River (and to a certain extent by the erosion of the coast). This set of conditions promote the genesis of sandbanks (*restingas* - sandy shores), and the subsequent formation of lagoon systems (Abecasis, 1961; Abecasis, 1961; Guilcher *et al*., 1974).

In the specific case of the entire system that extends from Palmeirinhas (the starting point of the sandbank/*restinga* of *Mussulo*) up to the end of the Ilha do Cabo, the existence of a source of important sediment, and the inflection East (90°) of the coastline to the north of the mouth of the Kwanza River, enabled the accumulation of alluvium, and the development of sandy shores along the coast (Guilcher *et al*., 1974; Seyve *et al*., 2000) Figure 4.2).

Figure 4.2: Orientation of the coastline, sandbank (*restinga*) of *Palmeirinhas*, sandy shores of the study area, the yellow square corresponds to the study area (adapted from Holísticos, 2011).

Currently, the natural dynamic of this system lies under a strong anthropogenic pressure, and it is possible to observe the following:

- The transport of sediments from South to North is interrupted intermittently due to maintenance dredging for the navigation channel used by the Catamaran;
- To the fullest extent of the study area, inter-tidal zone (including onshore component of the beaches) is under the strong influence of disorganized human activities;

- The Praia do Bispo system has become a virtually closed system with the construction of embankments connecting this system to Chicala;

On the other hand, in the areas covered by Phases 1 and 3 there are morphological units situated 100 meters above sea level characterized by being a clear plateau with a mixture of tabular shapes and hills dissected by intermittent streams. The same is true for the morphological unit with located between 50 and 100 meters, except in areas contiguous to the Bengo river, which are characterized by having considerable slope in which erosion processes are more intense.

The area related to Phases 1 and 3, within the detached perimeter of the Futungo de Belas comprises two types of morphological unit forms located below 50 meters, including the escarpment cliffs direction Northeast-Southwest (NE-SW), parallel the coast line, whose slope above 10% is considerably accentuated further north, and less steep slopes in the same direction, which allows drainage always towards the bay and sediment formations originated by marine processes (Figure 4.3).

Figure 4.3: Morphological overview at the northern limit of Phase 1.

4.2.2. GEOLOGY AND LITHOLOGY

The study area is located in the Sedimentary Basin of Kwanza, and has a continental and marine origin (Guilcher *et al.*, 1974). The continental coastline is originated in the Pleistocene, and it is characterized by lowlands, essentially composed by quartz deposits, with the existence of some recent alluvial formations (Diniz, 1973) (see Figure 4.4).

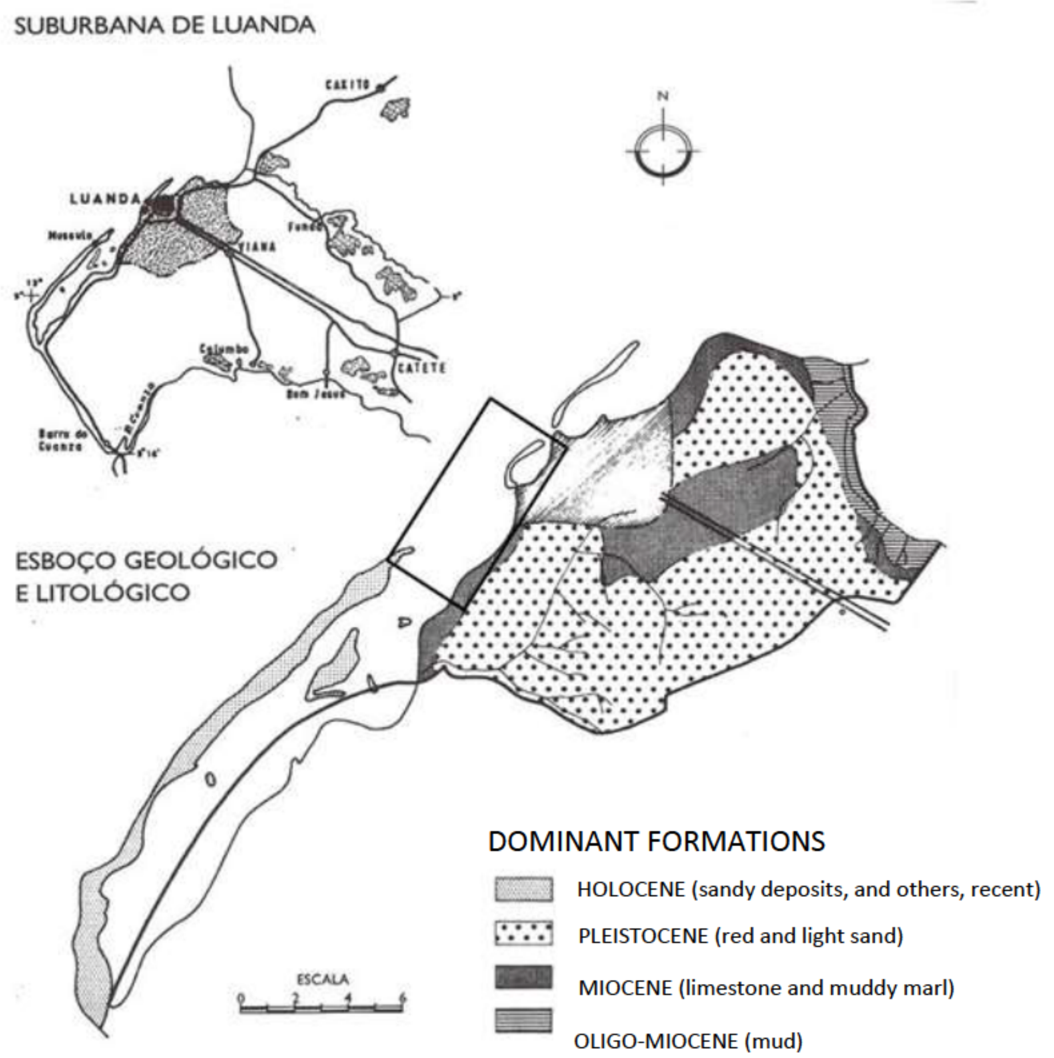


Figure 4.4: Geological and lithological map of the suburban area of Luanda, the black square demarcates the study area (adapted from Diniz, 1974).

The submerged sandy shores of the sub-basin of Corimba, and the shoreline of Praia do Bispo, are recent (Quaternary), being essentially composed by alluvial deposits originated in the Kwanza River (currently with the overlapping of soil borrowed from other parts). These deposits accumulate on the red clayey and sandy terrace/plateau of the Pliocene (Guicher *et al.*, 1974).

It is important to mention that the Mussulo Lagoon zone, and the study area may be originated in two rifts of the continental shelf, with a South-West orientation, and other

South-East (Guilcher *et al*., 1974; Seyve *et al*., 2000). These rifts transform the coast, resulting in its wedged geometry, which is favourable to the accumulation of sediment in the coastal protrusion formed by the clayey terrace (Guilcher *et al*., 1974; Seyve *et al*., 2000). This model is based on the geological composition of the Cazanga Island, and the existence of Fundão Bumba which, according to Guilcher *et al*. (1974) e Seyve *et al*. (2000), is originated in remnants of the continental shelf, in its sinking, and in an ancestral opening of the sandbank (*restinga*).

4.2.3. SOILS

The coastal strip of the sub-basin of Corimba, where Phase 1 fits in, is dominated by xero-lithosols, the coastal strip of Praia do Bispo by *catete* soils, and their sandy shores are comprised of loose sand (they are currently modified, with the prevalence of soil borrowed from other parts of Musseque (see Figure 4.5, Diniz, 1974). The study area in Phases 1 and 3 is characterized in its originality for having psamitic soils (Altunaga, 2008). Meanwhile, in greater detail, a symbiosis of two types of qualifiers for the same, may be seen, i.e. chrome psamitic and psamo-fersialit soils.

4.2.3.1. TYPES OF SOILS

- ✓ *Catete Soils*

Also known as Black Clay, are dominant in the Sedimentary Basin do Kwanza, are originated in the Tertiary, and consist of clay, marl, and limestone from the Oligo-Miocene, and Upper Miocene. They are brown or gray mineral soils (black when humid), with a single texture (the genetic horizons are not distinguished). Their mineral band is thin, and comprised of expansible clay, mainly from the montmorillonite group. They are extremely hard when dried, and display wide and deep cracks. In contrast, they are sticky and malleable when humid (Diniz, 1974).

- *Xero-lithosols*

These soils are little evolved, without genetic horizons, or with a superficial thin horizon. They have brown colour and clayey texture. These soils usually occur in the vicinity of the *catete* soils (Diniz, 1974).

4.2.3.2. COMPOSITION

- *Catete Soils*

They are comprised of limestone material, gypsum crystals, and other concretionary forms of limestone and manganese. They display a very coarse prismatic structure, with a tendency to form blocky or granular aggregates. The prismatic structures display polished sliding surfaces (Diniz, 1974).

- *Xero-lithosols*

They are originated by various lithological materials, from non-consolidated (clay and marl) to consolidated (limestone) materials. If the last two predominate, there is the existence of stony elements, in more or less abundance (Diniz, 1974).

4.2.3.3. DISTRIBUTION

The catete soils are distributed along the coastal strip that corresponds to the system of Praia do Bispo (in the more flat zones). The xero-lithosols are distributed along the coastal strip of the sub-basin of Corimba (Diniz, 1974).

4.2.3.4. IMPORTANCE

- *Catete soils*

These are very productive soils, rich in mineral nutrients (calcium and magnesium). They exhibit physical properties that enable good water absorption. In contrast, they exhibit a deficient degree of aeration. They are usually soils associated with cotton farming, although they may be used for the growing of corn, sorghum, and sunflower (Diniz, 1974).

✓ *Xero-lithosols*

These are poor soils that due to their characteristics are unimportant (Diniz, 1974).

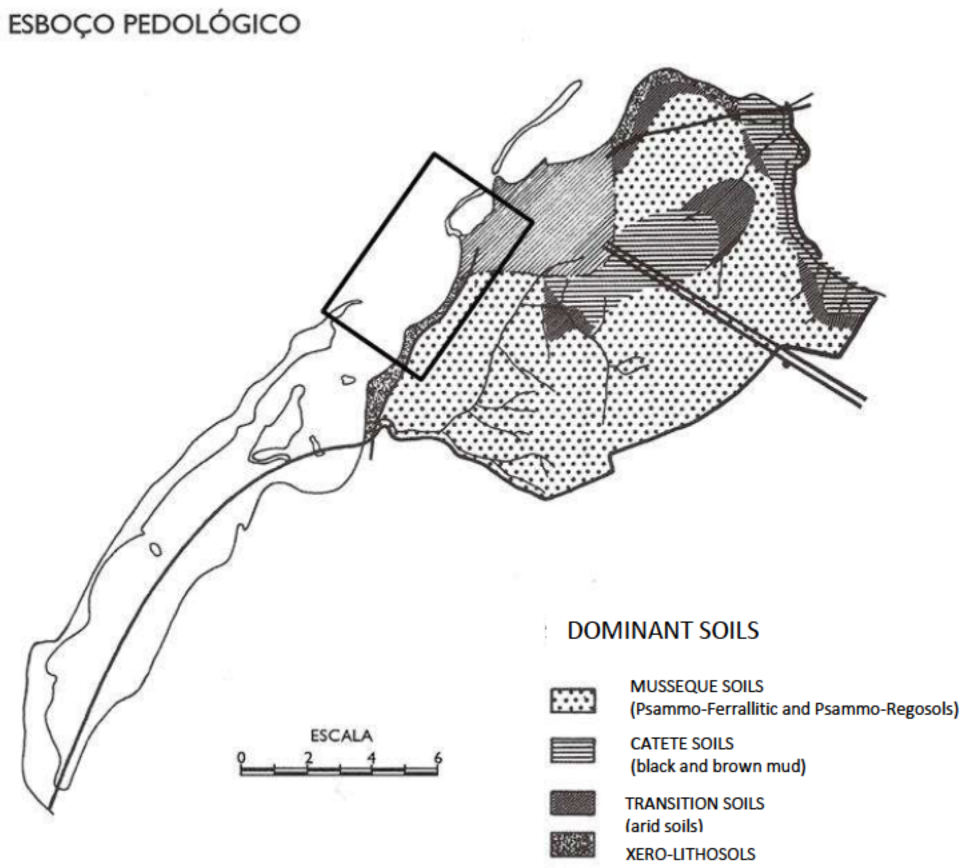


Figure 4.5: Pedological map of the suburban area of Luanda, the black square corresponds to the study area (adapted from Diniz, 1974).

4.3. SEDIMENTOLOGY

According to Carvalho (1964), the coastline is comprised by two groups of superficial sand originated recently (Quaternary): the *Ambriz* sand (a more recent white sand), and the Quelo sand (red colour, it corresponds to the soils of the *musseques*). The Quelo sand is originated in the upper part of the city (Luanda plateau), and due to erosive processes (essentially from the rainwater) is deposited along the coastline (overlapping the Ambriz sand).

According to the stratigraphic profiles obtained by various studies (e.g. Carvalho, 1964; Torquato & Rocha, 1969) located in the Flandrian cliff line/Casa das Palmeirinhas, Morro dos Veados, and Morro da Samba, it is possible to define the horizons of the sandy layers in the following manner (see Figure 4.6 and Figure 4.7):

- Surface (0-1 m) – brown sand with ferruginous tubiform concretions, and with Paleolithic instruments, anthropic accumulation of *Ostrea*, *Arca senilis Lin., Murex* with ceramic fragments.
- 1-5 m – reddish-yellow sand with Paleolithic instruments, sandstone with ferruginous patches, and light concretions and marl.

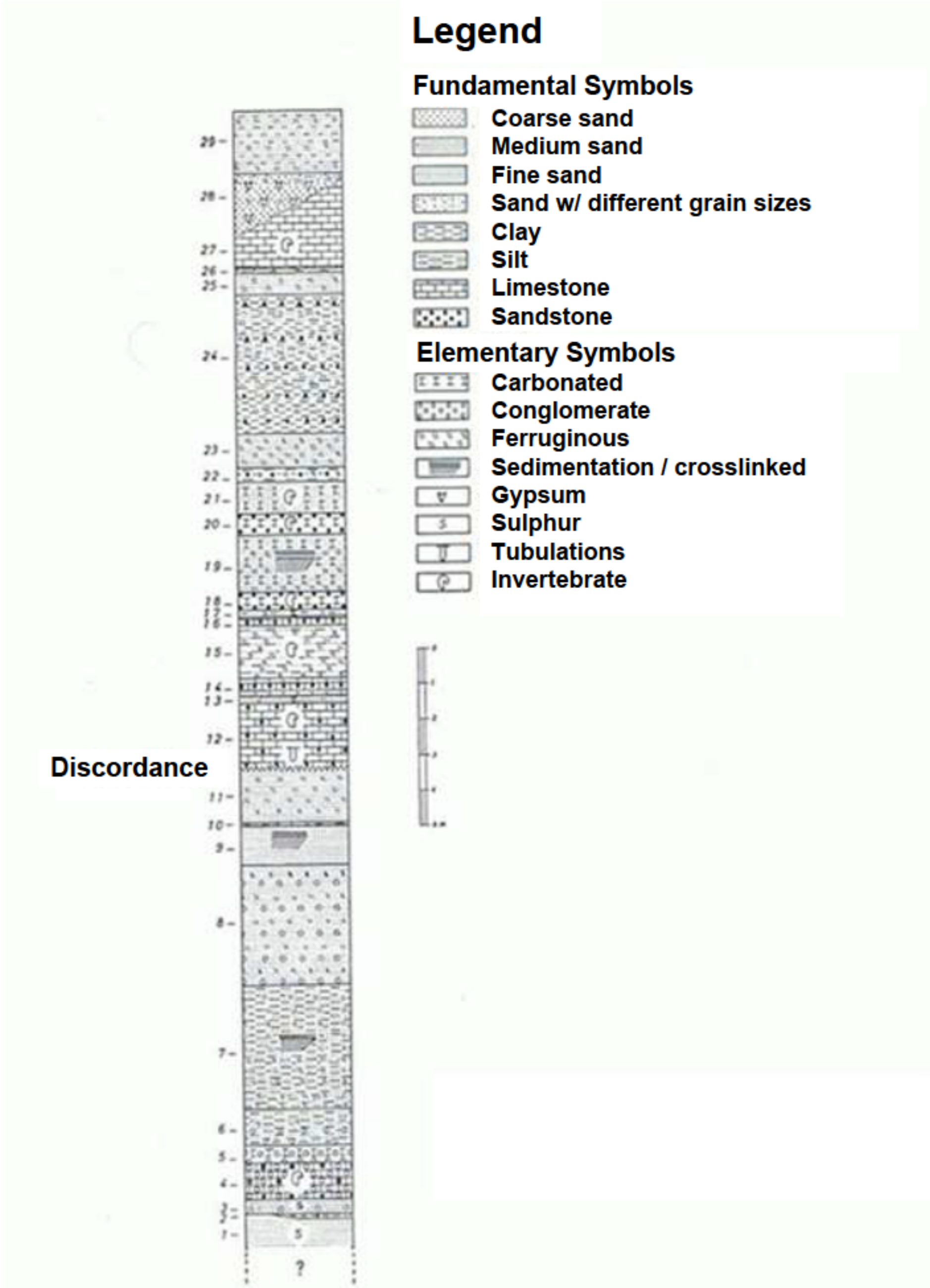


Figure 4.6: Cross-section of the visible layers of Morro da Samba. The region between layers 1 and 11 should be considered as Burdigalian, and the remaining as Plio-Pleistocene (adapted from Torquato & Rocha, 1969).

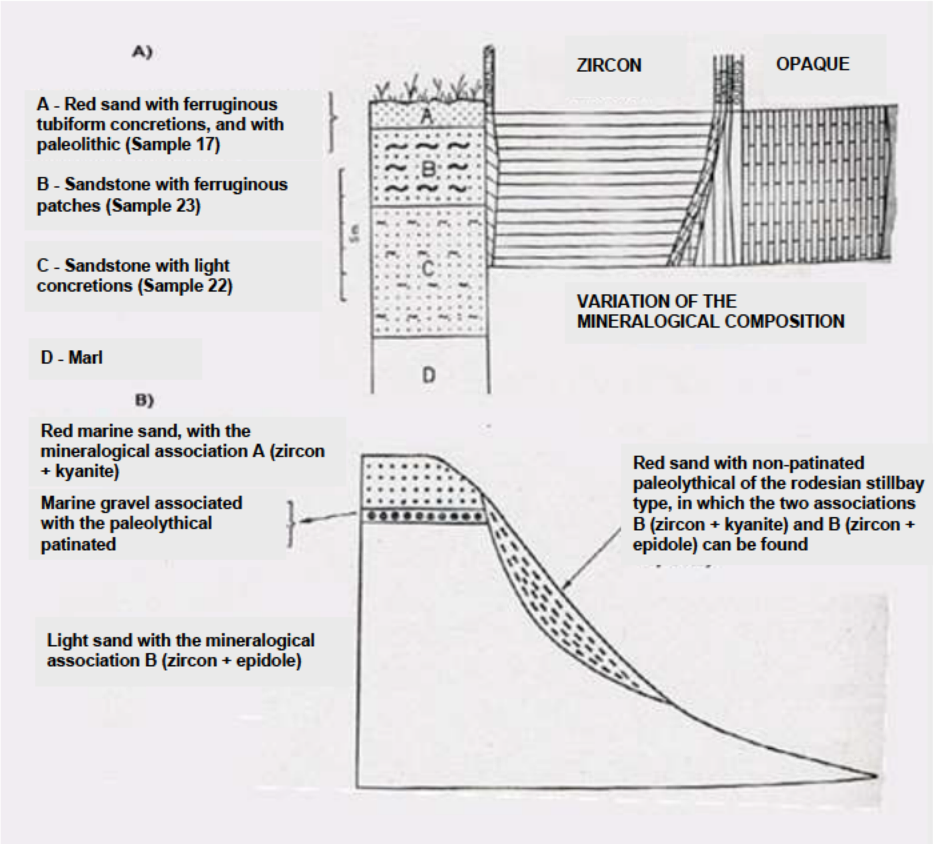


Figure 4.7: a) Cross-section of the Flandrian cliff line South of *Casa das Palmeirinhas,* and b) Diagram displaying the relative position of the detritic units (adapted from Carvalho, 1964).

The sand of the Luanda beaches is comprised of medium/fine sand, well calibrated, of marine origin (overlaying marine gravel), poor in typically aeolian grains, and with a granulometric composition characterized by sand particles (80%), clay (8-15%), and lime (1-5%) (Carvalho, 1964). The quartz section exhibits an accentuated wearing out, and an average rounding between 0.3 and 0.5 (it corresponds to samples 2.03A - 2.21A of Figure 4.8). It exhibits a brilliance that can be explained by the dissolution of the quartz by the seawater subsaturated in silica (Carvalho, 1966).

The submerged sandy shoreline of the Corimba sub-basin, and emerged in the system of Praia do Bispo is essentially comprised of *Quelo* sand, and pluvial sediment (Kwanza River). Inside the system of Praia do Bispo, the most common sediment is characterized by deposits of silt and clay, with dark gray pellets overlaid with organic matter. The darkest colour of this sediment is associated with the existence of the Cyanophyceae algae, typical in anoxic environments.

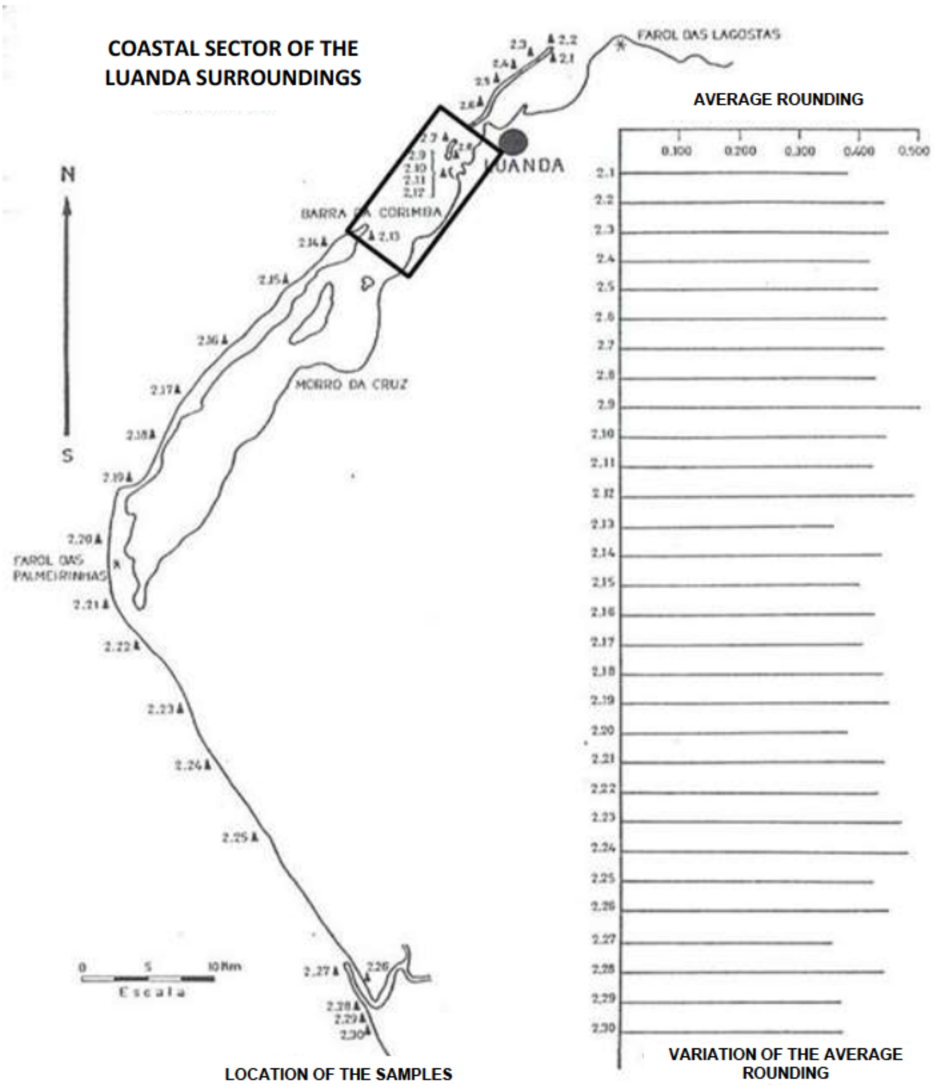


Figure 4.8: Variation of the average rounding of the quartz grains of the samples collected in the coast of the Luanda surroundings, the black square demarcates the study area (adapted from Carvalho, 1966).

4.4. HYDROGRAPHY

Regarding the water resources, no studies were performed on the existence and distribution of groundwater, however the existence of water tables can be considered, due to the geological and lithological characteristics of the region. However, given the proximity of the area to the coastal region, there is a strong probability of saltwater intrusion in the abovementioned aquifers, if any.

As for the surface waters in the area of Phase 4, the absence of a permanent natural course is noted, and the existence of natural drainage lines, however, with the severe anthropic modification, whether due to obstruction, or due to the construction processes, or even due to the bypass of its course. In the traffic area of the Road of Marginal da Corimba nine important drainage ditches are confirmed, as displayed in Figure 4.9.

Figure 4.9: Location of the drainage lines in the study area (image provided by GoogleEarth).

As for the surface waters in the area of Phases 1 and 3, the hydrographic microbasin surrounding the dismembered perimeter of the Futungo de Belas, is presented with a different runoff division resulting from surface waters arising from large rainfalls from Morro Bento (see Figure 4.10).

Figure 4.10: Limits of the hydrographic microbasin surrounding the dismembered perimeter of the Futungo de Belas with drainage to the Mussulo bay. Presence of drainage lines in the study area.

It should be noticed that there is no permanent natural course, but instead, there are natural drainage lines, but having marked anthropic modification, either by obstruction due to construction processes, or by deviation of its course (Figure 4.11), channelling to the Mussulo bay the waste effluents of sewage and rainwater from the surroundings (Figure 4.12).

Figure 4.11: Drainage lines existing in the study area. The first image shows a line obstructed by civil engineering works, and the second one, an effluent drainage ditch coming from Talatona.

Figure 4.12: Spreading of effluents coming from the Talatona area that flow along one of the drainage ditches that cross the perimeter towards the Mussulo bay.

It should be noticed that the region has its Western boundary with the Mussulo bay, whose tides and currents have an influence on the coastal modelling and the local biota.

4.5. PHYSICAL OCEANOGRAPHY

In the context of sedimentary environments, the coastal zone of Luanda is characterized for being a transitional coastal environment where sedimentation processes prevail over those of transport and erosion. This coast lays out as a discontinuous sandbank stretching from Palmeirinhas to the Luanda bay, where its end has recurved due to the tidal currents.

The Baseline of the current conditions of the marine environment of the para-lagoon system located between Corimba (Mussulo pier), and Praia do Bispo (including the inland area) consisted in two (2) distinct phases:

- Data collection:
    - Historical data;
    - Field trip for the *in situ* data collection;
    - Analysis of the sediment transportation model;
- Cross-referencing available information.

The bibliographic review of relevant studies for this Baseline was focused on the physical and chemical parameters of the para-lagoon environment and distribution, and the temporal variability of the temperature, salinity, dissolved oxygen (DO), nutrients, and pollution. In addition, the focus was on the dynamics of the sediment of the study zone, taking into account the wind regime, ripple, tides, and the results of the sediment transportation models. It is important to stress that detailed analyses of water quality have been made in the EIS of the Futungo de Belas Master Plan of 2011, and the data obtained from samples collected for this EIS are only for supporting and emphasizing the previous report and verify possible changes as well as ecosystem development of the study area.

Five (5) types of data were used during the study, namely:

- Surface temperature: dataset compiled by the NCEP Centre, the *optimum interpolated sea surface temperature* (oi-sst), which is available for use, and consultation[18];
- Salinity: provided by NOAA-CIRES *Climate Diagnostic Centre* through the *World Ocean Atlas* 2001[19] (WOA01).
- Primary production (chlorophyll a, chla): obtained through the platform developed by NASA (GIOVANI), to make available real-time data of the MODIS[20] satellite.

[18] **OI-SST** – http://www.emc.ncep.noaa.gov/research/cmb/sst_analysis/

[19] **WOA01** – htpp://www.cdc.noaa.go/

[20] **CHLA** – http://disc.sci.gsfc.nasa.gov/giovanni/

- *In situ* data survey: temperature, salinity, dissolved oxygen (OD), nutrients, and water quality.
- Sediment transportation model.

A field trip was planned and executed to collect *in situ* samples for water quality parameters. This field work also aimed at the collection of sediment samples for the analysis of heavy metals, chemicals, radioactivity, biodiversity; and water for the analysis of coliform bacteria, and hydrocarbons.

Finally, all the available information was compared, cross referenced, and reviewed, taking into account the potential impacts, in a context of changes of the hydrodynamics of the study zone.

4.5.1. METHODOLOGY

For the insertion zones of Phases 1 and 3, there have been samplings in August and September 2011 for the 2011 EIS of the Futungo de Belas Master Plan. In addition, information has been collected *in situ* on the 1st and 2nd of June 2014 for Phase 4. The field work was performed between 7.00 am (peak of the high tide) and 2.00 pm (low tide).

The observation grid between Corimba and Praia do Bispo consisted of 3 (three) sections perpendicular to the coastline (Figure 4.13 to Figure 4.15). These sections extend slightly beyond the submerged sandy shoreline, which is no more than an extension of the Mussulo Island, and may be identified up to Praia do Bispo ((Figure 4.13 to Figure 4.15). Five (5) points in sections A and B were sampled: three (3) inland, one (1) in the sandy shoreline, and one (1) beyond the shoreline. Six (6) points were occupied in Praia do Bispo, to cover zones of major interest, such as the discharge of effluents (e.g. bA and bB).

Figure 4.13: Demarcation of the study zone (yellow square, from *Corimba*/Extremity of Mussulo to Praia do Bispo (image provided by GoogleEarth).

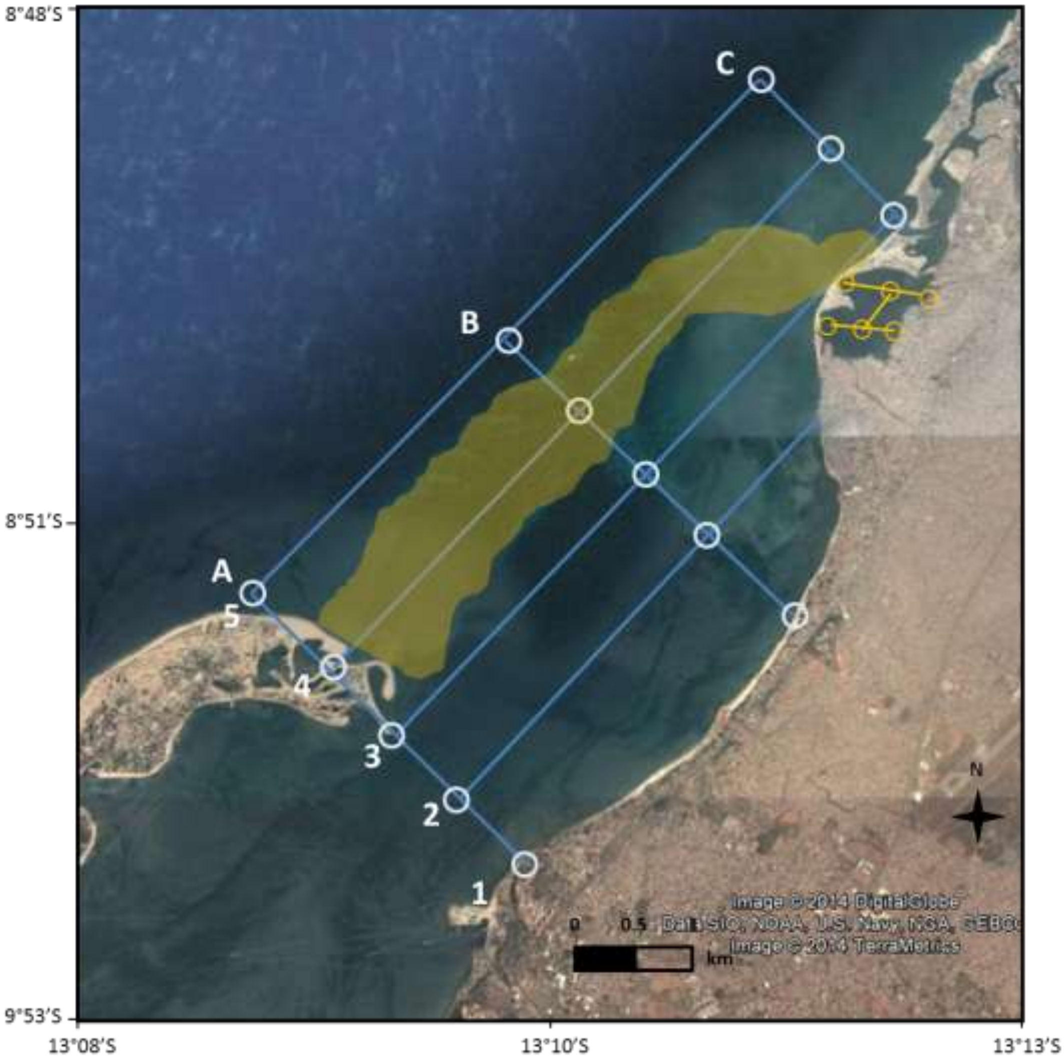


Figure 4.14: Sections (blue and yellow lines), sampling points (white and yellow circles), and identification of the submerged sandy shoreline (yellow shading) along the study zone (image provided by GoogleEarth).

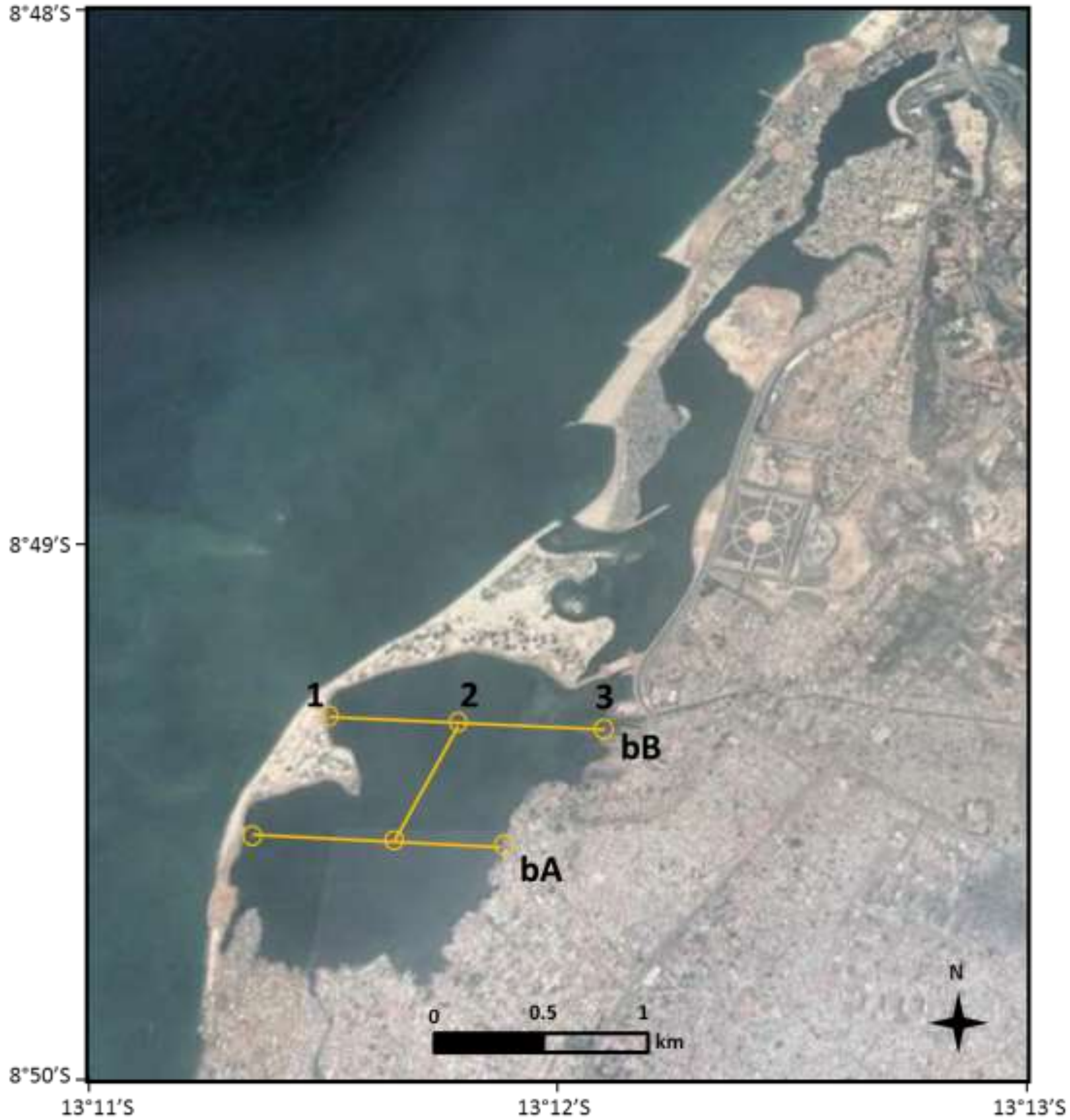


Figure 4.15: Location of the sampling points and sections (yellow lines and circles) in Praia do Bispo (image provided by GoogleEarth).

A speedboat and a GPS made available from the Mussulo pier were used to perform the field work, to determine the position of the stations under study. A 2.5 litre Niskin bottle was used to collect the water, being thrown in the sea as many times as required to assemble the sample quantity (Figure 4.16). The collection of the water samples was undertaken at 50 cm of the surface. The samples were sent to the Ambiafrica Lab in Luanda for the microbiological analysis, and to the CSIR Lab in Cape Town/South Africa for physical & chemical analysis, and heavy metals.

The Horiba multi-sensor, model U50G, was used for the *in situ* reading of the following parameters:

- pH;
- Conductivity (µS.cm-1);
- Turbidity (NTU);
- Dissolved Oxygen (mg.l-1);
- Water Temperature (ºC);
- Salinity (‰);
- Total Dissolved Solids (g.l-1); and
- Depth (m).

All the data collected was recorded in field data sheets, and subsequently scanned.

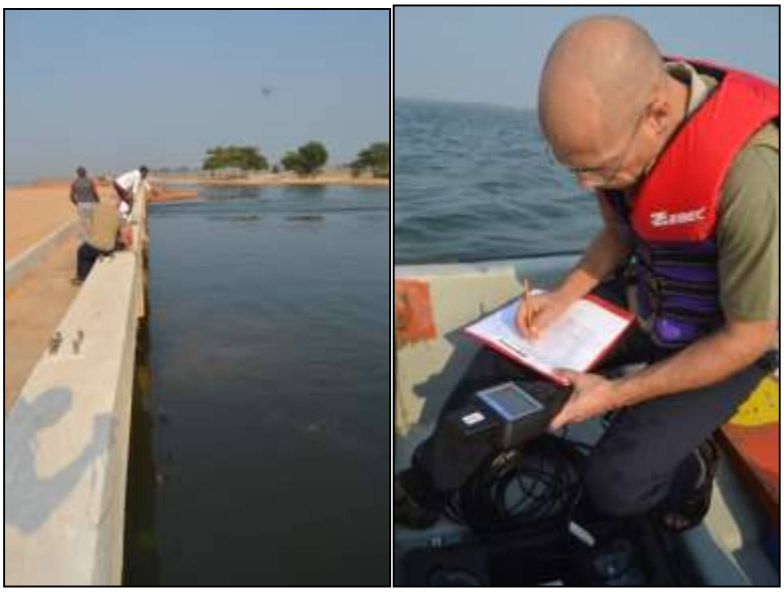


Figure 4.16: *In situ* water analysis.

The sediment was collected with a dredger (Figure 4.17), stored, and subsequently analysed in a laboratory. Biological analysis were undertaken to determine the benthonic community, and the chemical parameters. All the information was compiled in field data sheets, and later scanned for processing with the MATLAB® software.

Figure 4.17: Collection of sediment samples.

4.5.2. SUBSTRATE

The substrate of the study zone is essentially sandy, with the most common sediment characterized by deposits of silt and clay, with dark gray pellets. The existence of mud in the zones closer to the coastline, essentially result from the build-up of materials from the discharge of effluents. In the submerged sandy spit (an extension of the Mussulo Island), the existence of shells (or their fragments) is also quite common. The following subsystems may be identified in the Mussulo Lagoon: mangrove, grasslands, and communities of sandy and sandy-vasoso substrate (Costa *et al.*, 1994; Costa *et al.*, 2002; Santos, 2007).

4.5.2.1. SEDIMENT QUALITY

The sediment quality parameters were considered when doing the review of results. The guidelines detailed in Table 4.6 below were collected from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000), given that Angola does not have a defined standard. The probable effects concentrations define the inferior threshold of concentrations of contaminants that are normally associated with adverse biological effects.

The lab results for the samples collected in specific points of the study area, namely, A1, A3, B3, C3, C4, D2, and D4 are listed in **Table 4.7** (refer to the collection methodology in Section 4.5.1).

Table 4.6: Guidelines for Sediment Quality of ANZECC (2000).

Element	Orientation	Probable Effects Concentrations*
METALS (mg/kg)		
Arsenic	6	33
Cadmium	0.6	10
Chromium	26	110
Copper	16	110

Element	Orientation	Probable Effects Concentrations*
Lead	31	250
Mercury	0.2	2
Nickel	16	75
Zinc	122	820
ORGANIC (μg/kg)		
Acenaphthene	16	500
Anthracene	85	1100
Fluorene	19	540
Naphthalene	160	2100
Phenanthrene	240	1500
Benz(a)anthracene	261	1600
Benzo(a)pyrene	430	1600
Dibenz(h)anthracene	63	260
Chrysene	384	2800
Fluoranthene	600	5100
Pyrene	665	2600

*Probable Effects Concentrations (PEL)

Table 4.7: Results of the sediment quality sampling.

Parameter	Unit	A1	A3	B3	C3	C4	D2	D4
METALS								
Mercury	μg/Kg	14	<10	<10	<10	<10	<10	269
Nickel	mg/Kg	4.1	<0.5	<0.5	<0.5	<0.5	<0.5	11
Arsenic	mg/Kg	2	1	1	<1	<1	<1	9
Cadmium	mg/Kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/Kg	42	1.9	2.6	3.9	4.1	1.5	42
Copper	mg/Kg	9.5	2.1	1.8	3.1	2.0	1.9	28
Lead	mg/Kg	17	6.9	4.5	7.6	6.2	5.2	61
Zinc	mg/Kg	49	6.3	4.4	15	5.0	6.5	139
POLYCYCLIC AROMATIC HYDROCARBONS								
Acenaphthene	μg/Kg	<100	<100	<100	<100	<100	<100	<100
Anthracene	μg/Kg	<100	<100	<100	<100	<100	<100	<100
Benz(a)anthracene	μg/Kg	<100	<100	<100	<100	<100	<100	<100
Benzopyrene	μg/Kg	<100	<100	<100	<100	<100	<100	<100
Benzo[k]fluoranthene	μg/Kg	<100	<100	<100	<100	<100	<100	<100
Benzoperylene	μg/Kg	<100	<100	<100	<100	<100	<100	<100

Parameter	Unit	A1	A3	B3	C3	C4	D2	D4
Chrysene	µg/Kg	<100	<100	<100	<100	<100	<100	<100
Dibenz(h)anthracene	µg/Kg	<100	<100	<100	<100	<100	<100	<100
Fluoranthene	µg/Kg	<100	<100	<100	<100	<100	<100	<100
Fluorene	µg/Kg	<100	<100	<100	<100	<100	<100	<100
Indeno[1,2,3-cd]pyrene	µg/Kg	<100	<100	<100	<100	<100	<100	<100
Naphthalene	µg/Kg	<100	<100	<100	<100	<100	<100	<100
Phenanthrene	µg/Kg	<100	<100	<100	<100	<100	<100	<100
Pyrene	µg/Kg	<100	<100	<100	<100	<100	<100	<100

From the sampling points analysed, D4 and A1 revealed the highest values, given that D4 exhibited five (5) parameters with values above the standard recommended by ANZECC (2000). However all these values are below the concentrations, with harmful effects for the aquatic biota.

4.5.3. BATHYMETRY

The description of this parameter is based on the bathymetric model of Seyve *et al*. (2000) (Figure 4.18), profiles based on the Nautical Chart 1050 (1974) (Sales, 1991; Figure 4.19 and Figure 4.20), and *in situ* observations performed for the numerical model (Figure 4.21).

According to Seyve *et al.* (2000) (Figure 4.18 to Figure 4.21) the existence of the two (2) sub-basins (Corimba and Ramiro) is clearly visible. The study zone is located in the northern zone of the Mussulo Lagoon, and corresponds to the para-lagoon system of Corimba (Figure 4.18 to Figure 4.21). It extends from the mouth of the lagoon as far as Praia do Bispo. The maximum depth of this sub-basin can reach 25 m, being extremely important for the water renewal processes of this lagoon zone.

The existence of a submerged sandy shoreline with depths of up to 3 m in the extremity of Mussulo is visible. This strip extends from the Extremity of Mussulo as far as Praia do Bispo, gradually disappearing until reaching the Ilha do Cabo (Island of Luanda). The submerged strip plays a key role in the hydrodynamics, and sediment transportation of the study zone.

It works as an energy dissipator of the local ripple (particularly during the Southern Hemisphere Winter), and the sediment reservoir that supply the Bispo/Chicala systems, and the Ilha do Cabo to the North (during the Southern Hemisphere Summer). Currently, the strip is interrupted by a navigation channel known as Catamaran Figure 4.21).

The upper panel of Figure 4.18 corresponds to the study zone (black rectangle), and the black circle in the lower panel indicate the position of the submerged sandy shoreline. The colours correspond to the depth scale in meters.

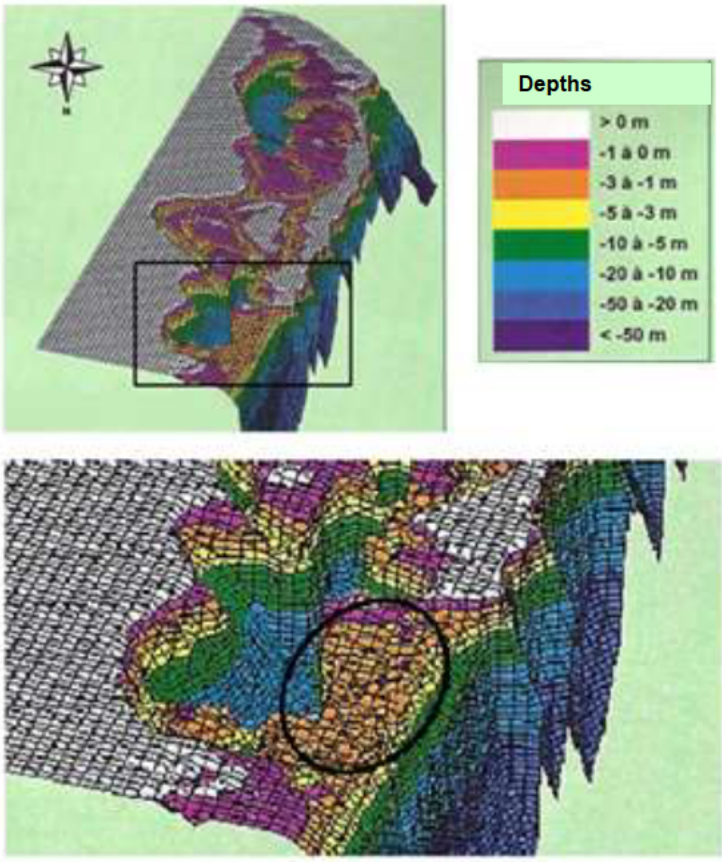


Figure 4.18: The upper panel corresponds to the Bathymetric Model of the Mussulo Lagoon (adapted from Seyve *et al*, 2000).

Figure 4.19: Location of the sections included in the study undertaken by Sales (1991), the black square corresponds to the study zone (sub-basin of *Corimba*; inside Praia do Bispo is not visible).

In this report only the PMC e TB profiles were taken into account (based on the bathymetries published in the Nautical Chart 1050 (1974) of the Hydrographic Mission of Angola, and São Tomé, 1971-1972).

The profiles of Figure 4.20 are based on the bathymetries published in the Nautical Chart 1050 (1974) of the Hydrographic Mission of Angola, and São Tomé, 1971-1972.

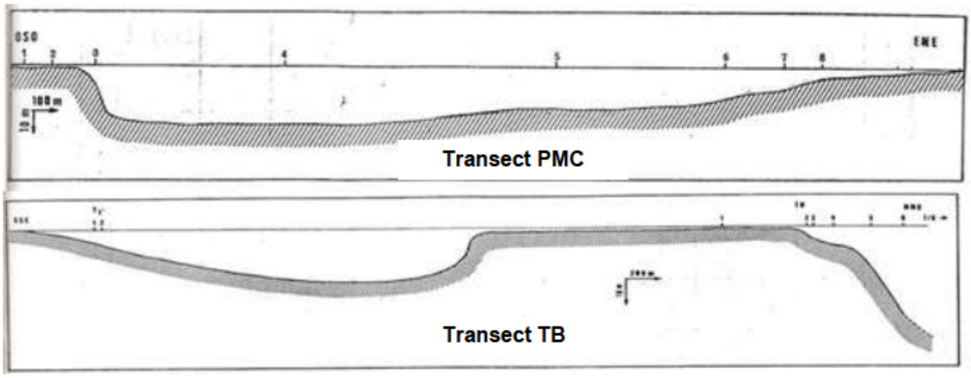


Figure 4.20: Depth profiles in two sections of the sub-basin of Corimba (see Figure 5; Sales, 1991).

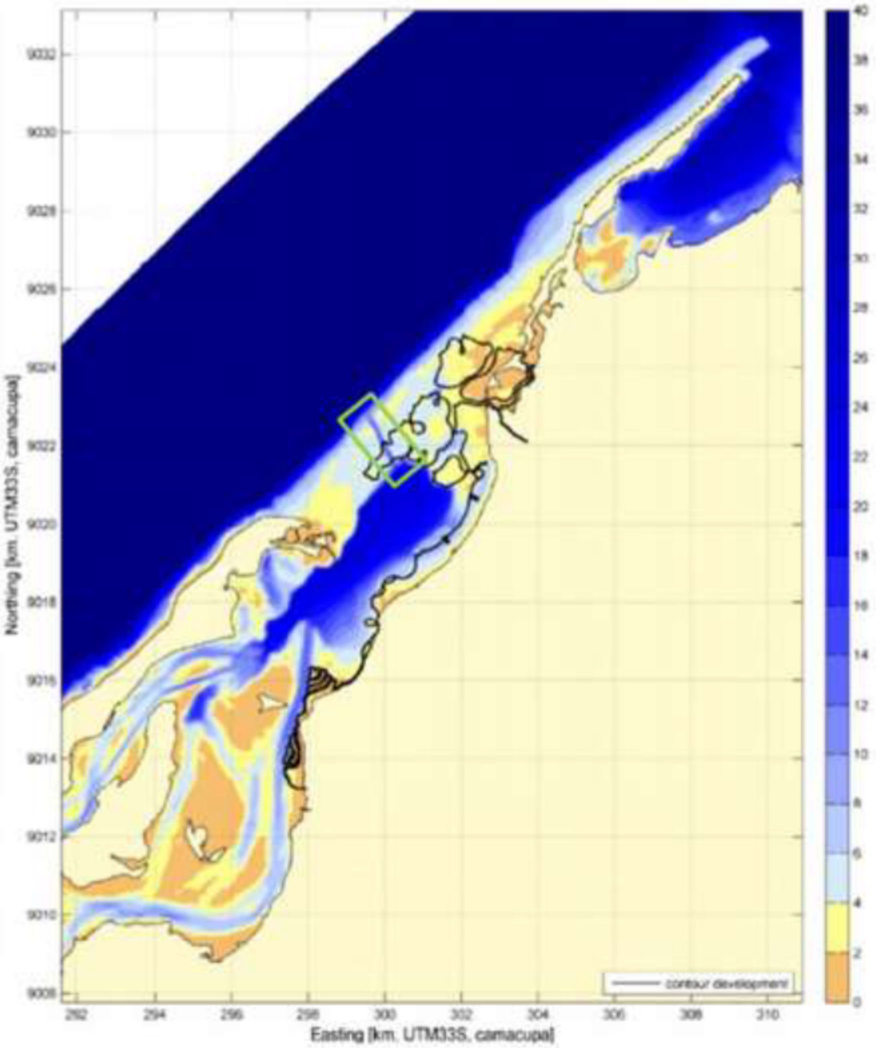


Figure 4.21: Current bathymetry of the study zone: the colour scale corresponds to the variations of the bathymetry, black lines correspond to the areas that are expected to be reclaimed from the sea (the Marginal road, and the artificial islands in a subsequent phase), the green square demarcates the navigation channel zone (adapted from Deltare, 2014).

4.5.4. TIDES, SWELLS AND WAVES

The Angolan coast has semi-diurnal tides, i.e. tides with a 12.42 hour-periodicity (half lunar day), This tidal regime is characterized by two (2) high tides, and two (2) low tides in each tidal cycle (in each Lunar day, 24 hours and 50 minutes). The average amplitude is 1.2 m above the hydrographic zero (Bird & Schartz, 1985).

The hydrographic zero used in this Baseline is located in the Port of Luanda. It is located 1.10 m below the sea level, and 3.0 m below the level mark installed near the tide gauge (in the South corner of the pier of the Naval Facilities). According to the tidal forecasts provided by the Hydrographic Institute (IH) – Portuguese Navy, the amplitude of the tide varies between 0.3 and 2.0 m (corrected values) respectively, for high and low tides. It is necessary to take into account that the harmonic analysis performed by the IH is undertaken with tide gauge records/observations from 1973, being necessary to apply a rectification of + 0.1m to the estimated values (see Tide Table/Forecast for the Port of Luanda during the 3rd quarter of 2014, **Figure 4.22**).

According to previous studies characterizing the offshore ripple (Fonseca, 1971; CSIR, 2001; Queiroz 2013), the study area is characterized by ripples predominantly from the South-Southwest with significant heights between 1.0 and 2.0 m, reaching up to 3.0m during the

Southern Hemisphere Winter (particularly when rip tides occur) (Figure 4.23,

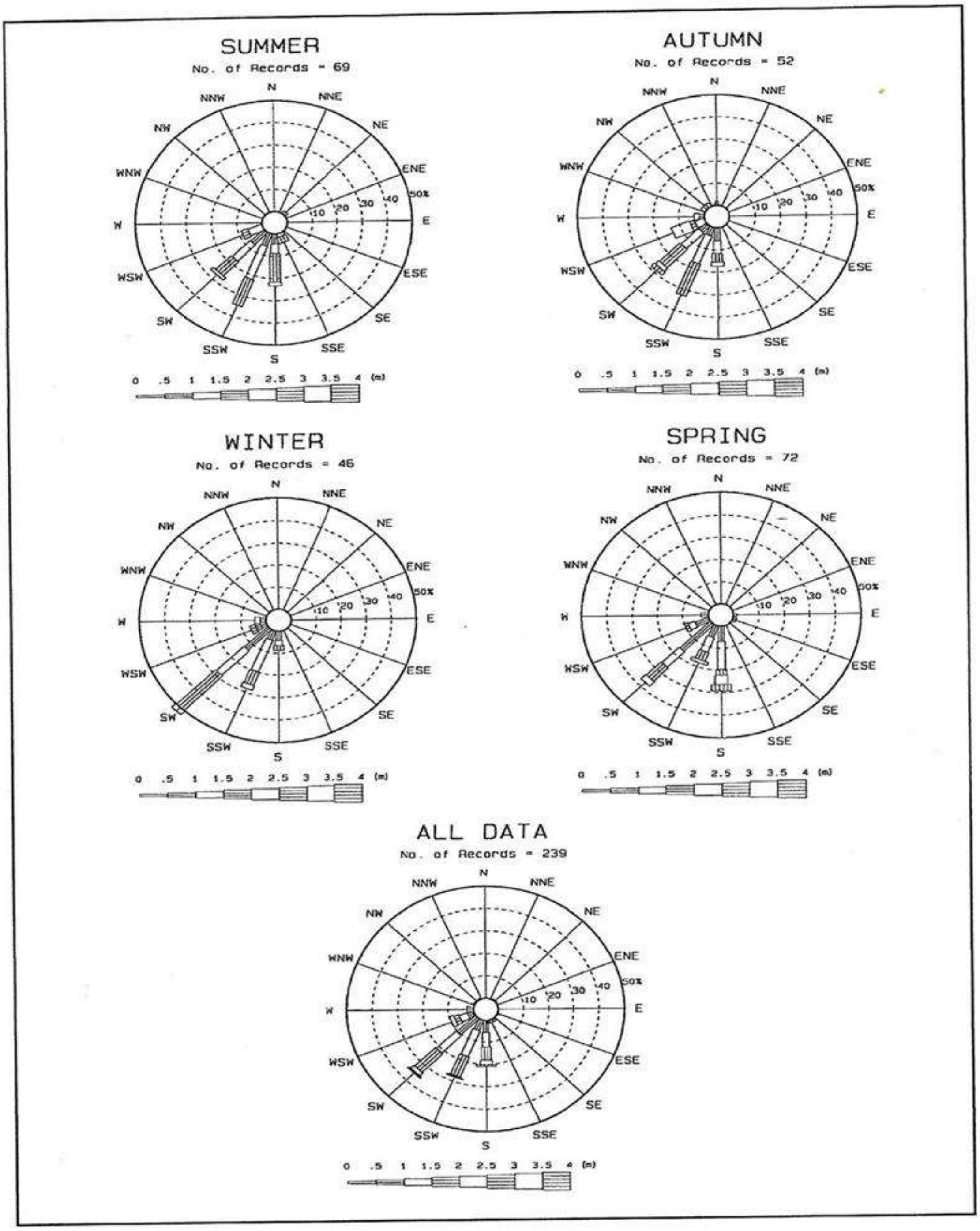


Figure 4.24, and Figure 4.25). The ripple and swells are intimately connected to the seasonal variations of the South Atlantic Anticyclone (Fonseca, 1971). In the event of strong rip tides, these can be originated in northern incursions (South-North) of cyclones of the polar front (Antarctic region) and/or events in which the South Atlantic Anticyclone is more intense

(higher than 1030mb), and shifts above the Tristão da Cunha Island forming a wave train that reaches the Angolan coast within a 48-72 hour period (Fonseca, 1971).

As previously mentioned, the predominant ripple in the Angolan coast comes from the Southwest. It has a prominent role in the genesis, and dynamic of the coastal strips that exist in the study area (Mussulo Island and the Praia do Bispo/Chicala system). The combination of the ripple and the wind (also predominantly with basically the same direction), results in the sediment transportation in the South-North direction along the Angolan coast. In turn, the sediment transportation is supplied by the rivers that flow into the sea along the coast, and the coastal wind erosion. This dynamic originates all the lagoons/barrier islands that exist along the Angolan coast (Fonseca, 1971; Abecassis, 2001).

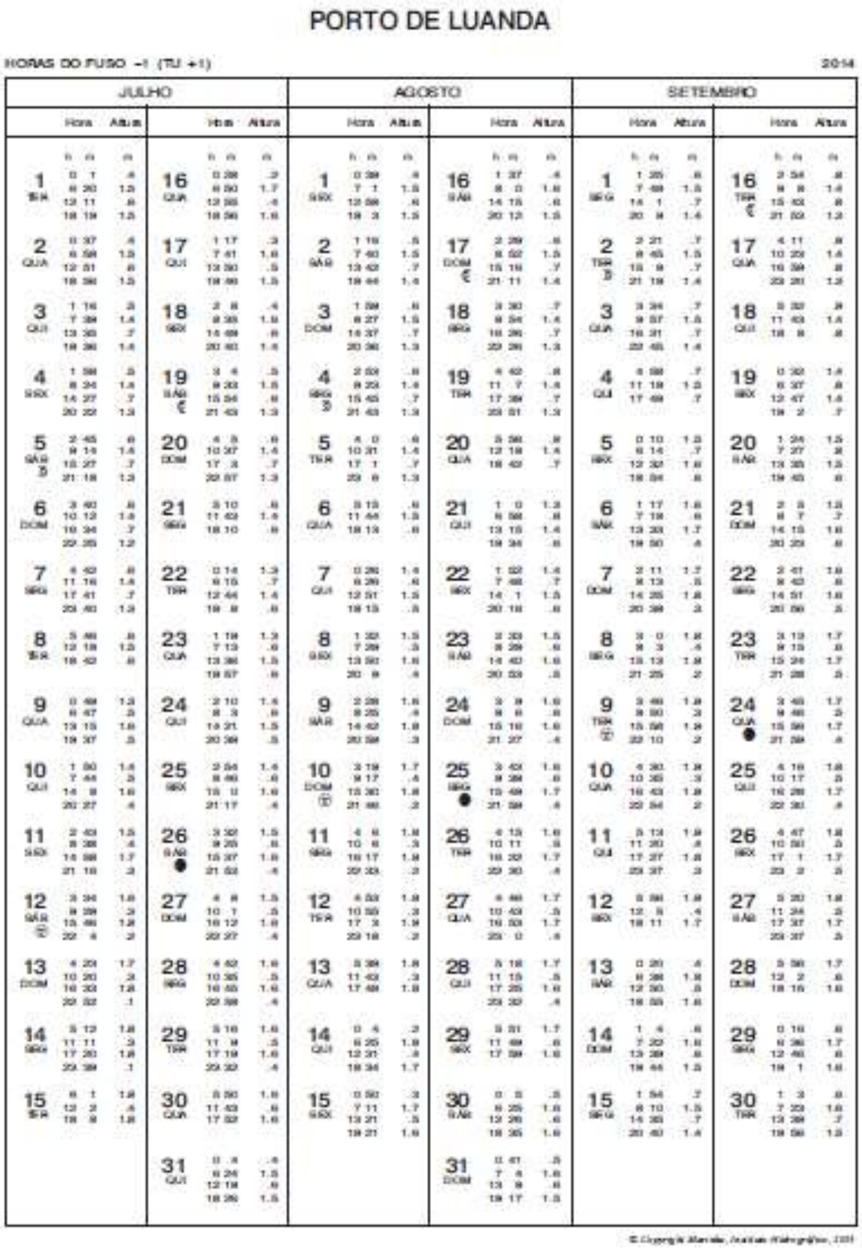


Figure 4.22: Tide Table/Forecast for the Port of Luanda in the 3rd Quarter of 2014 (Source: Hydrographic Institute - Portuguese Navy).

The field work was performed on the 1st and 2nd of July, between 7:00 AM and 2:00 PM. The collection of samples and data *in situ* was performed during the peak of the high tide, and during the low tide period.

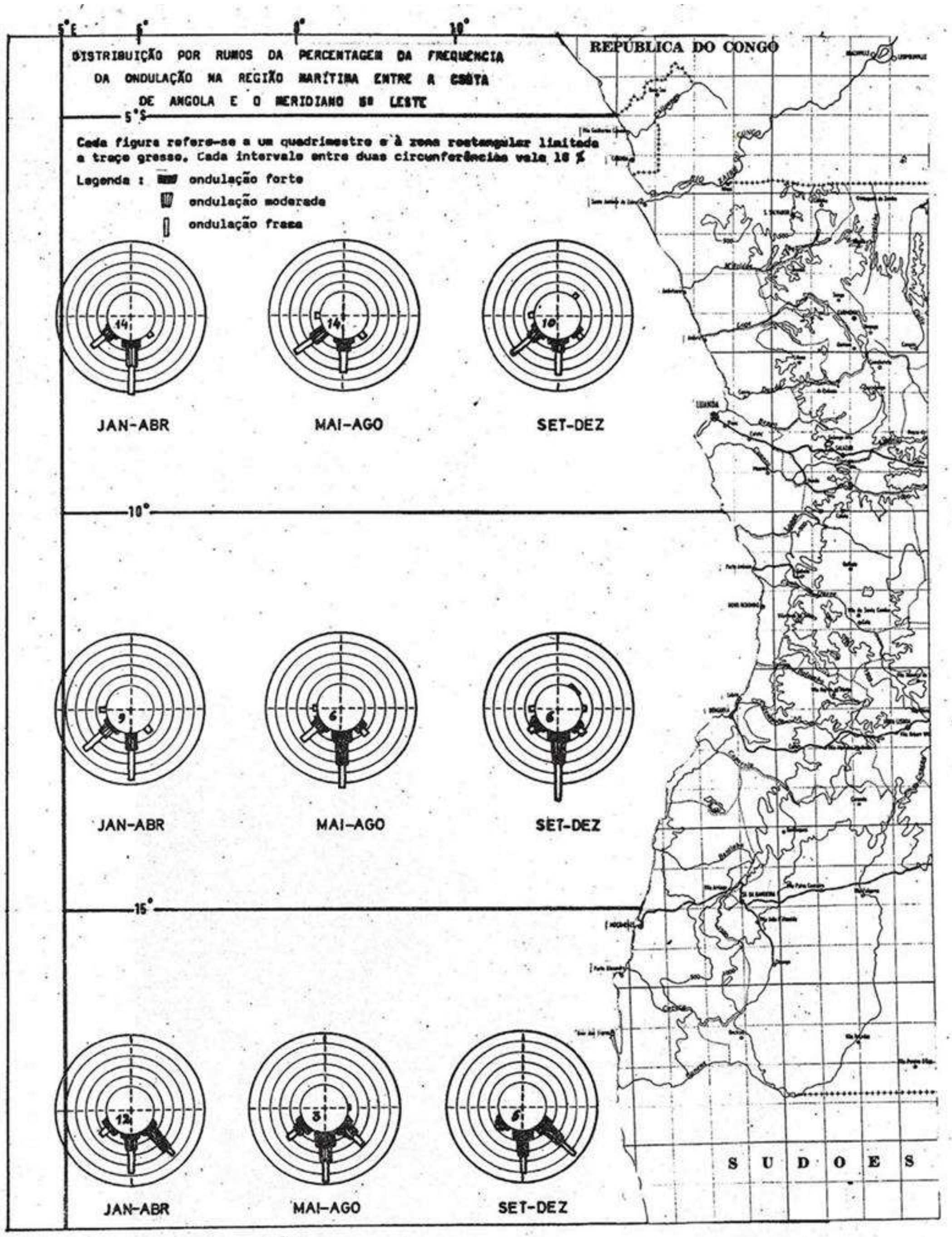


Figure 4.23: Seasonal climatology of the ripple along the Angolan coast based on the U.S. Navy Marine Climatic Atlas Navaer Vol. IV South Atlantic Ocean (adapted from Fonseca, 1971).

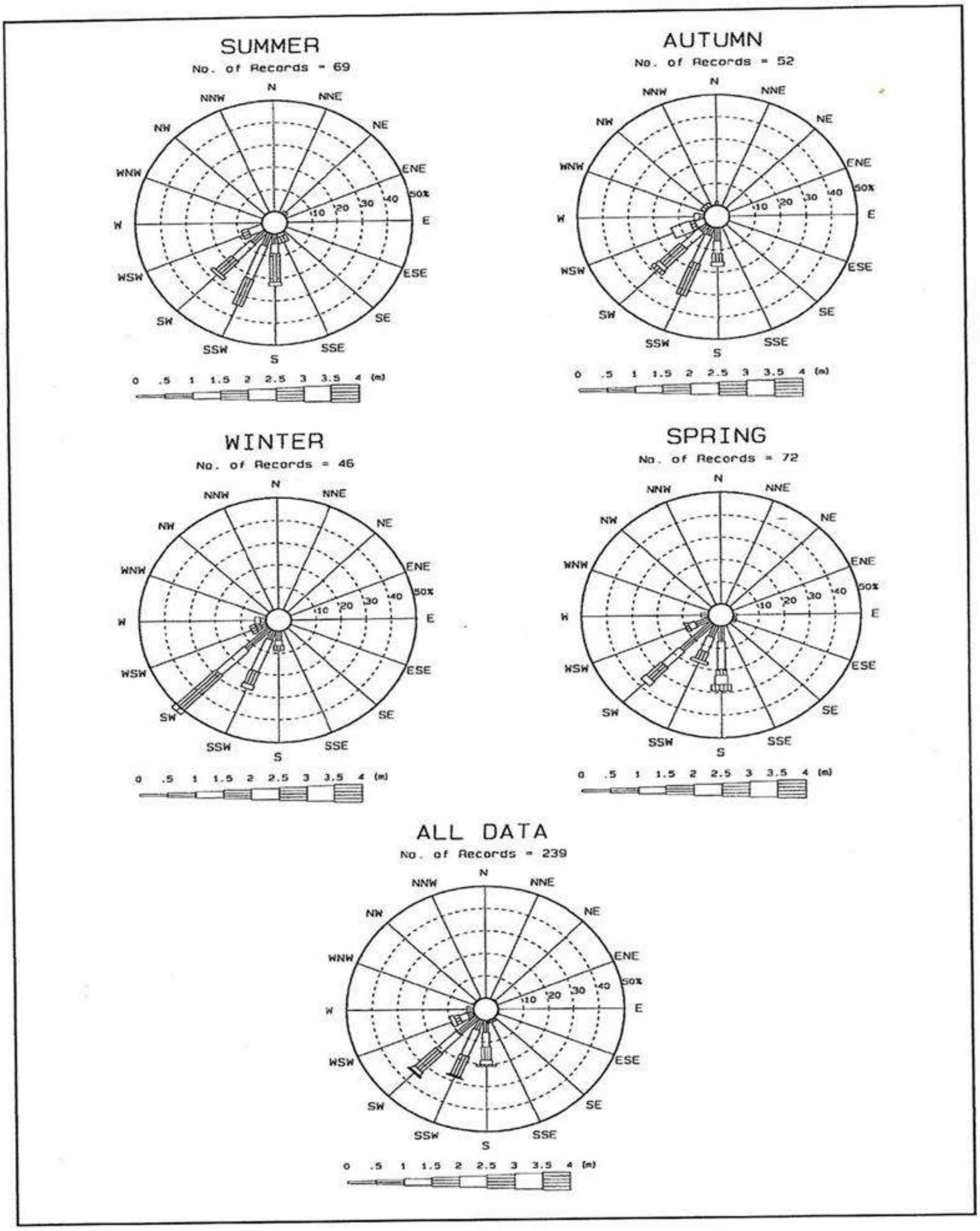
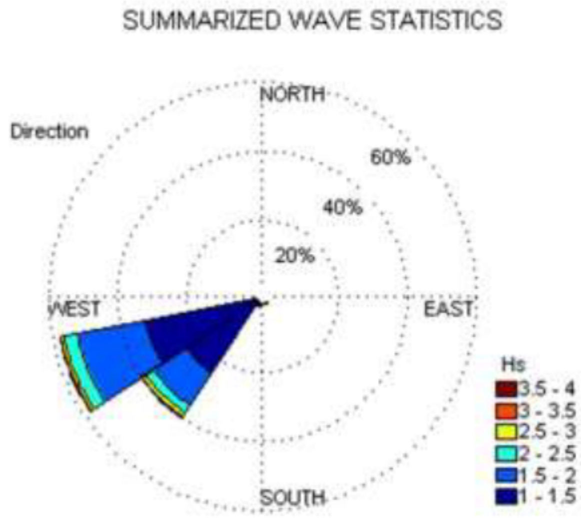


Figure 4.24: Seasonal climatology of the ripple between 11°-12°S and 13°-14°E (study region), data from the Vessels of Opportunity (VOS) program, South African Data Centre for Oceanography (adapted from CSIR, 2001).



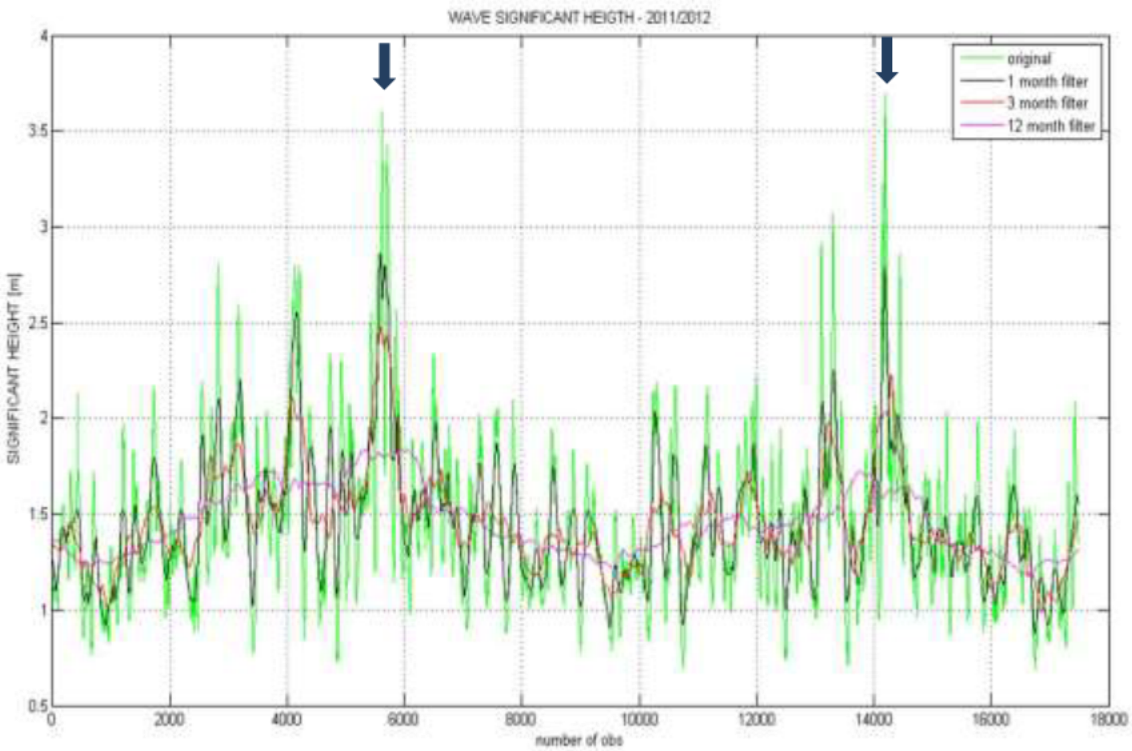


Figure 4.25: The upper panel corresponds to the climatology of the predominant ripple in the study zone.

The panel of Figure 4.25 corresponds to the significant height of the ripple, and the circles correspond to the percentage of its frequency in relation to its direction and significant height. The lower panel corresponds to the time series of the significant height of the ripple, between January of 2011, and December of 2012 (green line), black arrows correspond to the ripple peaks during the Southern Hemisphere Winter (from June). Data from WW3 (NOAA) for the years of 2011 and 2013 was used (adapted from Queiroz, 2013).

4.5.5. OCEAN CURRENTS

The study area is influenced by one main current; the Angola Current (AC, warm current). According to Shannon *et al.* (1987) the AC is an extension of the Guinea Current (GC) (Figure 4.26). The characteristics of the AC reflect its equatorial origins, i.e. warm and saline waters, with low oxygen content. It is a permanent current (flowing southwards) sighted along the continental slope of Angola, reaching up to 200m of depth. These authors describe the current as weak during the Southern Hemisphere Winter/Spring, being more intense at the end of the Southern Hemisphere Summer. This seasonal variability of the AC is directly related to the equatorial processes, more specifically with the biannual variation of the intensity of the trade winds, and consequent geostrophic adjustment to the system of equatorial currents. According to Mohrholz *et al*. (2001), and direct observations, the AC can reach speeds up to $40 cms^{-1}$.

Due to the location and nature of the project to be developed in the study area, it is necessary to take into account the interaction between the various components of the sediment transportation (cross-shore and longshore), the tidal currents (that follow the tidal fluctuations) and the ripple regime. The last two control the system of near-shore currents, and the sediment transportation in a more evident manner, even if in different time scales. However, the sediment transportation may cause significant changes in the bathymetry (e.g. submerged sandy shores that are formed due to the cross-shore transportation that is characteristic in the winter), and thus control the currents and ripple.

In the Angolan coast, the final balance of these components results in the semi-permanent transportation of the sediment in the South-North direction (during the Southern Hemisphere Winter the cross-shore component gains importance when compared with the longshore, and the South-North transportation is less effective). In the study area, the near-shore dynamic is high and complex, the important role of each one of the components mentioned in controlling the currents, and the resulting sediment transportation (Fonseca, 1971; Abecassis, 2001; Queiroz, 2013).

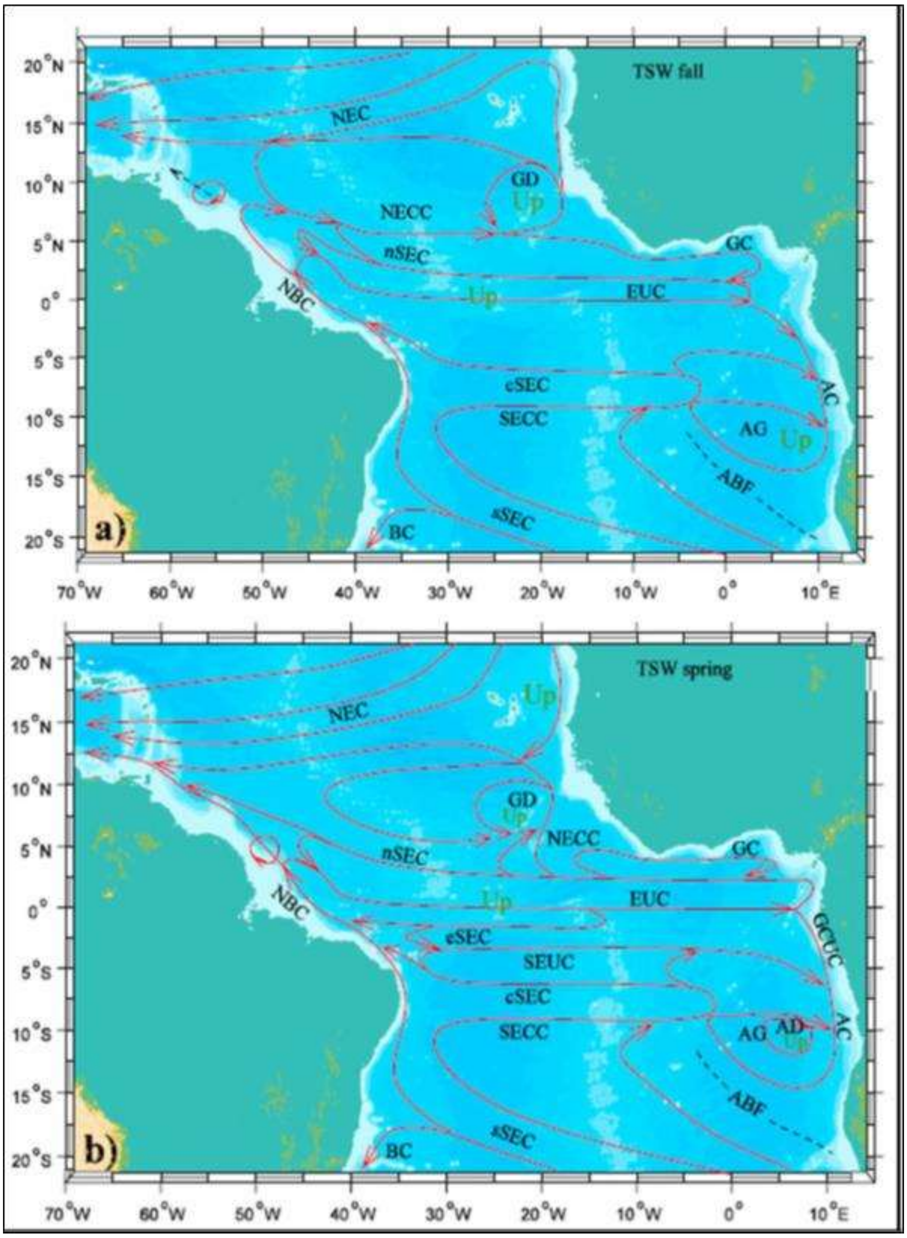


Figure 4.26: Schematic representation of the horizontal distribution of the main tropical currents between 0 and 100m of depth. a) Southern Hemisphere Autumn e b) Southern Hemisphere Spring.

Figure 4.26 displays the North Equatorial Current (NEC), Guinea Dome (GD), North Equatorial Countercurrent (NECC), Guinea Current (GC), South Equatorial Current with its Northern (nSEC), Equatorial (eSEC) and Central (cSEC) branches, Equatorial Under-Current (EUC), North Brazil Current (NBC), Gabon-Congo Under-Current (GCUC), Angola Gyre (AG), Angola Dome (AD), South Equatorial Under-Current (SEUC), the South Equatorial Countercurrent (SECC), and the Brazil Current (BC). ABF is represented by the dashed line; “Up” represents the potential coastal upwelling zones (Stramma et al., 2003).

According to the results of the numerical model HIDROMOD applied to the Mussulo Lagoon and the Luanda Bay (Consulmar, 1996), the circulation in the sub-basin of Corimba (study area) is more intense along the submerged sandy shoreline (1 m/s regardless of the stage of the tides) (Figure 4.27). In addition to significant speeds, the constant changes of direction of the tidal current suggest that this zone is characterized by strong dynamics. These results highlight the importance of this shoreline (including the sub-basin of *Corimba*) in the hydrodynamics, and sediment transportation of the study zone.

Currently, the system of Praia do Bispo underwent changes of great magnitude. Previously, the zone from Praia do Bispo to Chicala was exposed to near-shore coastal processes (ripple and tides). Nowadays, this zone is closed, forming a land-locked basin protected from coastal processes. The only connection to outside areas is located North of Chicala, and its renewal and circulation occurs exclusively due to the action of the tides. It is important to note that the results of the HIDROMOD model are not applied to this zone.

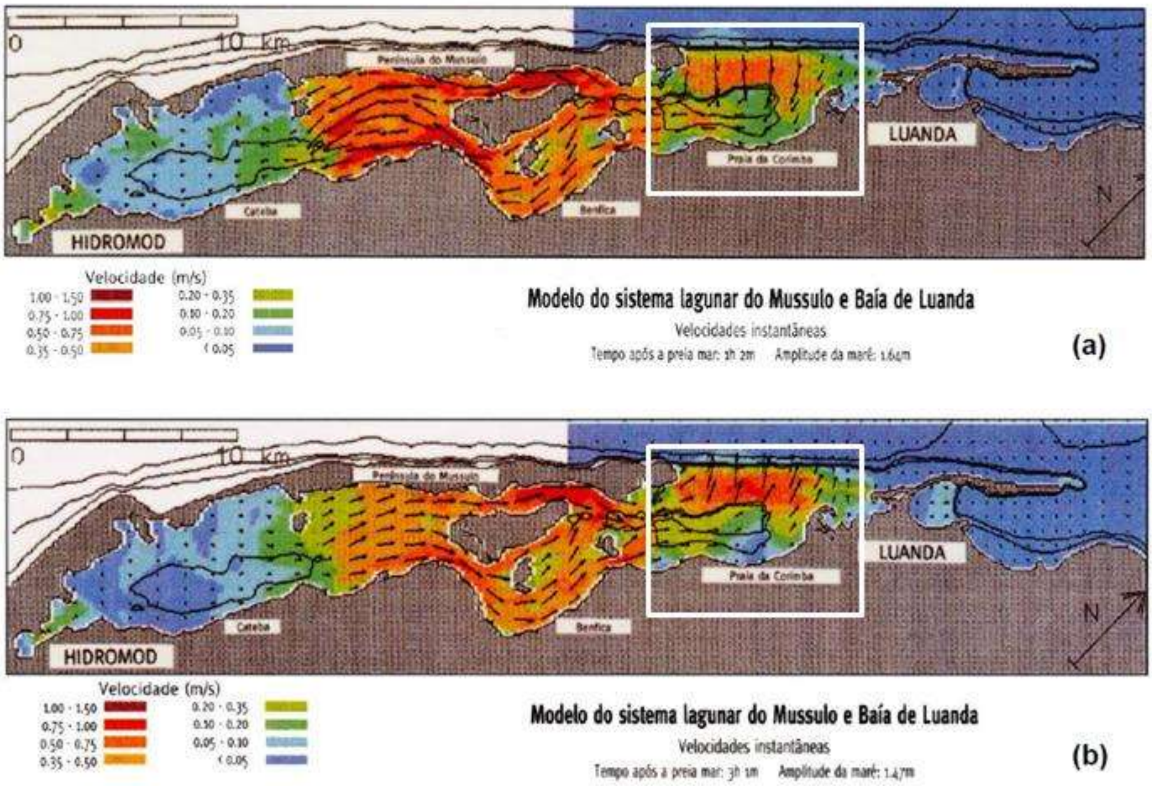


Figure 4.27: Results of the HIDROMOD numerical model for the Lagoon System of Mussulo and Luanda Bay, circulation speed (*m/s*) during a) high tide, and b) low tide. The white square demarcates the study area (adapted from Consulmar, 1996).

4.5.6. WATER TEMPERATURE

The coastal sea surface temperature of the study area varies between 21°C during the Southern Hemisphere Winter, and almost 28°C in the summer (Bennekom & Berger, 1984). Figure 4.28, Figure 4.29, and Figure 4.30 shows the climatology of the surface temperature along the African Coast, between the Equator and 30°S respectively (Queiroz, 2011), the interanual variations for the same region, and the times series used for the study zone. It is also possible to clearly observe the regular annual cycle of the temperature, its response to the insolation cycle (particularly during the Southern Hemisphere Summer), and during the winter, the cooling of the surface waters, direct consequence of the equatorial upwelling. It is also possible to observe interanual variations such as the Benguela Niños (Figure 4.29; e.g. 1984, 1995 e 2011). In the time series of the surface temperature collected in the study area it is also possible to distinguish the annual cycle, as well as the abovementioned inter annual variations (Figure 4.30).

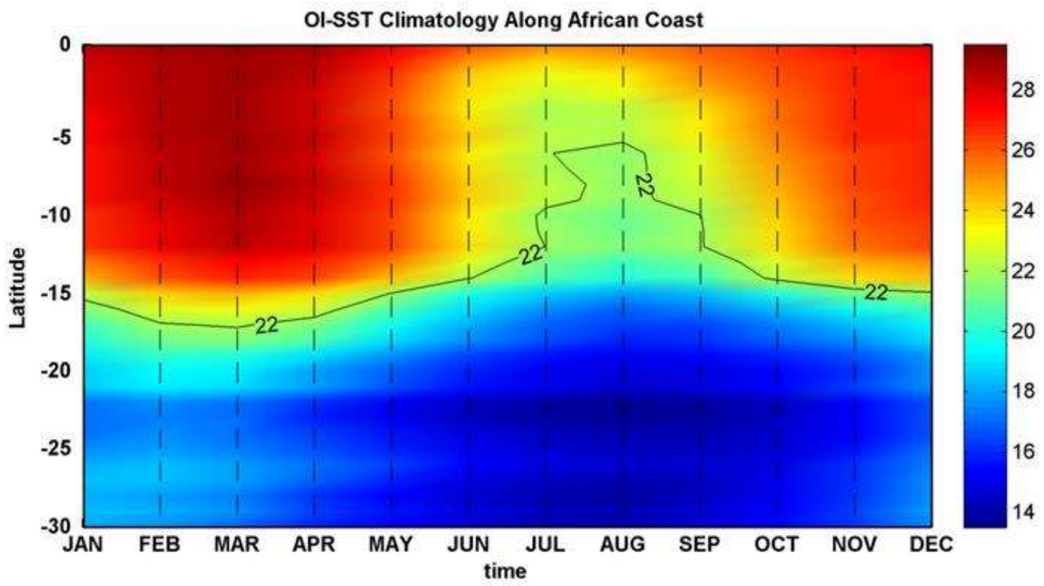


Figure 4.28: Climatology of the sea surface temperature (1982-2011) along the African Coast (Equator-30°S), derived from dataset Optimum Interpolated – Sea Surface Temperature (Queiroz, 2011).

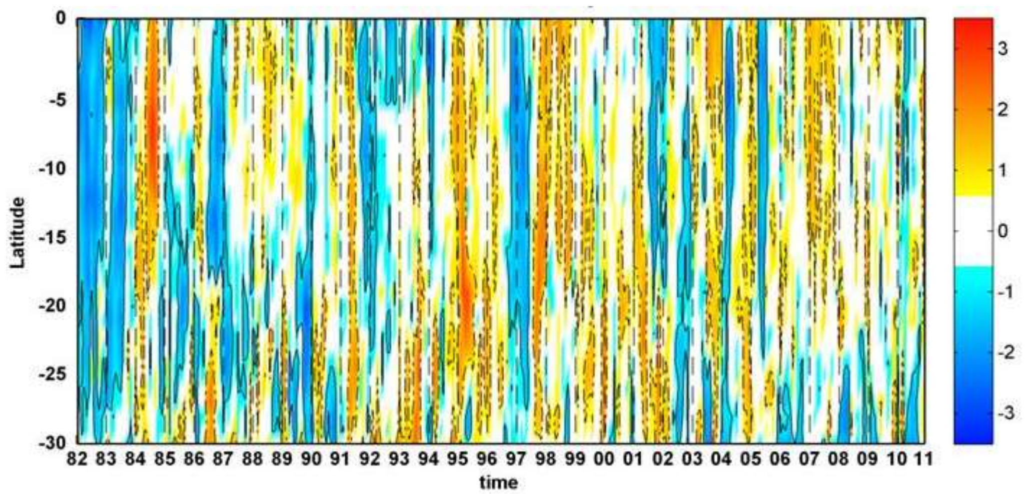


Figure 4.29: Temporal (1982-2011) and southern (Equator-30°S) variation of the standard anomalies of the sea surface temperature along the African Coast.

The dashed line in Figure 4.29 corresponds to the positive anomalies (water warmer than the average), and the bold line corresponds to the negative anomalies (water colder than the average). Derived from dataset Optimum Interpolated – Sea Surface Temperature (Queiroz, 2011).

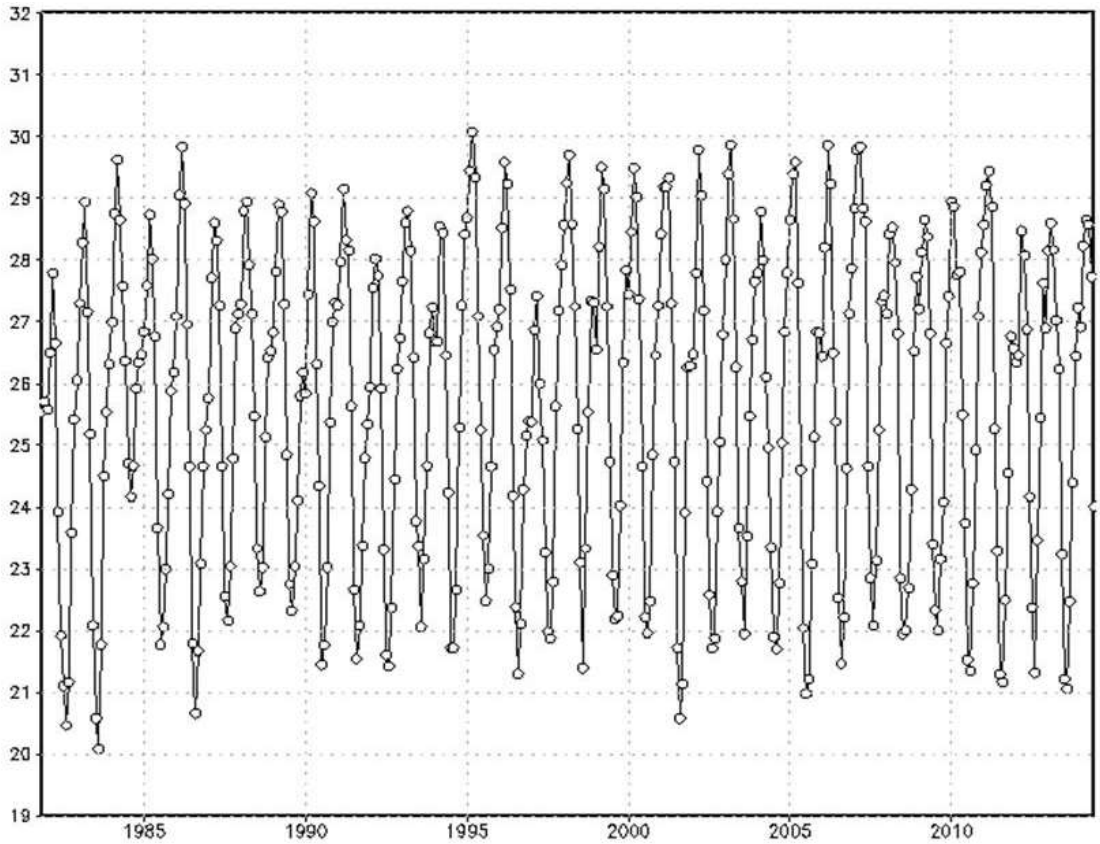


Figure 4.30: Time Series (1982-2006) of the sea surface temperature for an area-averaged between 8°S-9°S and 12°E-13°E. (http://www.emc.ncep.noaa.gov/research/cmb/sst_analysis/

The *in situ* temperatures are slightly above the values recorded by the satellite; however these are comparable (Figure 4.31 to Figure 4.33). This difference is acceptable, given that the satellite data does not have sufficient spatial resolution, to capture the temperature variation in the near-shore zones. In addition, they are monthly averages, and as such do not reflect the diurnal variations observed during the field work.

In the sub-basin of Corimba the *in situ* data reveals a relatively homogeneous water column. The recorded gradients reflect the differences in depth, and the transitions to more exposed zones, and with more effective circulation (particularly the transition between the submerged shoreline, and depths >50 m) (Figure 4.32 and Figure 4.33).

In Praia do Bispo system the water column is homogeneous, i.e., it is well mixed (Figure 4.33). It is important to note that this zone has depths <1 m in most of its extent, the circulation is essentially due to the tidal variations. Currently, the connection to Chicala is made through a narrow channel, limiting significantly the renewal of the water within. The greater differences in terms of temperature (temperature gradient evident between this zone and inside the system) come from this channel.

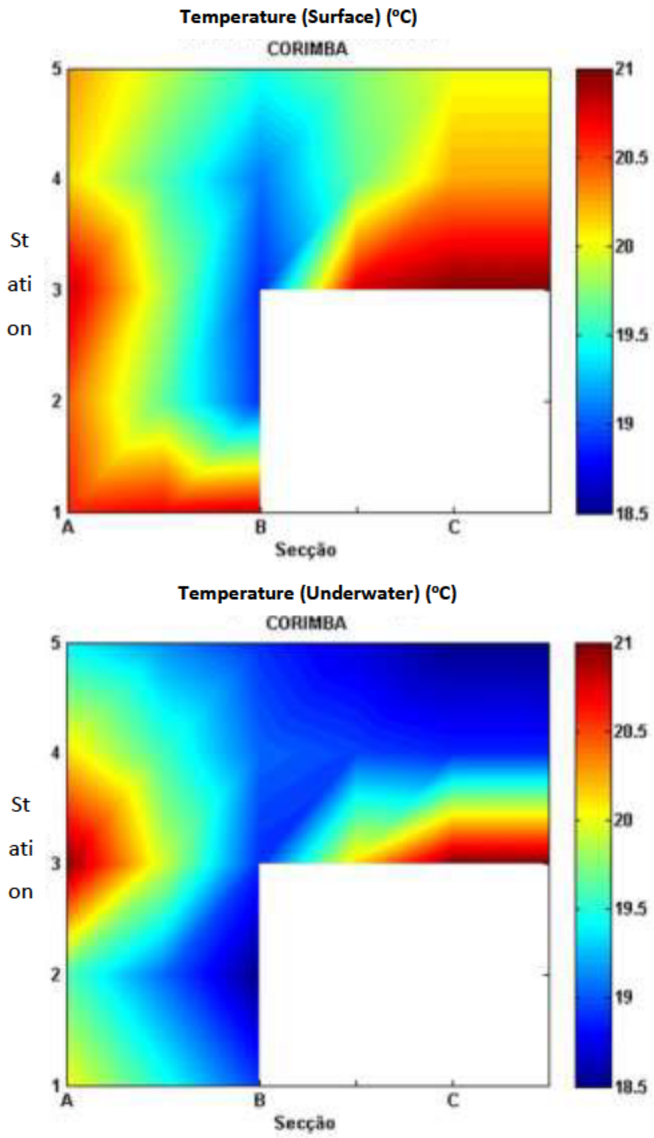


Figure 4.31: Distribution of the temperature (°*C*) in the sub-basin of Corimba (data *in situ*). Section A corresponds to the mouth of the Mussulo Lagoon, and Section C to Praia do Bispo (see Figure 4.14).

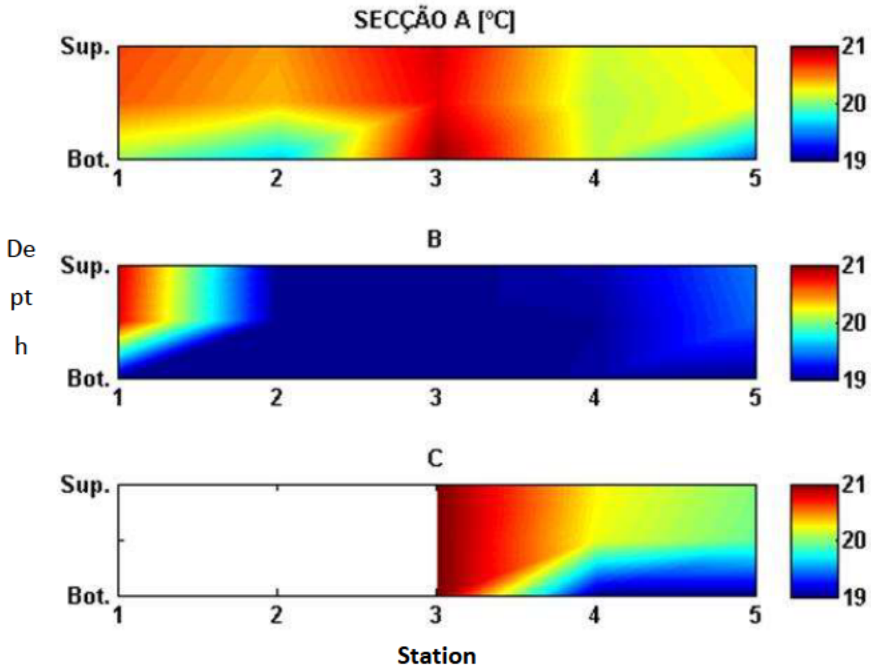


Figure 4.32: Vertical distribution of the temperature (°C) in the Corimba sub-basin along the sampled sections: A, B, and C (data *in situ*). Section A corresponds to the mouth of the Mussulo Lagoon, and Section C to Praia do Bispo.

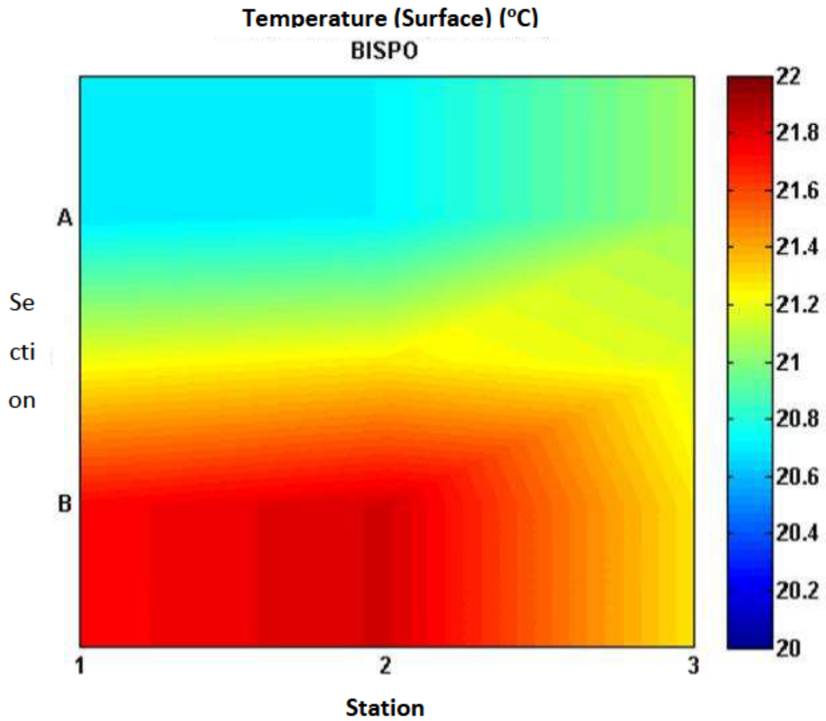


Figure 4.33: Distribution of the temperature (°C) in the system of Praia do Bispo (*in situ* data). Section A/Station 1 corresponds to the bridge zone between Bispo and Chicala.

4.5.7. ANALYSIS OF SATELLITE IMAGES

- ✓ *Dissolved Oxygen*

The sub-basin of Corimba and the system of Praia do Bispo are located in a zone where the drainage of effluents, and the anthropogenic pressure area extremely relevant. This drainage can be an important source of sediment, nutrients, and contaminants. The action of the effluents will have an impact on the level of Dissolved Oxygen (DO) (through the promotion of primary production and biological consumption). However, there are no data *in situ*, and studies that enable the in-depth Baseline of the study area. The existing data is large scale, and of climatological temporal resolution. The data obtained during the field trip, partially complement the previous information. However, since there is no continuous monitoring, these data only served as a baseline.

According to various studies (e.g. Monteiro *et al*., 2006; Monteiro *et al*., 2008; Stramma *et al.,* 2010; Monteiro *et al.,* 2011), the water masses of the Angolan coast are poor in DO (concentrations between 2.0 ml/l and 0.1 ml/l). In addition, some incidents of extreme hypoxia have been reported in the last decades (Monteiro *et al*., 2006). This specific characteristic of the waters in the region is due to physical (ocean-atmosphere interaction), and biogeochemical (biological activity) factors. On the other hand, both factors are modelled remotely (equatorial variability/equatorial upwelling), and locally (Angolan Dome/ intensity of the equatorial upwelling).

Figure 4.34 represents the a) DO annual average on the surface (global coverage; Stramma *et al.*, 2010), average b) DO annual average along the African West Coast (Equator to 30°S), between the surface and 500m of depth (Monteiro *et al.*, 2011), and c) time series of the DO off the Lobito coast between 1994 and 2003 (Monteiro *et al.*, 2006) respectively. It is possible to observe from these data that the waters of this region are in fact poor in DO, not exceeding 5ml/l on the surface. As previously mentioned, it is necessary to take into account that the coastal waters are subjected to processes that significantly change the characteristics previously described: ventilation processes (resulting from the ripple), biogeochemical action (e.g. primary production), and anthropogenic pressure (e.g. through effluents). In fact, the *in situ* data reveals that the study areas are relatively ventilated, with DO values higher than those found in deep-sea waters (6-12 ml/l in the sub-basin of *Corimba*, and 5-7.5 ml/l in the system of Praia do Bispo (Figure 4.36e Figure 4.37).

The distribution of DO in the sub-basin of Corimba reveals the importance of the area with a circulation and ventilation zone from the Mussulo Lagoon (maximum OD in Section A consistent with high tidal current in the direction of the Lagoon). The existence of water pumped from a nearby yard to the sub-basin of Corimba is revealed by the water plume with a minimum DO. The existence of this minimum DO in the zone, between points A3 and A4, also reveals the importance of the submerged sandy shoreline in the control of the study area hydrodynamics (Figure 4.35 and Figure 4.36).

The main source of water renewal inside the system of Praia do Bispo is in the channel located in point A1, in this zone there is a maximum DO, consistent with the existence of a greater circulation, in this case associated with the tidal current (Figure 4.37). It is important to mention that, although the system has a limited circulation, the DO does not indicate a system in hypoxia.

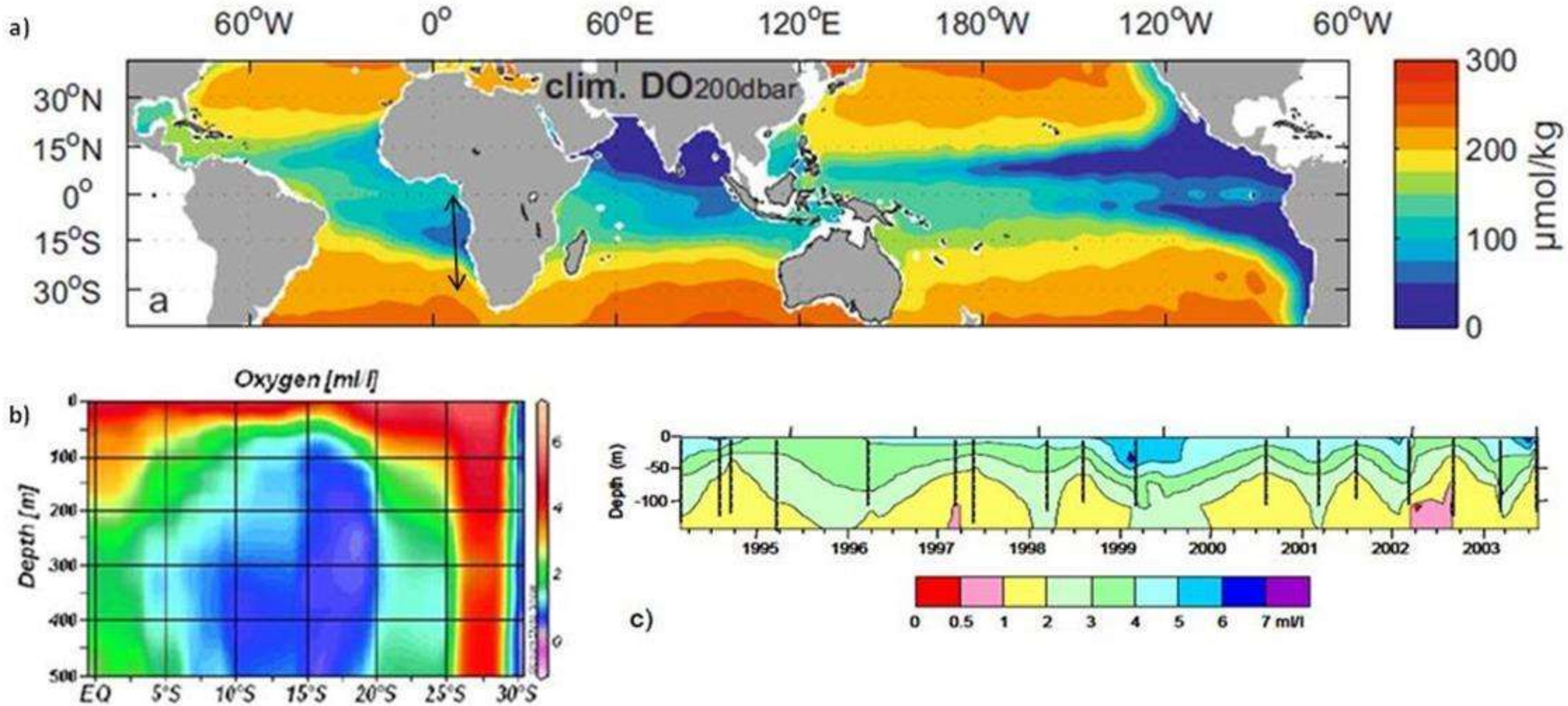


Figure 4.34: Distribution of the DO: a) DO annual average on the surface (the black arrow indicates the southern coastal section represented in b), Stramma et al., 2010), b) DO annual average along the African West Coast (Equator to 30°S), between the surface and 500m of depth (Monteiro et al., 2011), and c) time series between the surface and 200m of DO, in the coast of Lobito between 1994 and 2003.

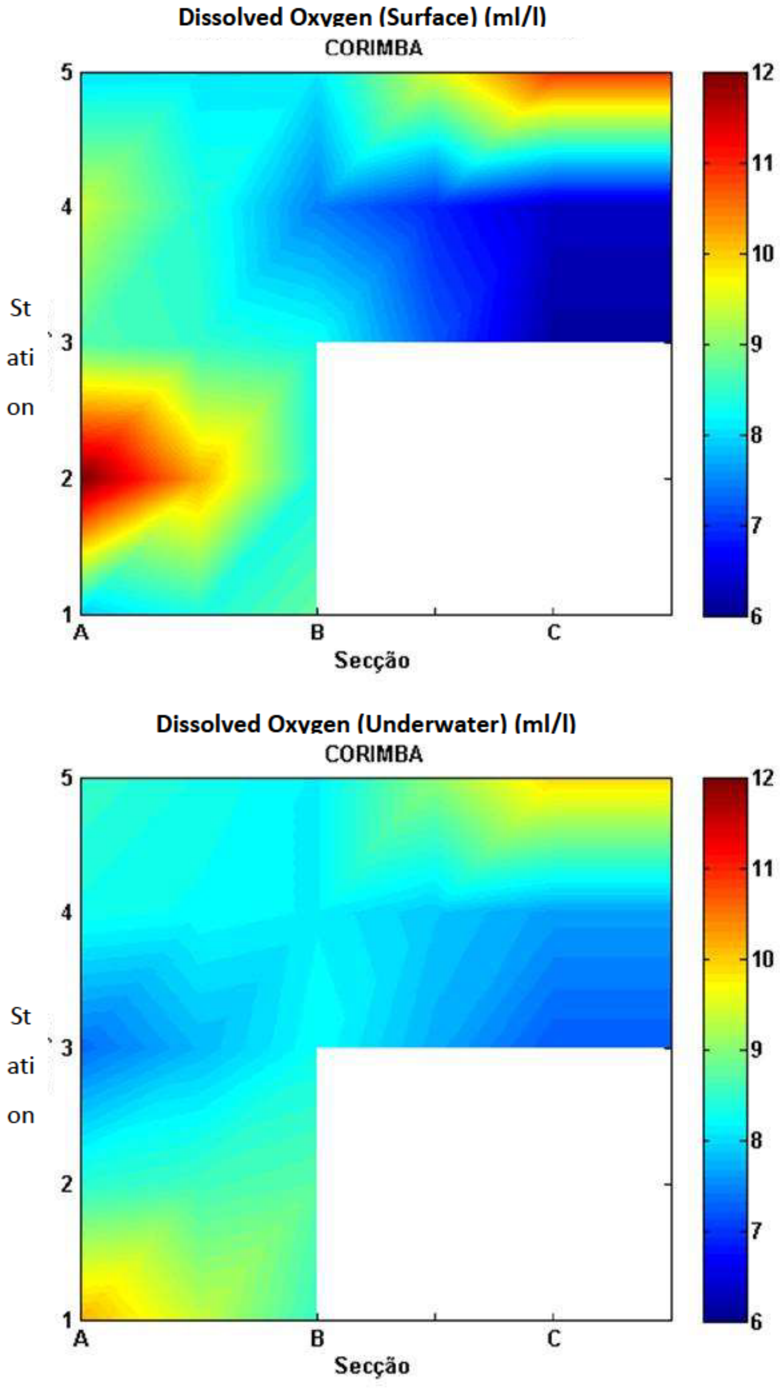


Figure 4.35: Distribution of the Dissolved Oxygen (*ml/l*) in the sub-basin of Corimba (*in situ* data). Section A corresponds to the mouth of the Mussulo Lagoon, and Section C to Praia do Bispo Section A/Station 1 corresponds to the bridge zone between Praia do Bispo and Chicala.

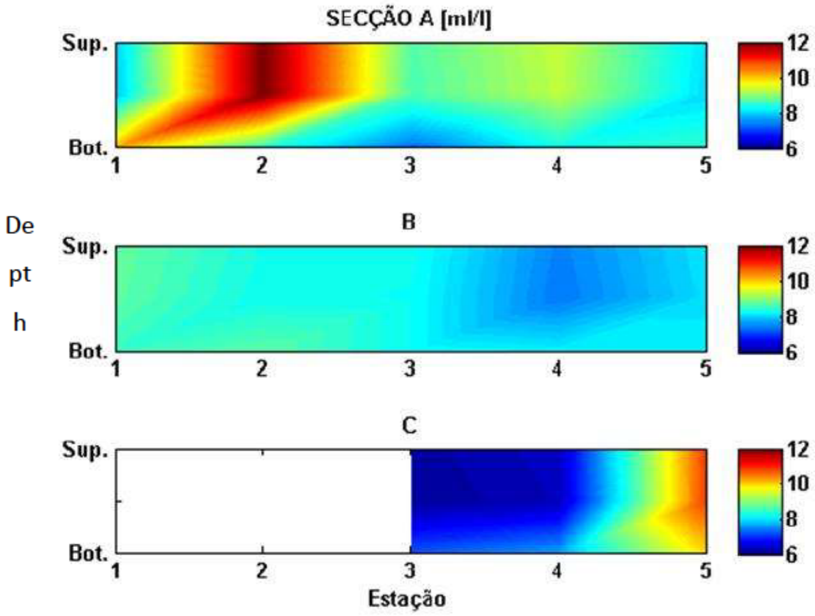


Figure 4.36: Vertical distribution of the Dissolved Oxygen (*ml/l*) in the sub-basin of Corimba along the sampled sections: A, B e C (*in situ* data). Section A corresponds to the mouth of the Mussulo Lagoon, and Section C to Praia do Bispo.

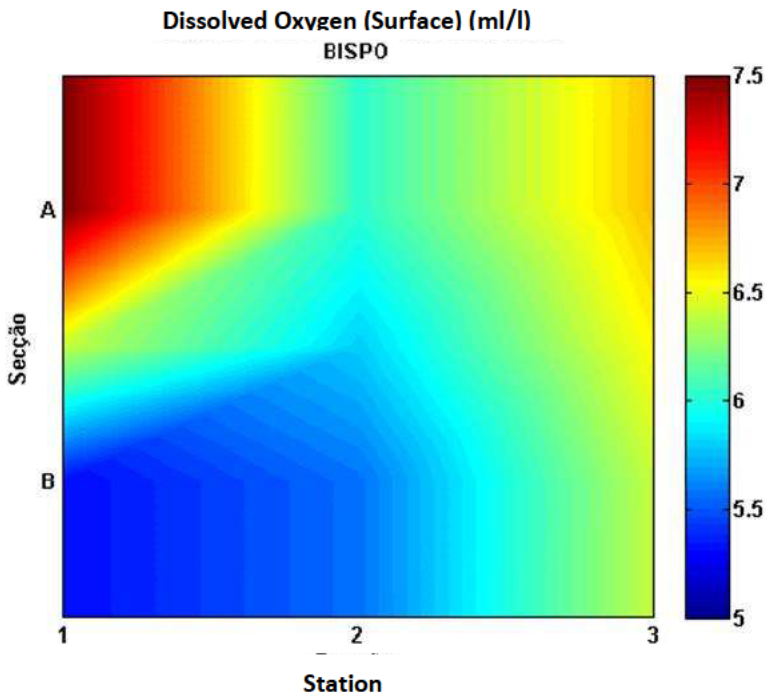


Figure 4.37: Distribution of the Dissolved Oxygen (*ml/l*) in the system of Praia do Bispo (*in situ* data). Section A Station 1 corresponds to the bridge zone between Praia do Bispo and Chicala.

- ✓ *Salinity*

The salinity distribution on the surface waters of the Angolan Coast is largely controlled by the behaviour of the Congo river´s water flow. However, the study area is also largely influenced by the variability of the Kwanza River. The variability of these two rivers is influenced by the southern migrations of the Intertropical Convergence Zone, and the precipitation pattern associated thereof (Yoo and Carton, 1990). According to Dossier and Donguy (1994), the low salinity plume of the Congo River reaches its maximum spatial extent in January, after the December flood. According to the climatological data of the surface salinity of MOHC (annual average in the Angolan Gyre), the influence of the Congo River may be clearly confirmed to 9° S (the study area is centered in 8.5° S) with salinity values not exceeding 34.5 ‰ near to the coast.

In the sub-basin of Corimba, the salinity values recorded during the field trip are comparable with what was previously mentioned (Figure 4.39 and Figure 4.40). On the surface, the salinity gradient in the direction of the Mussulo Lagoon is satisfactorily captured. In Section C (existing yard) there is a significant reduction of the salinity (in fact this plume is also visible in Section C). These results from the water pumping process performed within the scope of the ongoing construction work. The vertical sections confirm what was already described: higher salinity at the entrance of the Mussulo Lagoon, less saline water plum recorded between Sections B and C.

Inside the system of Praia do Bispo, the salinity distribution reflects what was already described in the temperature section (Figure 4.41). Here it is confirmed that the Section A/Station 2 zone, corresponds to the channel that connects Praia do Bispo and Chicala, it is the only area where circulation is effective. Maximum salinity is recorded in this zone, which results from the transportation of more saline water inside the system. In contrast, Station 3 shows lower salinity values, and the values are similar to what is recorded in Section C of the sub-basin of Corimba.

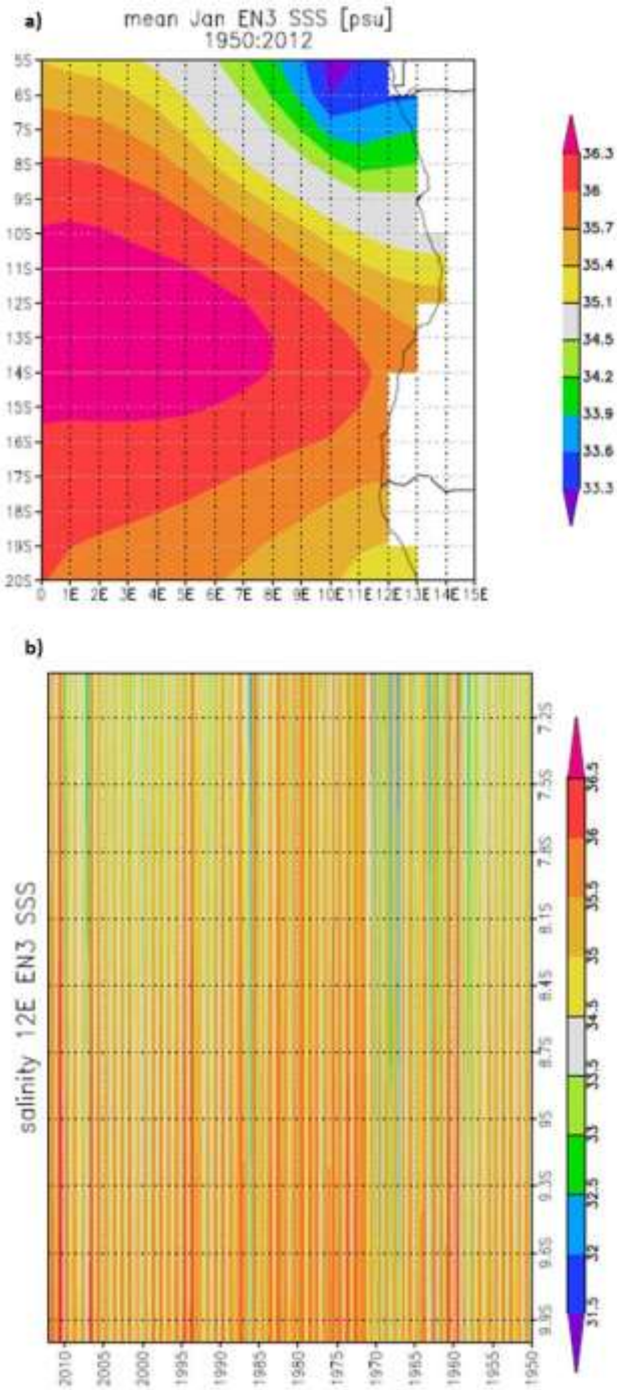


Figure 4.38: a) Horizontal distribution of the annual average surface salinity (1950-2012) in the Angolan basin, and b) interanual variation of the salinity along the coast of the study area (7°-10°S), and in a point centered in 13°E (http://climexp.knmi.nl).

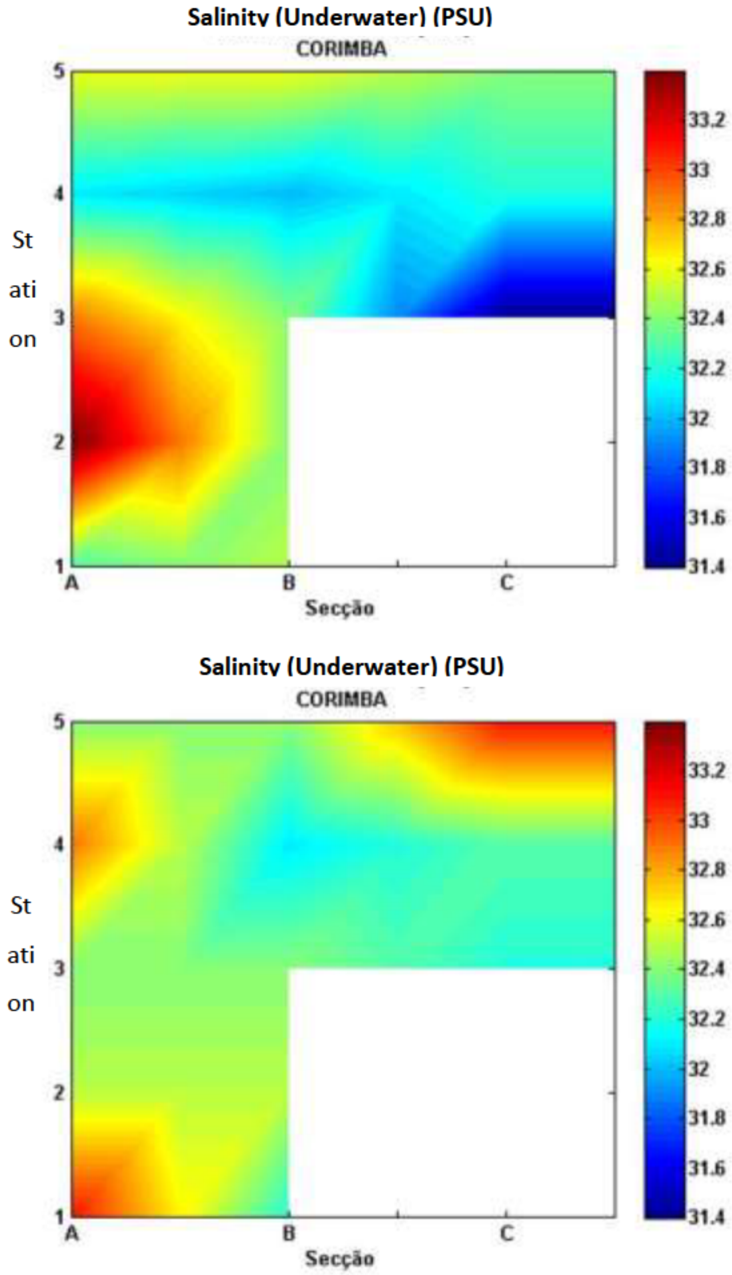


Figure 4.39: Salinity Distribution (*PSU*) in the sub-basin of Corimba (*in situ* data). Section A corresponds to the mouth of the Mussulo Lagoon, and Section C to Praia do Bispo, Section A/station 1 corresponds to the bridge zone between Praia do Bispo and Chicala.

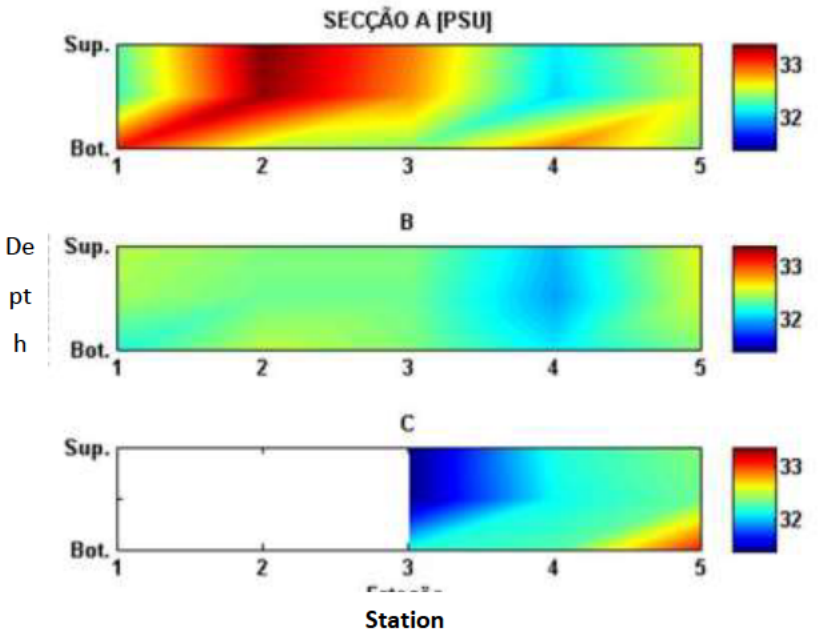


Figure 4.40: Vertical distribution of the Salinity (*PSU*) in the sub-basin of Corimba along the recorded sections: A, B, and C (*in situ* data). Section A corresponds to the mouth of the Mussulo Lagoon, and Section C to Praia do Bispo.

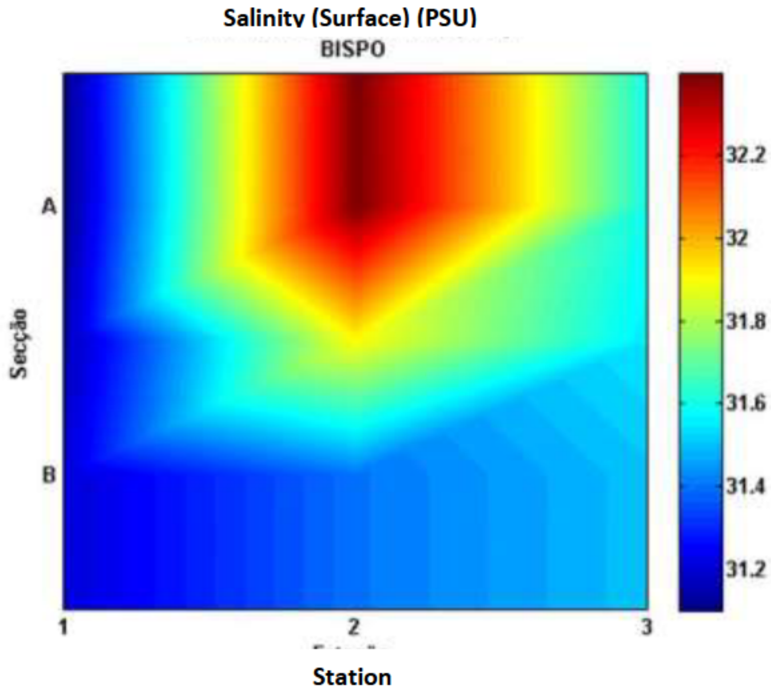


Figure 4.41: Salinity Distribution (*PSU*) in the system of Praia do Bispo (*in situ* data). Section A/station 1 corresponds to the bridge zone between Bispo and Chicala.

- ✓ *Nutrients*

According to some studies (Bennekom e Berger, 1984; Wasmund *et al.,* 2005; Shillington *et al.,* 2006; Mohrholz *et al.,* 2008; Moore *et al.*, 2009), from several cruises along the West African coast, the surface waters along the North/Central coast of Angola are characterized by low levels of inorganic nutrients (Figure 4.42 to Figure 4.44).

According to Bennekom & Berger (1984), the concentrations of nitrate-nitrogen and phosphates vary between ±0.3 and 0.5 µM/l respectively. Wasmund et al. (2005) reported unusual higher values for the above-mentioned nutrients (1.0 µM/l of phosphates, and 4.5 µM/l of nitrates) during a cruise between August and September of 2000 (Figure 4.42). In April of 1999, some stations were settled off the Lobito coast (Mohrholz *et al*., 2008). The reported results shows low concentrations of nitrates on the surface (<0.1 µM/l) and waters along the thermocline (<1 µM/l), and a significant increase in the intermediate layers (150m 400m), with concentrations >25 µM/l (Figure 4.43). More recently, Moore *et al*. (2009), based on a compilation of historical data of WOCE, suggest extremely low concentrations of nitrates on the surface waters (0.1 µM/l,) and a distribution of phosphates along the thermocline of 1 µM/l ().

As abovementioned (for the salinity and DO parameters) in previous sections, the concentration of nutrients in the coastal strip of the study area also depends on the action of the effluents that are introduced, as well as the anthropogenic pressure. Due to the fact that the available data, and studies do not solve the seasonal variations of the nutrients, it is not possible to thoroughly describe their variations.

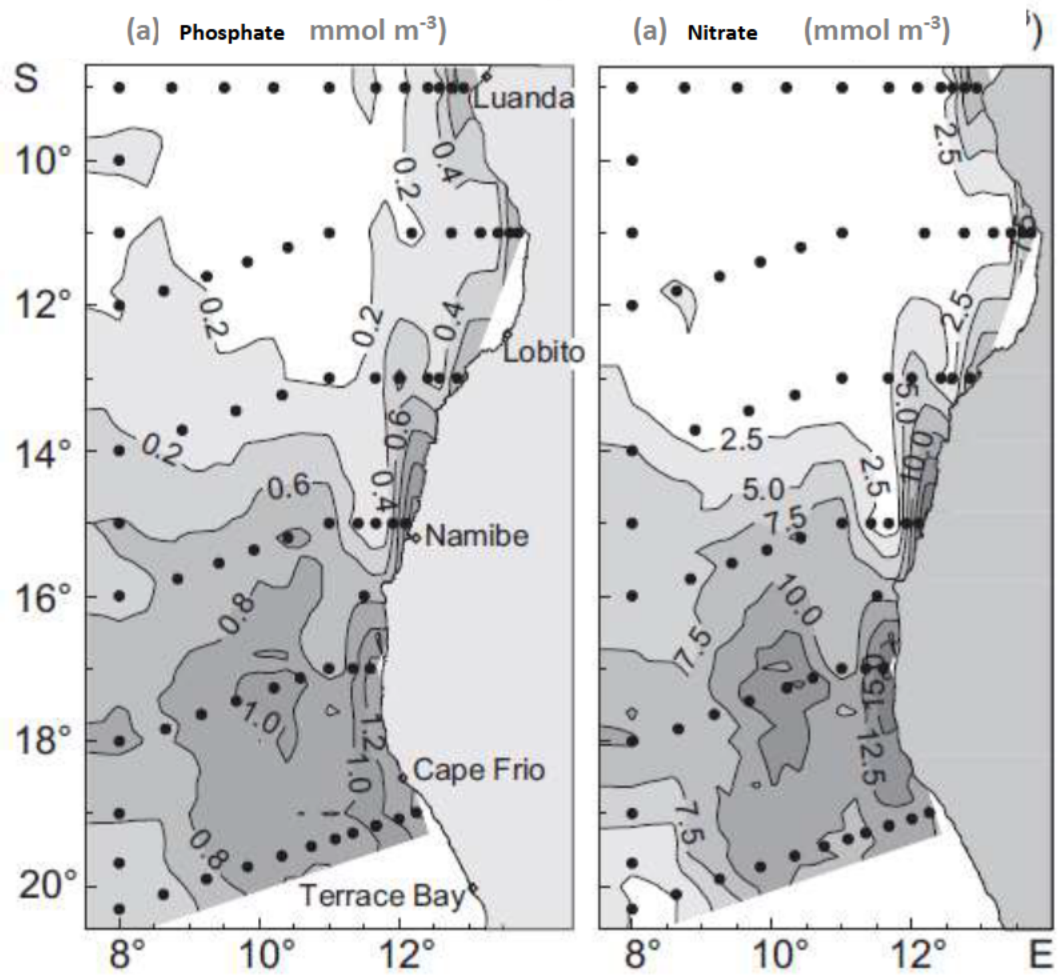


Figure 4.42: Superficial distribution of the concentration of nutrients a) phosphates, and b) nitrates in 2000 (Wasmund *et al.*, 2005).

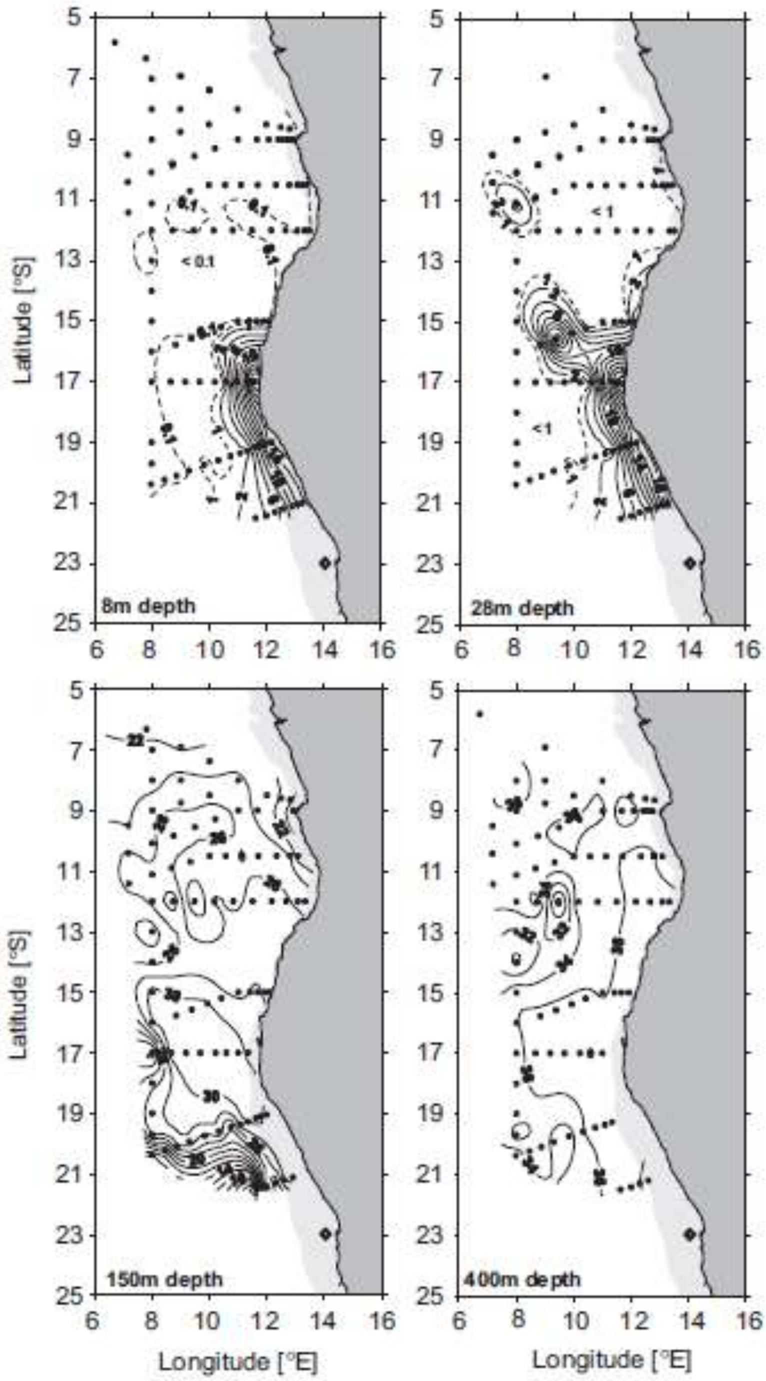


Figure 4.43: Horizontal maps of the nitrate concentration on the surface (8m), along the thermocline (28m), upwelling waters (150m), and in the centre of the layer with minimum oxygen rates (400m). Data from *R/V Poseidon* (April 1999) (Mohrholz *et al.*, 2008).

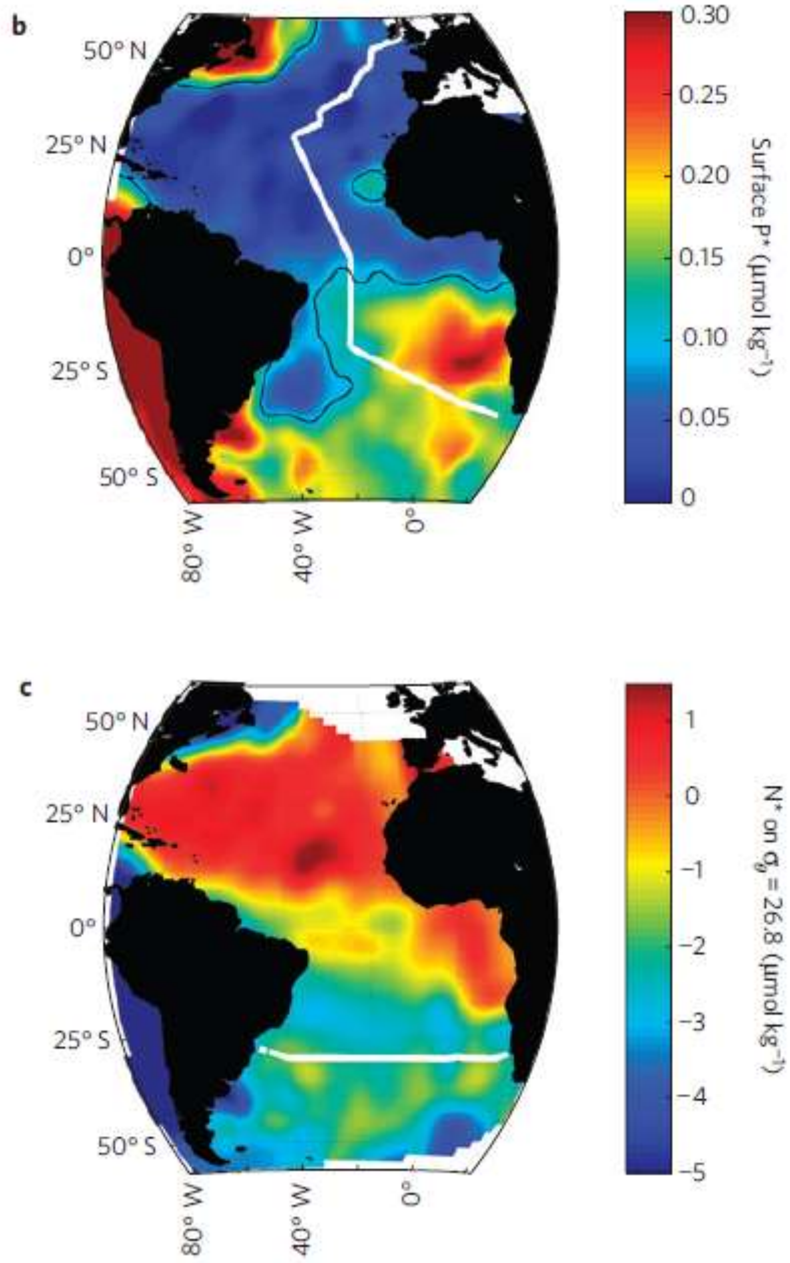


Figure 4.44: Distribution of high/low concentrations (red/blue) of nutrients over the Atlantic Ocean, annual averages; b) phosphate climatology on the surface, and c) nitrate distribution along the thermocline (Moore *et al.*, 2009).

✓ *Primary Productivity (Existence of chlorophyll)*

The study area exhibits a well-defined cycle of biannual primary production (chla) (Figure 4.45 and Figure 4.46). Figure 4.45 and Figure 4.46 show that in this latitude (~8.5° S, black line, Figure 4.45) this cycle exhibits 2 maximum values of chla, which correspond to the peaks of equatorial production, and the flow of the main rivers of the region (in a similar way to the parameters described in the previous sections).

In the first half of the year (January-June), the zone exhibits relatively low values of chla, in contrast with the latitudes to the South that consistently exhibit high values (characteristic of the cold water systems). It is important to note that at this time of the year, the primary production is associated with the discharges of the main river of the region (Kwanza). These discharges make available high quantities of nutrients to the waters of the region, and reach their peak in January/February.

In the second half of the year there is a clear change in the system, with the primary biological activity playing a determinant role. The highest values of chla are explained by the equatorial upwelling regime. This regime begins in May/June, reaching its peak in July/August, and diminishes progressively in intensity by the end of the year (Sætersdal *et al.*, 1999; Shillington *et al*, 2006).

It is necessary to be careful when using these data to characterize the study area. Even though the time series were extracted for a relatively narrow coastal area, and the data is high resolution (4km), these may not be representative, and lack local validation (comparison with time series of data *in situ*). In addition, the data obtained during the field work are not sufficient to describe the seasonal and annual intervariability of the system.

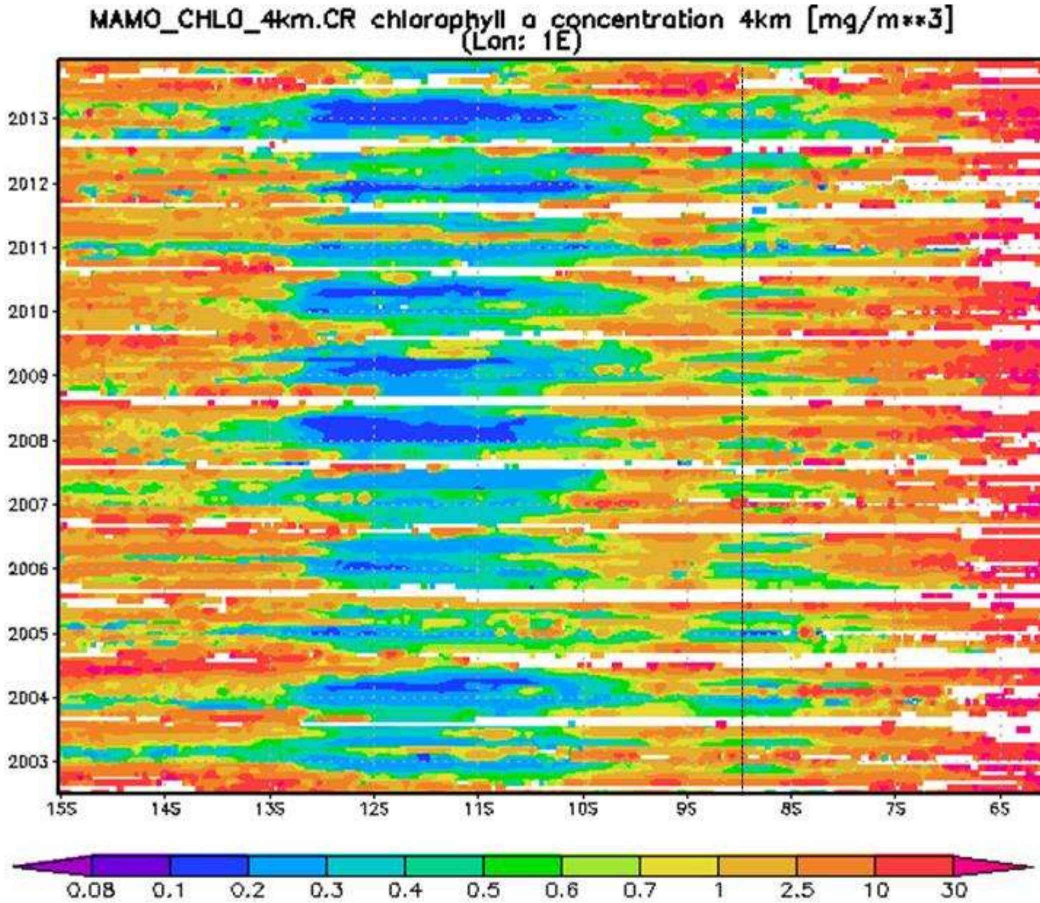


Figure 4.45: Superficial pattern of Chlorophyll a (used as a proxy of the abundance of phytoplankton) along a southern coastal section between 2002 and 2013. The dotted black line refers to the latitude of the sub-basin of Corimba (MODIS data, http://disc.sci.gsfc.nasa.gov/giovanni/).

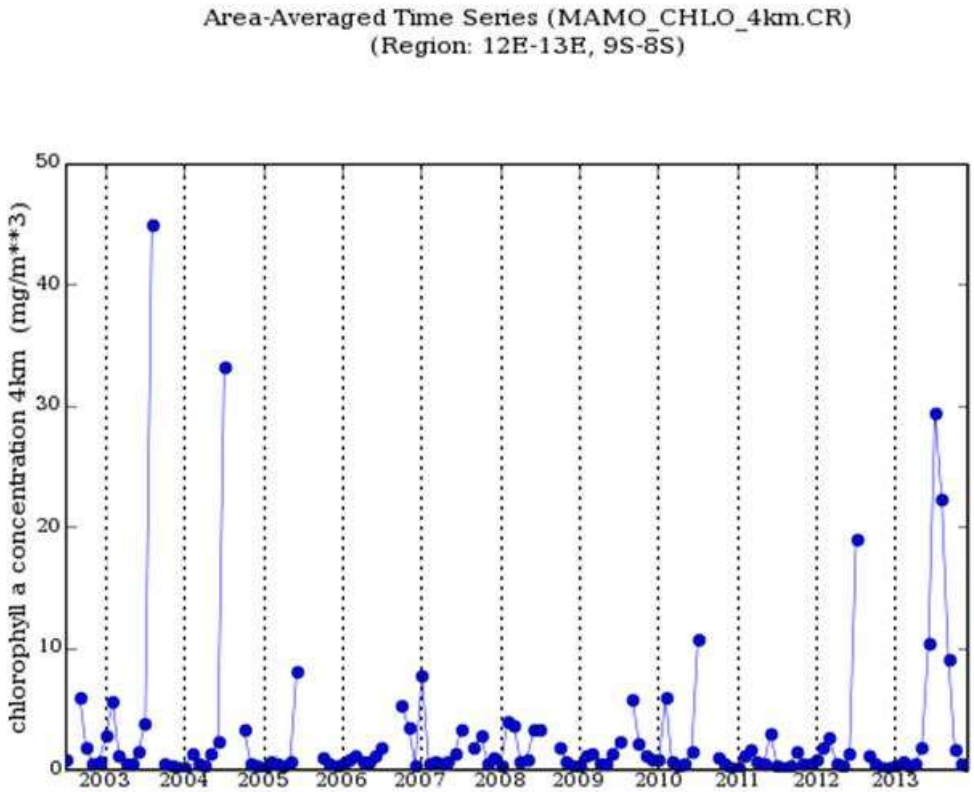


Figure 4.46: Time Series of Chlorophyll a extracted from MODIS data between 2002 and 2011. Area-Averaged between 8°S-9°S e 12°E-13°E (http://disc.sci.gsfc.nasa.gov/giovanni/).

4.6. WATER QUALITY

The biological, physical and chemical Baseline of the water plays a predominant role in the aquatic ecosystems, given that there is a strong interrelationship between the physical and chemical parameters, and the living beings that inhabit these ecosystems. Various parameters were determined to characterize the water condition, and represent its biological, physical and chemical characteristics. These parameters are quality indicators, and become pollutants when reaching values higher than the threshold for a specific use.

The water quality influences directly the flora and fauna in an ecosystem, being one of the most important factors when determining and establishing the biological communities. In addition, clean water is a requirement for the health and well-being of the population.

The relevant physical and chemical parameters will be described in this section for this study. Data from the field work, historical satellite images, and laboratory analysis were taken into account for this description.

4.6.1. PHYSICAL AND CHEMICAL PARAMETERS

The Baseline of the Project area of Marginal da Corimba is essential, not only for the acknowledgement of the patterns of the aquatic ecosystem, but also for the ecosystem's management practical purposes.

Even though there aren´t many quantitative data on the quality of this area, the system is extremely vulnerable to pollution processes that may be caused as a result of various anthropic activities. In the last few years the increase in human settlements in the surroundings, and the direct drainage of domestic effluents and solid wastes without any treatment, increased considerably the pressure on the natural aquatic system, thus contributing to the degradation of its quality.

In situ Analysis

Readings of the water quality parameters were undertaken in specific points of the study area, as described in item 4.5.1 of the chapter, being the results are listed in Table 4.8. The parameters were assessed in all points, on the surface (50 cm), and underwater. The measurement depth was not uniform, due to depth variations in the sampling points, alternating between 4.1 and 1.8 m.

- ✓ ***pH***

The pH may be considered one of the most important variables for the Baseline of the aquatic environments, and at the same time can be one of the most difficult to interpret, due to the great number of factors that may influence it. For example, pH is important in the geochemistry of the system, and acts as an indicator of the processes involving biological production and breathing. The pH and water temperature variations influence the toxicity of some heavy metals, such as zinc, lead e cadmium. According to USEPA (1986), the pH of the sea water normally varies between 6.5 and 8.5, however in shallow, estuarine, and coastal waters; a pH of 9.0 is the acceptable threshold.

The pH exhibited an average value of 8.99 on the surface, and 8.93 underwater in all points (see Figure 4.47). The individual values obtained are slightly higher than the standard value of USEPA in points A1, A2, A3 e B5.

The values obtained in the 2014 sampling are within the variation pattern found by the Environmental Department of the Faculty of Science (NAFC) in the study carried out in the years 2004 and 2005, and the pH at that time showed values between 8.9 and 9.41. Although pure water is neutral with respect to pH, because the dissociation of water molecules produces an equal number of H + and OH- ions, the presence of CO_2 and highly alkaline sodium, potassium and calcium ions, tend to make the sea water slightly alkaline between 7.5 and 8.4.

Table 4.8: Results of the *in situ* water analysis sampling.

Points	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C3	C4	C5
Parameters	**Suf.**	**Suf.**	**Suf.**	**Suf.**	**Suf.**	**Suf.**	**Suf.**	**Suf.**	**Suf.**	**Suf.**	**Suf**	**Suf.**	**Suf.**
Temperature (º C)	20.3	20.5	20.5	18	18.8	19.9	18.3	17.8	18.18	19.5	21.2	19.3	19.3
pH	9.07	9.09	9.11	8.9	8.98	8.95	8.96	8.9	8.96	9.02	8.96	8.96	8.97
Reduction and oxidation potential	123	113	111	116	110	117	112	115	123	122	105	109	116
Conductivity (mSmv)	48.9	50.1	49.8	50.3	50.9	50.7	49.8	49.8	49.7	10.2	49.6	50.6	50.7
Turbidity (NTU)	0	0	0	0	0	0	0	0	0	0	0	0	0
Dissolved Oxygen (mg/l)	9	8.6	9.2	14.09	9.3	14	7.25	11.1	7.32	11	10.09	12.3	11
Total Dissolved Solids (mg/l)	29.8	30	30.4	30	30.4	30.3	30.3	30.3	30.3	30	29.8	30.2	30.3
Salinity (mg/l)	31.8	32.7	32.5	32.5	32.9	23.3	32.3	32.3	32.4	32.6	31.9	32.8	32.8
Depth (m)	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.4	0.5
Points	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C3**	**C4**	**C5**
Parameters	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**	**Dpt.**
Temperature (º C)	20.3	19.8	19.95	*	17.9	19.8	18.2	17.78	17.7	17.6	20.9	17.9	17.3
pH	9.08	9.07	9.06	*	8.95	9.01	8.94	8.9	8.9	8.9	8.99	8.91	8.9
Reduction and oxidation potential	122	110	113	*	119	118	116	119	123	131	110	118	125
Conductivity (mSmv)	49.3	49.9	49.9	*	49.8	49.5	49.7	49.6	49.8	49.8	49.8	50	50
Turbidity (NTU)	0	0	0	*	0	0	0	0	0	0	3.7*	0	0
Dissolved Oxygen (mg/l)	7.85	6.65	6.62	5.7	5.5	5.12	6.6	6.4	6.13	5.29	7.6	5.14	5.02
Total Dissolved Solids (mg/l)	30.1	30.5	30.4	*	30.4	30.2	30.3	30.3	30.4	30.4	30.3	30.5	30.4
Salinity (mg/l)	32.2	32.6	32.5	*	32.4	32.2	32.3	32.3	32.4	32.4	32.4	32.5	32.4
Depth (m)	4.1	14.6	17.5	2*	5.5	5.2	3.2	2.55	3.9	27.8	1.9	5.5	27

*Error in the reading device.

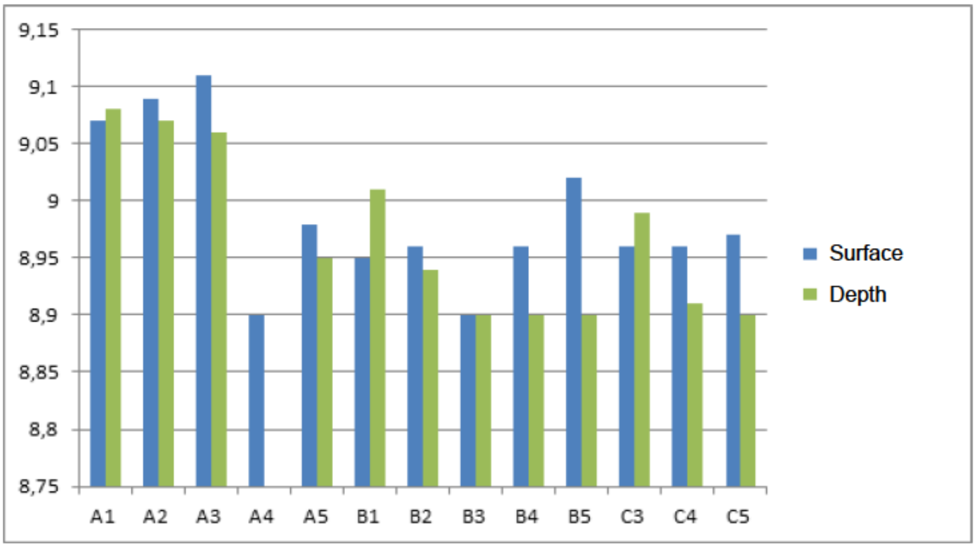


Figure 4.47: Values obtained for the pH in the different sampling points.

- ***Conductivity***

The solids may be found dissolved in nature. The salts that dissolve in water divide up into positively and negatively charged ions. Conductivity is the water´s ability to conduct an electrical current, and the dissolved ions are the conductors. It is expected that a solution with a higher concentration of ions will exhibit a higher conductivity. In tropical regions the conductivity values in aquatic environments are more related to the geochemical characteristic of the region where they are located, and the climate conditions (dry and rainy season), than to the trophic state. The electrical conductivity of the sea water is used as an indication of salinity.

The values proved to be constant in all the assessed points, except for point B5, which exhibited a lower value of 10.2 $\mu S.cm^{-1}$, as displayed in Figure 4.48. This value may be considered an error of the reading device in the sampling point.

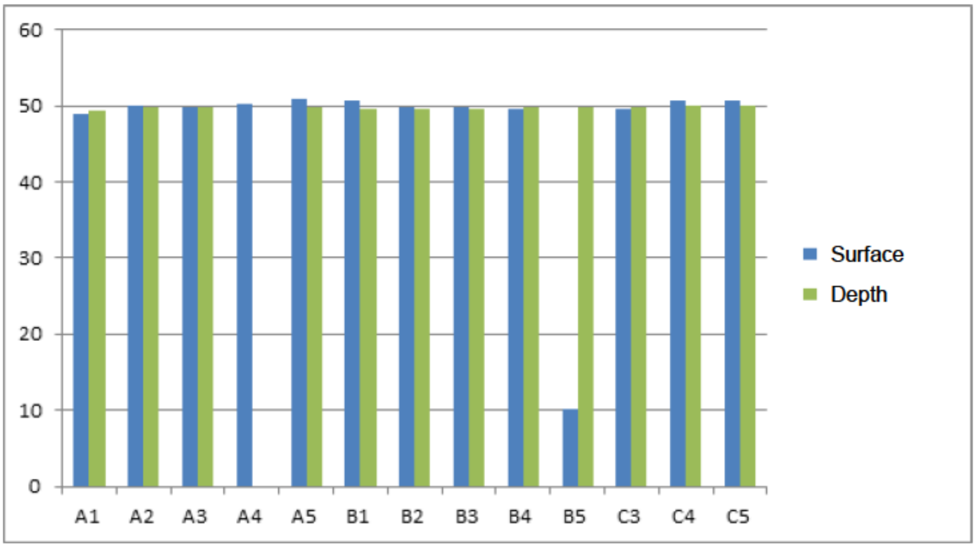


Figure 4.48: Values of the electrical conductivity ($\mu S.cm^{-1}$) obtained in the different sampling points.

Overall, the conductivity values increase when the decomposition process becomes more intense, due mainly to the release of organic matter in the system. The records of this variable may aid the identification of pollutant sources in aquatic environments, or even enable us to identify specific sources in the system where the natural process is more accentuated.

The 2014 samplings show slightly lower values than in 2011 and the lowest value observed in 2011 was 52.3 $\mu S.cm^{-1}$ and the maximum value in 2014 was 50.7 $\mu S.cm^{-1}$. There was a certain spatial homogeneity of the electrical conductivity values at the sampled points between 2011 and 2014.

The high conductivity values may be probably explained by the major quantity of dissolved ions that exist in the water, given that the sea water is quite rich in ions, as clearly shown in the salinity values obtained.

- ✓ ***Dissolved Oxygen***

The oxygen is essential for the breathing of all life, including the majority of the marine e estuarine organisms. The quantity of oxygen available for the aquatic life depends on a number of factors that affect the oxygen solubility in the sea water (temperature, pH, salinity, etc.). The oxygen levels are higher in surface waters, and particularly in the coastal waters. The recommended minimum concentration of dissolved oxygen in marine and estuarine waters is 8.0 mg/L (CCME, 1999).

The Dissolved Oxygen (DO) exhibited concentrations with minor variations in the various sampling points (Figure 4.49), with a minimum concentration of 5.12 mg/L (underwater) in point B2, and a maximum content of 14.09 mg/L in point A4 (surface). The values obtained were higher than 6.0 mg/L, as recommended by the National Environment Council (CONAMA, 2005), except points A4, A5, B1, B5, C4 and C5 (underwater values).

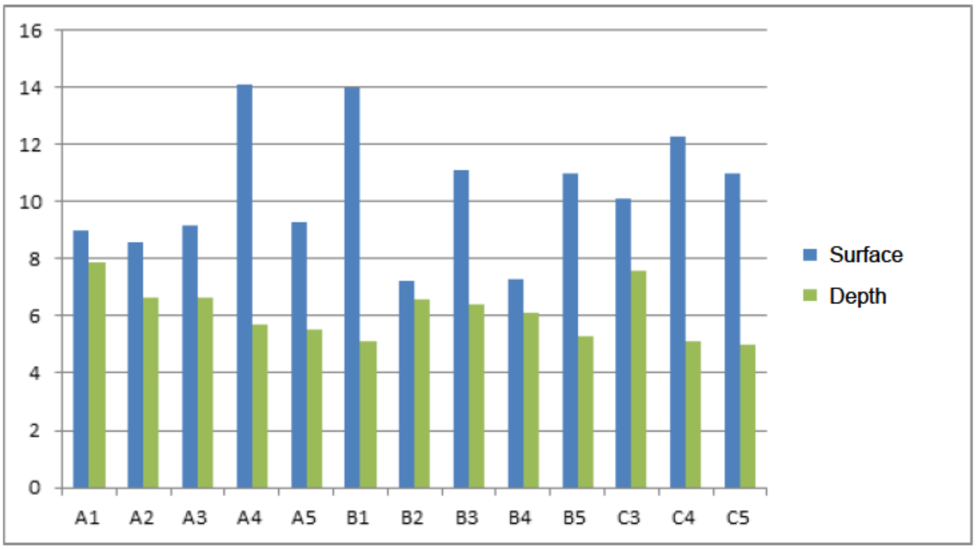


Figure 4.49: Values of the Dissolved Oxygen (mg.L-1) obtained in the different sampling points.

The oxygen levels are higher in the surface waters, particularly the coastal waters. The surface of the marine and estuarine waters enable the increase in oxygen through gas exchange, and sufficient light may penetrate the surface waters, to enable the oxygen release processes of photosynthesis to occur. (CCME, 1999)[21]. When conditions are met, the oversaturation of oxygen occurs, reaching up to 130 and 165% (corresponding to values of 11.1 mg/L and 14.2 mg/L).

[21] Canadian Council of Ministers of the Environment, 1999. Available at: ceqg-rcqe.ccme.ca/download/en/178.

The dissolved oxygen showed higher concentrations during the 2014 samplings. Also in these samplings higher variations were observed at the different sampling points, and minimal concentrations of 5.5 mg / L and maximum levels of 12.6 mg / L have been noted. The values obtained in the 2014 samplings, at the closest points of the coast are above levels considered acceptable for coastal environments.

- ***Turbidity***

The water turbidity is mainly caused by the particles suspended, and the dissolved compounds in less proportion. The results obtained revealed low values in all of the sampling points. The analysis performed in the beginning of October 2010 by the Central Laboratory of Sonangol, upon request of the Implementation Commission of the Gabinete de Gestão do Polo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo, indicate turbidity values below 10 NTU, in 8 of the 10 sampling points. Turbidity varied at different sampling points, and a minimum of 2.7 NTU value has been noted at point 1 at the surface and a maximum of 242 NTU value at point 6 (bottom).

- ***Water Temperature***

The water temperature along with the salinity, is one of the most important physical factors that affect marine and estuarine organisms. It affects almost all of the physical properties of the sea water (CCME, 1999).

The water temperature exhibited nearly constant values, with mean temperatures of 19.35^{o} C on the surface, and 18.34^{o} C underwater. Figure 4.50 shows that the water temperature in the study area exhibited a certain spatial evenness, considering the sampling schedule. An error occurred in the reading device in point A4.

Figure 4.50: Water temperature values (ºC) obtained in the different sampling points.

The results obtained clearly show that the water temperature is directly related to the air temperature, and consequently to the climate, thus mirroring the mean values anticipated for the low-latitude regions.

According to Bomba (1999) the surface water temperature values from the mouth of the Congo River, up to the extremity of *Palmeirinhas* during the dry season, varies between 18ºC and 23ºC, being 22ºC the estimated mean temperature. The values obtained for the sub-basin of Corimba are within the values estimated for the dry season (*cacimbo*), which confirms the correlation between the water temperature, and the insolation period throughout the year.

✓ ***Salinity***

Salinity indicates the concentration of mineral salts dissolved in water, and may be displayed in different forms, being the most frequent g/Kg, or ppt unit.

Salinity exhibits minor variations between the different oceans and seas. The average salinity in the Atlantic Ocean is 37.0 ppt. The salinity of surface waters varies with latitude in all oceans. This variation depends on the balance between evaporation and precipitation, which on the other hand relates to the atmospheric circulation. The salinity levels in coastal waters vary due to the river flow, influx of underground waters, evaporation rates, freshwater runoff as a result of rains, tidal currents, and the ocean (CCME, 1999).

The salinity variations in the surface water are higher than in deeper layers, due to the fluctuations that mainly occur in the interactions of the interface atmosphere-ocean. The diurnal variations are overall negligible, with the exception of regions between tides, or shallow lagoons, where the effects of the evaporation/precipitation balance may be acknowledged in a few hours. The seasonal variations are also insignificant, except in shallow coastal waters.

The results obtained indicate that the salinity in the sub-basin of Corimba vary between 23.3 (B1), and 32.9 (A5) ppt in the sampling points on the surface (see Figure 4.51); values below the estimation for the ocean waters of Angola, being reported values of 35.5-35.9 during the dry season. However the values found are acceptable, and foreseen, and may indicate a combination with emissions of wastes from anthropic activities.

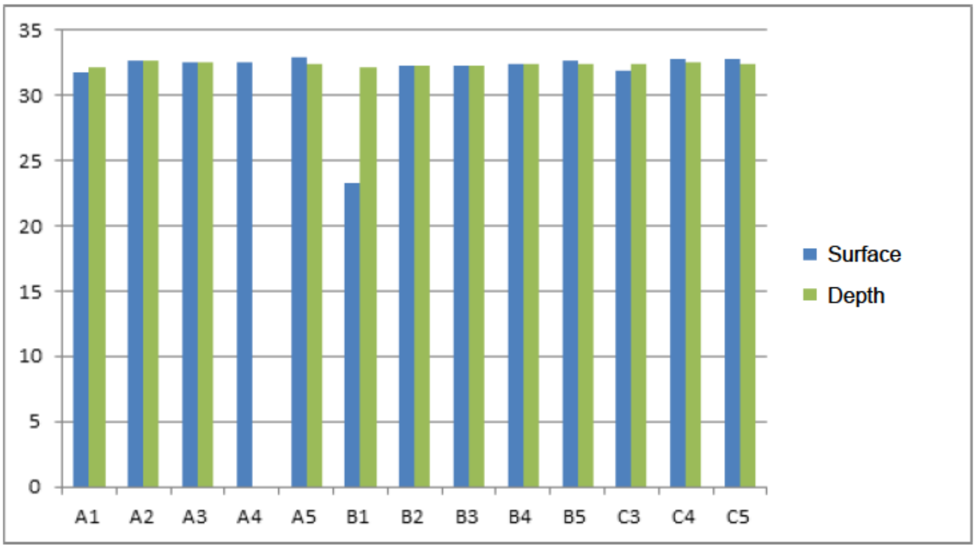


Figure 4.51: Salinity values obtained in the different sampling points.

- ***Total Dissolved Solids (TDS)***

The organic matter occurs naturally in nature, as a result of the deterioration of organisms, plants, and animals that will be dissolved in water. The majority of the sources of dissolved solids is anthropogenic in nature, through agricultural runoff, industrial discharges, and sewage. Higher concentrations of TDS may occur during and after rainfall events. In most of the events, the total dissolved solids, the salt content, and salinity are equivalent, given that most of the dissolved solids are salts (Garrison, 2010).

The values obtained in 2014 for the TDS displayed in Figure 4.52 show that the lowest value found was 29.8 mg.L^{-1} (in points A1 and C3, on the surface), wherein the minimum value in 2011 was 31,5 mg.L-1 and the highest value was 30.5 mg.L^{-1} (in points A2 and C4, underwater) (for the 2014 samplings) and the maximum value was 32,3 mg.L-1 (for the 2011 samplings). These values are within what is usually recorded in the sea water of Angola.

Figure 4.52: Values of the Total Dissolved Solids (mg.l^{-1}) obtained in the different sampling points.

Laboratory Analysis

The laboratory results obtained for this study from the sampling described in item 4.5.1 of this chapter are listed in Table 4.9.

Table 4.9: Values obtained for the physical and chemical parameters in the sampling points.

Analysis	Unit.	B5	C3	C5	D2	D4	A1	A3	A5	B1	B3
NUTRIENTS											
Sulphate as dissolved SO_4	mg/l	2980	2730	2770	2910	2600	2820	2840	2850	2960	2700
Ammonium as N	µg/l	<5	592	14	<5	669	25	26	27	27	6
Chloride as Cl	mg/l	19800	18100	18700	19300	17200	19100	18300	19300	19800	17800

Analysis	Unit.	B5	C3	C5	D2	D4	A1	A3	A5	B1	B3
Total Phosphorus as P	mg/l	0.22	0.09	0.19	<0.05	0.25	<0.5	<0.5	0.40	<0.5	<0.5
Biological oxygen demand	µg/l	17.5	17.1	17.5	20.8	20.8	18	19	18.5	18.5	19.9
METALS											
Arsenic as dissolved As	µg/L	4	4	4	3	3	3	3	3	3	3
Cadmium as dissolved Cd	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	1.0	<0.5
Lead as dissolved Pb	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury as dissolved Hg	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrome as dissolved Cr	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper as dissolved Cu	µg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Nickel as dissolved Ni	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc as dissolved Zn	µg/L	<10	<10	16	<10	<10	<10	<10	16	<10	<10
POLYCYCLIC AROMATIC HYDROCARBONS											
Phenols	mg/	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Anthracene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Benz(a)anthracene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Benzopyrene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Benzo[bk]fluoranthene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Chrysene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Dibenzo [a, h] anthracene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Fluoranthene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Fluorene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Indeno [1,2,3-cd] pyrene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Naphthalene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Phenanthrene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Pyrene	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

- ✓ *Arsenic*

Arsenic has a complex biochemistry in the ocean, which has important implications in the toxicity of marine life, and its consumers (Neff, 2002). The concentrations of arsenic in coastal waters are usually higher than on the open sea, due to discharges of anthropogenic origin. According to USEPA (2014)[22], and as criteria to maintain the aquatic life, the maximum concentration of arsenic is 69 µg/l. The value found in the samples is below the recommended maximum value, in all points.

- ✓ *Cadmium*

Biologically, cadmium is a non-essential metal, and it is recognized for being highly toxic. Approximately 80% of the cadmium found in the coastal waters is complexed with colloidal or dissolved organic matter, and its average concentration in the South Atlantic Ocean varies between 0.028 and 0.084 µg/l (Neff, 2002). In marine waters (USEPA, 2014) the maximum concentration of cadmium is 40 µg/l, so the concentration obtained during the survey for this study is within the standard.

- ✓ *Zinc*

Most of the zinc found in the oceans results from atmospheric deposition. The zinc concentration in coastal waters is usually higher than on the open sea, similarly to arsenic, due to discharges of anthropogenic origin. The maximum concentration of zinc is 90 µg/l in saline waters (USEPA, 2014). The value found in the samples in all points was <10 µg/l, with the exception of point A5, which exhibited a value of 16 µg/l, even though it is still below the standard.

- ✓ *Lead*

Lead, as well as other metals found naturally in the oceans, and tissues of marine animals, and its average concentration in the surface waters of the South Atlantic Ocean is 0.03 µg/l (Neff, 2002). Although being released into the coastal waters through the discharge of man-made wastes, most of the lead found in the oceans comes from the atmosphere (Neff, 2002). In marine waters (USEPA, 2014) the maximum concentration of lead is 210 µg/l, a value well higher than the concentration obtained in the samples of this study (<5 µg/l).

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[22] USEPA - National Recommended Water Quality Criteria. Available at: http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#red, Access in: Aug/2014.

- ✓ *Mercury*

One important source of mercury in the oceans is atmospheric deposition. The flaring of fossil fuels is the main source of pollution by mercury. The mercury concentration in the coastal waters is higher than in the open sea, reaching levels higher than 0.02 µg/L. The discharge of industrial effluents into the water may increase the concentration of mercury (USEPA, 1986).

The USEPA standards (2014) indicate a maximum concentration of 1.8 µg/L, and CONAMA (2005) recommends 0.2 µg/L. The values obtained in this campaign for mercury are below the USEPA standards. However it is not possible to determine if this value is higher than the CONAMA standards, since the results obtained display concentrations inferior to the Limit of Detection (LoD).

- ✓ *Hydrocarbons*

Hydrocarbons consist basically of carbon and hydrogen, containing some trace metals such as iron, copper, aluminium, cobalt, titanium, magnesium, calcium, zinc, and barium, among others. The source of anthropogenic contamination of the oil in the sea includes the accidental spill of fuel from ships and oil platforms/rigs. Oil is less dense than water, and it is biodegradable. Since it floats on the surface of the water, a major impact on the environment from the oil results in a suppressing layer, unless it is previously physically or chemically dispersed (ANZECC, 2000). Direct toxic effects were recorded in the field after diesel spills; particularly for fishes, benthonic organisms, bivalve molluscs, copepods, crabs, and other invertebrate animals. The values found for hydrocarbons in all the points, in the two campaigns are under the standard values of ANZECC (2000).

- ✓ *Nickel*

The bioconcentration of nickel is not a significant problem in aquatic environments. Its toxicity in the sea water increases with the decrease in salinity (ANZECC, 2000). The nickel element was always under the stipulated threshold of 70 µg/L (standard value for slightly or moderately disturbed systems), for all the standards compared with the results obtained.

- ✓ *Phenols*

There is no available data on the chronic toxicity of phenol in salt water, and species sensitive to this parameter (USEPA, 1986). According to CONAMA (2005) the maximum concentration of phenol in salt water is 60 µg/L, being the values found in the study area inferior to this threshold.

- ✓ *BOD*

The BOD (Biochemical Oxygen Demand) of water is the quantity of oxygen required to oxidate organic matter through aerobic microbial decomposition, to originate a stable inorganic form. High values indicate the existence of great quantities of organic matter, as shown in points D2 and D4.

4.6.2. MICROBIOLOGICAL PARAMETERS

The water may contain certain microorganisms that are harmful to the health of human beings, especially some pathogenic bacteria. The main bacteria used as an indicator of faecal pollution in the water are members of the coliform group, particularly the *Escherichia coli (E. coli)*. *E. coli* is exclusively of faecal origin, and always exists in high densities in the feces of humans, mammals, and birds (CETESB, 2015).

Therefore, determining the concentration of these parameters becomes extremely important, given that it is an indicator of the potential existence of enteric pathogenic microorganisms that are responsible for the transmission of waterborne diseases, as well as the existence of any other component in the domestic sewage.

As such, water samples were collected in the different points listed in section 4.5.7, and sent to the laboratory of Ambiáfrica in Luanda. The results of the analysed samples enabled the acknowledgement that the water of the study area in the sampling points, regarding the bacteriological parameters, is contaminated by the existence of these organisms, being recorded higher values in the para-lagoon of Corimba (points D2 and D4).

The existence of such organisms is probably associated with the discharge of domestic effluents into the lagoon without prior treatment, which has been resulting in the degradation of the system. Such domestic effluents are originated in the houses that exist in the surroundings, as well as the houses that exist along the drainage lines that end in the Mussulo Lagoon, Corimba, and Samba/Chicala.

The health conditions of the Chicala lagoon are strongly impacted, with high levels of contamination in some of the sampling points, as validated in Table 4.10. Among the most degraded areas there are those located near major human settlements, or the mouth of the sewage pipes (points D2 and D4).

Table 4.10: Results of the bacteriological parameters analysed in the sampling points.

Point	E.Coli (Number/100mL	Faecal Coliforms (Number/100mL)	Coliform Bacteria (Number/100mL)
C3	385	866	3,285
B1	169	25	895
A1	233	33	1,553
D2	3,008	1,724	7,766
D4	2,613	9,208	12,997

In a 2010 campaign, at some sampling points, forming units of faecal coliform colonies were also detected on a small scale (1 or 2). The analyses carried out in early October 2010 by Sonangol's Central Laboratory, at the request of the Implementation Committee of the Tourism Development Pole Management Office of the Futungo de Belas and Mussulo, indicate that in terms of faecal coliforms and faecal streptococci, contamination only fell upon 2 of the 10 sampling points located near the lagoon continental surroundings and called Futungo, Rotunda-Corimba and Embarcadouro-Capossoka, and a higher concentration of forming units of faecal streptococci colonies compared to coliforms was observed. However, the number of colony forming units was not as high when compared to the results obtained for *Staphylococcus aureus*, and the sampling point called Futungo showed a higher coliform concentration (60 CFU at the surface and 100 CFU at the bottom) and streptococci (500 CFU at the surface and 1.700 CFU at the bottom). The coliform group is a large group of bacteria that have been isolated from samples of polluted and unpolluted waters and soils, as well as from feces of humans and other warm blooded animals. The existence of such colonies is an indication of the presence of faecal material in the water, since they are part of the normal flora of the digestive tract and are relatively resistant.

In terms of *Pseudomonas aeruginosa*, its presence was only detected in samples 2F and 3. In analyses carried out in early October 2010 by the Sonangol's Central Laboratory, at the request of the Implementation Committee of the Tourism Development Pole Management Office of the Futungo de Belas and Mussulo, the presence of Pseudomonas has been detected in all sampling points located on the Lagoon continental side. *Pseudomonas aeruginosa* is a bacteria whose source environment is the soil, but it is able to live in other environments as well as being an opportunistic pathogen.

The existence of thermotolerant coliforms indicates a recent contamination, originated from the discharge of domestic sewage, or animal feces.

4.7. MARINE AND COASTAL BIODIVERSITY

The field work undertaken in the region, as well as visits, reports, and a collection of samples for analysis served as indicators that represent, and where used to describe the biological community, e.g. phytoplankton, zooplankton, benthos, fishes, reptiles, birds, and mammals..

Representative samples were collected in the study area, with the use of 25µ and 55µ nets respectively, with which trawling was performed in the water column, in points A1, B3, C4, D2, and D4 (Figure 4.53), in order to analyse the phytoplankton and zooplankton.

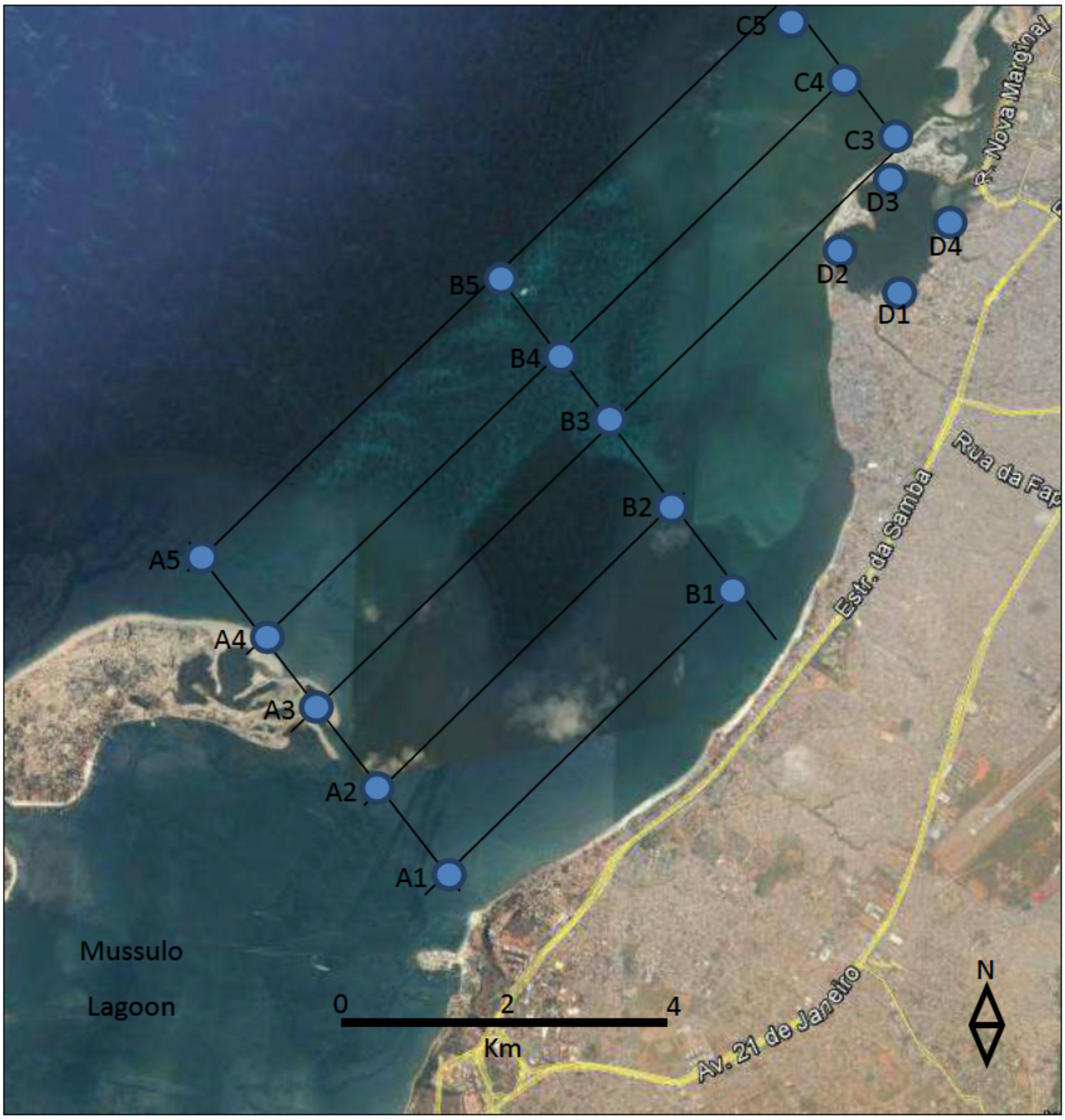


Figure 4.53: Sampling points used in the field surveys.

The samples were preserved in formaldehyde 2%, and sent to the laboratory of ecology of the Faculty of Sciences of Universidade Agostinho Neto (UAN) for screening and analysis.

Sediment was collected in points A1, A3, B1, B3, B4, C3, C4, D2, and D4 (Figure 4.53) to determine the benthic community, screening the organisms under different measures, and preserving them in formaldehyde 10%. The collected product was equally sent to the laboratory of ecology of the Faculty of Sciences for further analysis.

The ichthyofauna was determined based on bibliographical references, and the reptiles, birds, and mammals from references, and sighted during the collection of water and sediment samples.

4.7.1. PHYTOPLANKTON

✓ *Phytoplankton Composition*

During the analysis of the composition of the phytoplankton community in the study area, they were represented in the form of 36 taxa, being 19 identified as generic, and 17 as specific. The distribution of the different forms (Genus and Species) recorded in the different classes were the following: *Dinophyceae*, with 25 taxa (11 Genera and 14 Species); *Diatomaphyceae* with 11 taxa (8 Genera and 3 Species) (**Table 4.11**).

Table 4.11: Qualitative composition of the phytoplankton community in the study area (June 2014).

Class	Species
Diatomaphyceae	*Chaetoceros* sp
	Coscinodiscus sp
	Ditylium sp
	Gyrosigma acuminatum
	Leptocylindrus minimus
	Navicula sp
	Nitzschia sp
	Rhizosolenia sp
	Striatella unipunctata
	Surirella sp
	Thalassiothrix sp
Dinophyceae	*Alexandrium affine*
	Alexandrium sp
	Ceratium birundinella
	Ceratium furca
	Ceratium fusus
	Ceratium lineatum
	Ceratium sp
	Dinophysis sp

Class	Species
	Girodinium sp
	Gonyaulax sp
	Gymnodinium catenatum
	Noctiluca sp
	Peridinium sp
	Prorocentrum concavum
	Prorocentrum micans
	Prorocentrum minimum
	Prorocentrum sp
	Prorocentrum recticulatum
	Protoceratium sp
	Protoperidinium conicum
	Protoperidinium diabolicus
	Protoperidinium divergens
	Protoperidinium sp

✓ *Abundance and dominancy*

Figure 4.54 shows the variation in abundance of the different groups of phytoplankton organisms that exist in the study zone. In this work, the group of Dinophyceae was the most representative during the survey period with 67%, followed by the Diatomaceae with 33%.

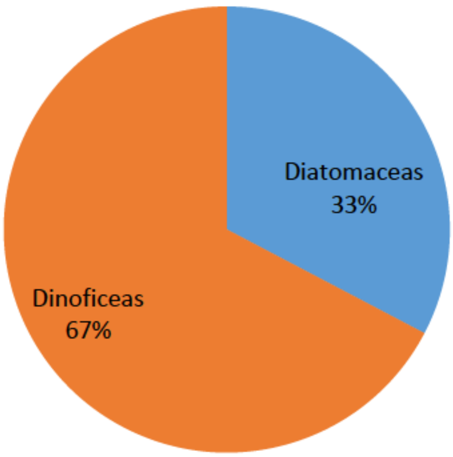


Figure 4.54: Abundance of the phytoplankton community groups recorded during the survey period (June 2014).

Sample D4 exhibited the highest number of cells; nearly 242,105 ind/L. *Leptocylindrus minimus* had the most abundant rate with 70,175 ind./L, followed by *Gymnodinium catenatum* with 61,404 ind/L. The less representative sample was D2 with 36,842 ind./L. *Leptocylindrus minimus* had the more abundant rate with 17,544 ind./L, followed by *Prorocentrum micans* with 8,772 ind./L (Figure 4.51).

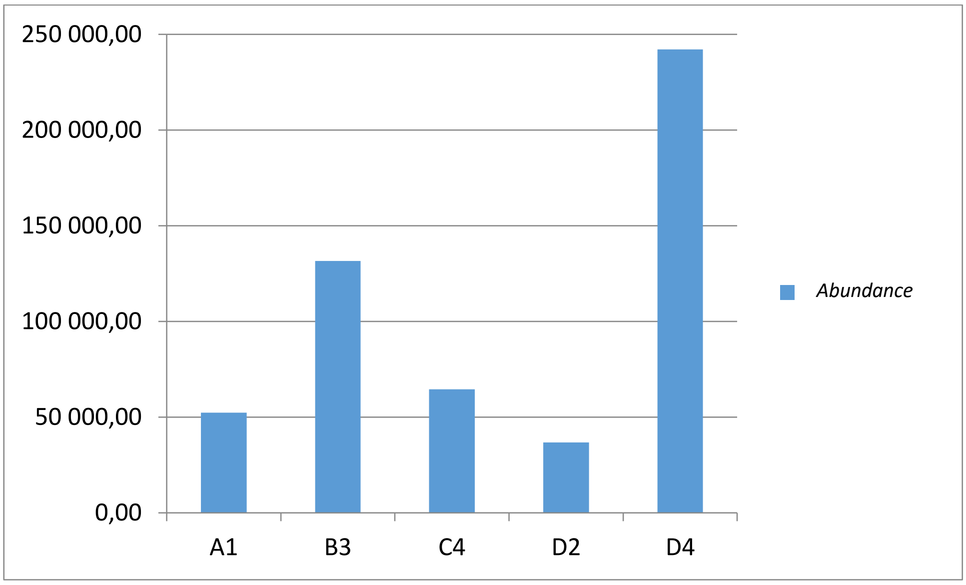


Figure 4.55: Abundance of the total phytoplankton per sample during the survey period (June 2014).

According to Branco, (1991), the Diatomaceae exhibit a characteristic, which is its permanent existence throughout the year in the plankton, being also considered "opportunists", increasing in density when populations of other phytoplanktonic groups decline after environmental disturbances, such as a higher input of nutrients for the system. In this study the Diatomaceae became secondary in terms of abundance, being outnumbered by the Dinophyceae.

According to ODA & BICUDO (2006), the Dinophyceae may be used as indicators of oligotrophy in the system, since these populations exhibit their stronger development during the period of depletion of nutrients in the system, contrary to the remaining phytoplankton groups. Thus, the dominance of the Dinophyceae in this study may be probably associated with the abovementioned factor. To be noted that some species that produce toxins were found, namely *Gymnidinium catenatum, Prorocentrum concavum*, and *Prorocentrum minimum.*

The species having direct interaction with the said area and which may be harmed by environment changes are those belonging to the diatomaceous group in particular the *Rhizosolenia indica* and the *Asterionella japonica*. Due to the high possibility that diatomaceous have in terms of replacing the species, it is possible to say that in past studies done by Silva & Rangel (2006) in the said area, the dominant species also belonged to the diatomaceous group, with emphasis on *Navicula directa* and *Chaetoceros curvisetus*.

4.7.2. ZOOPLANKTON

- ✓ *Composition of the Zooplankton*

In the study area for Phases 1 and 3, 14 zooplanktonic groups have been identified, namely: Copepods, Tintinnids, Appendiculariens, Polychaetes, Isopods, Cladocerans, Gastropods, Chaetognaths, Ostracods, Bivalves, Decapods, Pteropods and Siphonophores. During the analysis of the composition of the zooplankton community in the study area of Phase 4, the occurrence of 28 taxa was recorded, being 19 identified as generic, and belonging to the copepods, or mesozooplankton, and the remaining individuals belong to the permanent Holoplankton, and the temporary Meroplankton.

The distribution of the different groups found is as follows: Copepods with 19 taxa; the permanent Holoplankton with 8 taxa, while the temporary Meroplankton was represented by 1 taxa (**Table 4.12**).

Table 4.12: Qualitative composition of the zooplankton in the study area.

Group	Genera			
Copepods	*Calanus*	*Temora*	*Oncaea*	*Centropages*
	Corycaeus	*Pareucalanus*	*Acartia*	*Calanoides*
	Harpacticoides	*Subeucalans*	*Aetideus*	*Euchaeta*
	Copépodes Nauplius	*Pequenos copépodes*	*Euchaeta*	*Eucalanus*

	Metridia	*Oithona*	*Paracalanus*	
Permanent Holoplankton	*Medusae*	*Chaetognathas*	*Furcilia*	*Siphonophores*
	Ostracodes	*Mysidaceos*	*Appendicularia*	*Decapodes*
Temporary Meroplankton	*Polychaetas*			

✓ *Abundance and dominancy*

The copepods were the most representative group in this work, during the survey period, with 100% in points D2 and D4 Figure 4.56), both in the area of Phases 1 and 3 and in the area of Phase 4.

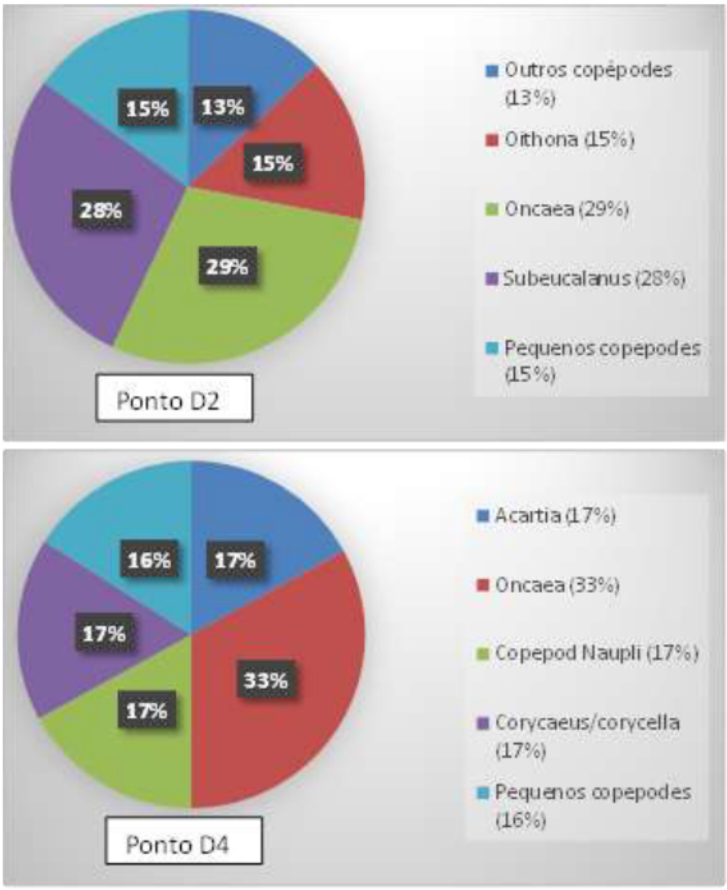


Figure 4.56: Abundance of the groups of the zooplankton community recorded in points D2 and D4.

In points A3, B3, and C4, the copepods were representative with 99%, 85%, and 95% respectively (Figure 4.57).

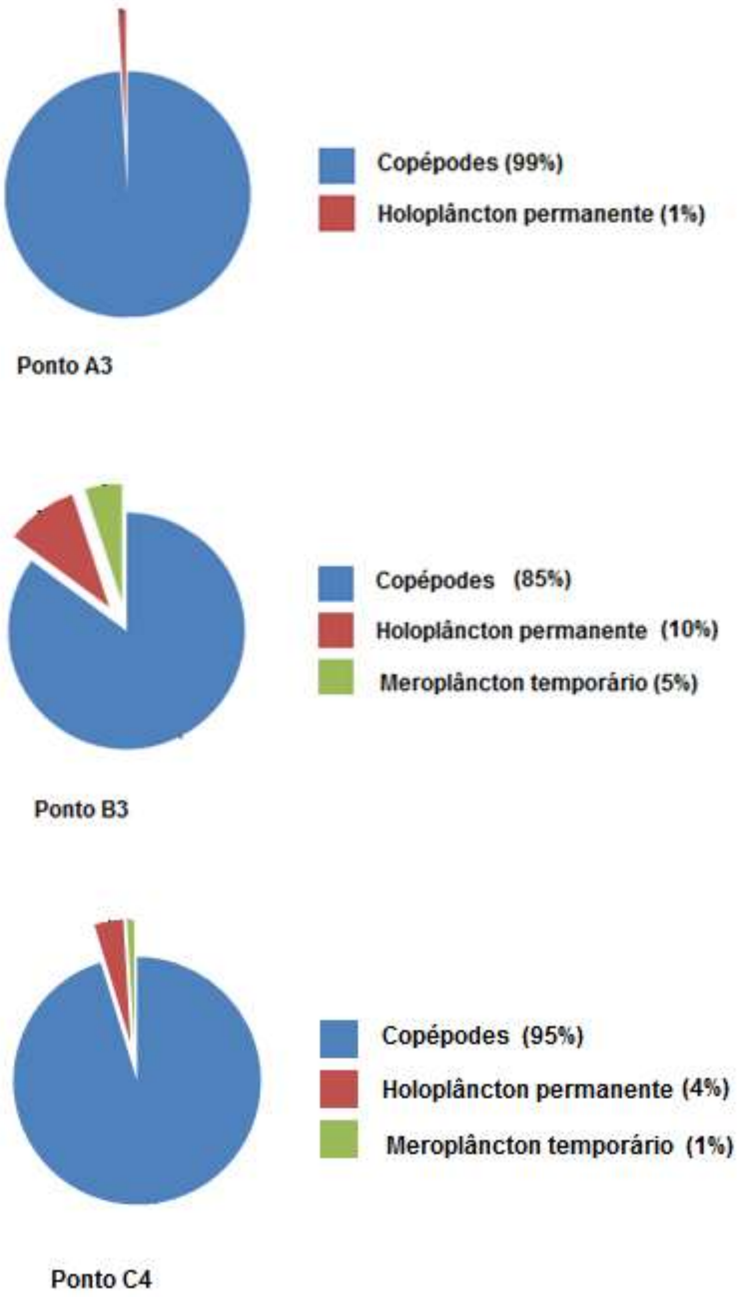


Figure 4.57: Abundance of the zooplankton community groups recorded during the survey period in points A3, B3, and C4.

Point A3 exhibited the highest number of individuals, with 707 ind/m^3, between the points under analysis, while point D4 exhibited the lowest number of individuals with 6 ind/m^3 (Figure 4.58).

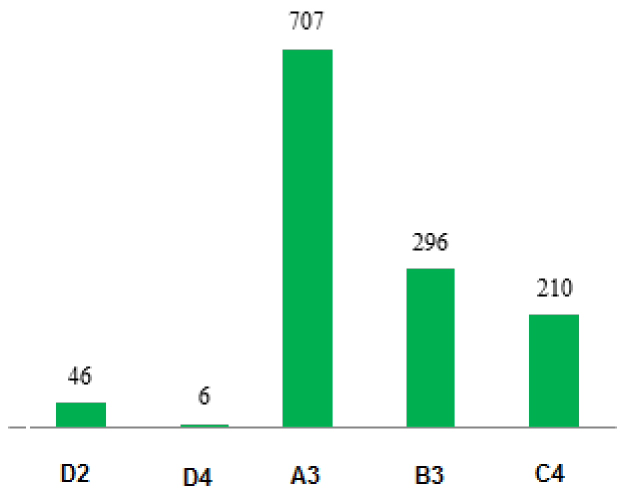


Figure 4.58: Density of the zooplankton community recorded in the sampling points in ind/m^3.

Zooplankton is the second link of the food chain in aquatic ecosystems: these organisms feed on the phytoplankton, and bacterioplankton – they are primary consumers, even though there are some predators in this group, which in turn serve as food for the larger organisms. Some species of whales feed on "krill" almost exclusively, a small pelagic shrimp, extremely abundant in the warm waters of oceans.

In addition, the zooplankton may be used as an indicator of the water quality, since these small organisms respond rapidly to the modifications to the environment, such as when the emission of chemical pollutants, and the discharge of sewage occurs.

According to Tundisi (1970) in aquatic ecosystems the copepods are usually the most important components of the Mesozooplankton in terms of abundance and biomass, acting as an important link, transferring energy, and the organic matter between the primary producers, and animals of superior trophic levels, such as planktivorous fishes, and invertebrate carnivores.

4.7.3. BENTHIC FAUNA

✓ *Identification of the existing taxa*

During the analysis of the benthic material that resulted from the screening of the sediment in eight (8) sampling points in the Corimba Bay, a total of 226 individuals were recorded. The phyla with more representation are *Mollusca* (60%), *Annelida* (19%), and *Crustacea* (13%). The phyla *Annelida*, *Cephalochordata*, *Nemertina*, *Nematoda,* and *Nematomorpha* contribute with values inferior to 5% (Figure 4.59).

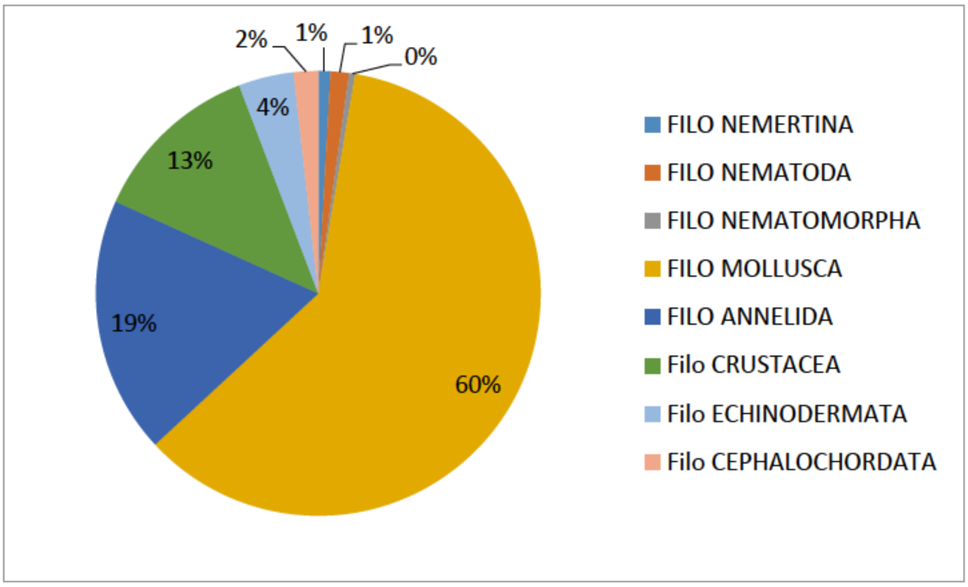


Figure 4.59: Composition of the benthic fauna that exists in the Corimba Bay.

✓ *Distribution of the community in the sampling points*

While analyzing the samples, it was possible to confirm that phyla *Mollusca* and *Annelida* exist in the entire study area, with the exception of Point D4. The location with the highest diversity of animal phyla is Point A3, with five (5) phyla (*Nematoda*, *Nematomorpha*, *Mollusca*, *Annelida*, and *Crustacea*). Points A1, B4, and D2 are the less diversified, with only two phyla (Figure 4.60).

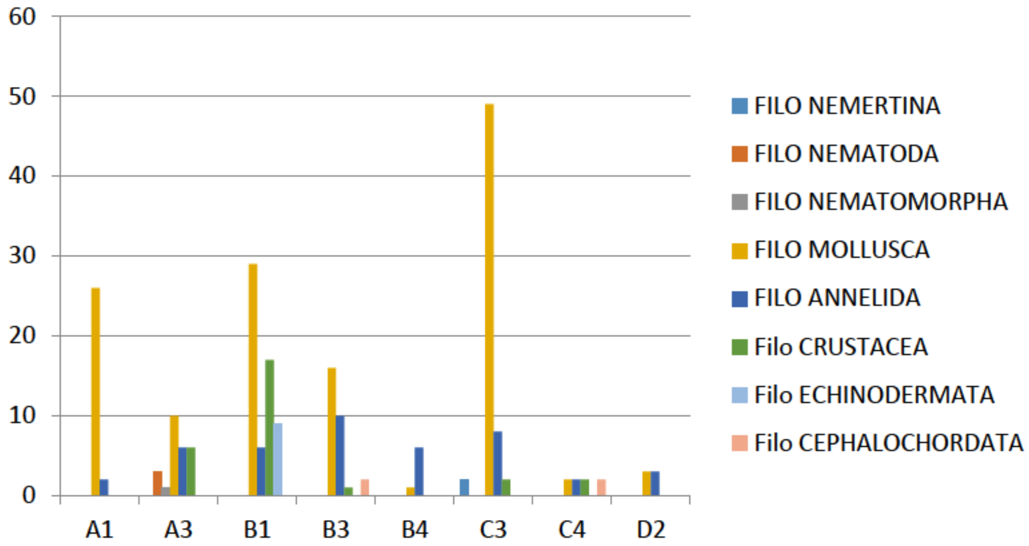


Figure 4.60: Composition of the fauna in the different sampling points of Corimba Bay.

Table 4.13 shows the fauna that exists in the sediment of the different sampling points. The "x" designates the existence of empty shells.

Table 4.13: Fauna that exists in the sediment of the different sampling points.

Taxa	Point							
	A1	A3	B1	B3	B4	C3	C4	D2
PHYLUM NEMERTINA						2		
PHYLUM NEMATODA		3						
PHYLUM NEMATOMORPHA (?)		1						
PHYLUM MOLLUSCA								
Class POLYPLACOPHORA								
Chiton sp			7					
Class GASTROPODA								
O. ARCHAEOGASTROPODA								
Family Trochidae	x							
Trochus sp			5					
Gibbula sp						1		
O. MESOGASTROPODA								
Family Rissoidae								
Rissoa parva				x				
Rissoa inconspicua						23		
Rissoa sp	8	x	5	x				x
Family Cerithiidae								

Taxa	Point							
	A1	A3	B1	B3	B4	C3	C4	D2
Cerithium sp			x					
Family Turritellidae								
Turritella sp	x							2
Family Hidrobiidae								
Hydrobia sp					1	5		
Family Eulimidae	x							
Eulima sp						19		
Family Calyptraeidae								
Crepidula porcelana								
Crepidula sp	x	1				x		x
Order NEOGASTROPODA								
Family Nassariidae								
Nassarius sp	x							
Family Marginellidae								
Marginella sp		x						
Family Conidae								
Conus sp					x		2	
Family Cysticidae								
Gibberula sp		x						x
Family Turridae								
Family Terebridae								
Terebra sp	x	x		x				
Cerithiopsis	x							
Family Epitoniidae	1							
O. HETEROSTROPHA								
Family Bullidae	1							
Subcl. Opistobranchia			4					
Family Architectonicidae								
Architectonica nobilis		1		15				
Architectonica sp		4	3					x
Family Pyramidellidae		x						
Turbonilla sp			x					
Class BIVALVIA								
Family Nuculanidae								
Leda sp	12		3					
Family Pectinidae								
Pecten sp						1		
Family Ostreidae								

Taxa	Point							
	A1	A3	B1	B3	B4	C3	C4	D2
Family Tellinidae								
Tellina mars		2						
Tellina sp	2							
Family Veneridae								
Venus sp			2					
Dosinia sp	2	2		1				1
Family Cardiidae								
PHYLUM ANNELIDA								
Class Oligochaeta								
Oligochaeta n.i.								
Class POLYCHAETA								
Polychaeta n.i.		2			1			
Order PHYLLODOCIDA								
Family Syllidae								
Syllidae n.i.								
Sphaerosyllis						1		
Family Nereididae								
Platynereis sp				2				
Family Glyceridae		1			2			
Glycera benguellana				1				
Glycera sp				4			1	3
Order EUNICIDA								
Family Eunicidae			2					
Eunice sp						5		
Nematonereis sp				1				
Family Lumbrineridae								
Lumbrineris sp		3						
Order ORBINIIDA								
Family Orbiniidae								
Scoloplos sp						1		
Order AMPHINOMIDA								
Family Amphinomidae								
Eurithoe sp			1					
Order SPIONIDA				2				
Family Spionidae								
Spionidae n.i.								
Scolelepis sp					3			

Taxa	Point							
	A1	A3	B1	B3	B4	C3	C4	D2
Polydora ciliata?	1							
Polydora caeca								
Order CAPITELLIDA								
Family Arenicolidae							1	
Order TEREBELLIDA								
Family Terebellidae			1					
Family Cirratulidae								
Cirratulus sp			2					
Cirriformia sp						1		
Order OPHELIIDA								
Family Opheliidae								
Order SABELLIDA								
Family Sabellidae								
Sabella sp								
Phylum CRUSTACEA								
Class Cirripedia								
Order Thoracica								
Balanus sp								
Class Malacostraca								
Order Decapoda								
Suborder Dendrobranchiata			15					
Suborder Pleocyemata								
Family Portunidae								
Cronius ruber								
Family Penaeidae						2		
Family Paguridae			1					
Family Leucosiidae			1					
Suborder Natantia								
Order Cumacea								
Bodotria scorpioides		2						
Order Amphipoda		4		1				
Family Gammaridae								
Gammarus sp								
Family Ampithoidae								
Ampithoe sp								
Family Melitidae								
Order Isopoda								

Taxa	Point							
	A1	A3	B1	B3	B4	C3	C4	D2
Order Tanaidacea							2	
Family Leptochelidae								
Phylum ECHINODERMATA								
Class Ophiuroidea			8					
Class Echinoidea								
Strongylocentrotus			1					
Phylum UROCHORDATA								
Class Ascidiacea								
Styela sp								
Phylum CEPHALOCHORDATA				2			2	

- ✓ *Assessment of the sensitivity of the disturbance*

Taking into account the direct effects of the dredging process on the benthic organisms, and the buildup of sediment, as well as the recovery capacity of these organisms, these can be classified as robust, vulnerable, and of intermediate vulnerability. Table 4.14 lists the genera that are detailed in the literature and classified in the categories of vulnerable, and of intermediate vulnerability.

Table 4.14: Sensitivity to the dredging effects of some benthic macroinvertebrates.

Vulnerable	Intermediate Vulnerability
Mollusca ***Chiton*** ***Dosinia***	**Mollusca** *Crepidula*
Annelida ***Lumbrineris*** ***Sphaerosyllis***	**Annelida** *Glycera* *Scoloplos*
Urochordata ***Styela***	

Even though it was not possible to identify the genus of the ophiuroids, it is important to note that some species are considered vulnerable. These organisms are fragile, even though they are capable of regenerating their arms. They seem to have some capacity to reappear from small quantities of sediment resulting from the dredging effects, but it is unlikely that they are capable of tolerating a significant overload of sand in the landfill.

4.7.4. ICHTHYOFAUNA

The data that was taken into consideration derived from the information described in the bibliography, reports from fishermen, and the experience of the consultancy group on the subject-matter. The objective is to provide a summary of the major resources with potential to occur in the surroundings of the project.

The fact that the Corimba seafront is connected to the Mussulo Basin, and it comprises mangroves, enhances the ichthyological biodiversity for the ecological characteristics, which in normal conditions these provide. Amongst the species of fishes that use the system the following are highlighted: shoals of juvenile snappers (*Lutjanus sp.),* groupers (*Cephalopholis sp.*), striped seabreams/sand steenbras (*Lithognathus mormyrus*), mulets (*Liza sp*.), parrot grunts (*Ponadasys peroteti*), as well as jacks (*Caranx sp*.) and barracudas (*Sphyraena sp.*).

On the other hand, the existence of protected waters in the Chicala lagoon, provides a condition to recreate innumerable species of the ichthyological component, with some interest for the maintenance of coastal ecological niches, and from an economic standpoint.

To be noted that the existence of shoals of fish provides the fishing resource for numerous fishermen that depend on fishing for their livelihood, since they are a factor of tourist attraction for sport fishing. Another important aspect from an ecological standpoint is the availability of food for numerous aquatic birds that inhabit or visit the lagoon system of the Mussulo Bay and Chicala.

Figure 4.61 illustrates migratory corridors of access by the ichthyological component to the Mussulo and Chicala Bays, most notably the Chicala Bay as a development point of certain species. It should be noted that this migratory transition zone provides the possibility of an ecosystemic functionality associated to the energy component, relatively important, since there are various trophic levels, with emphasis on predatory fish.

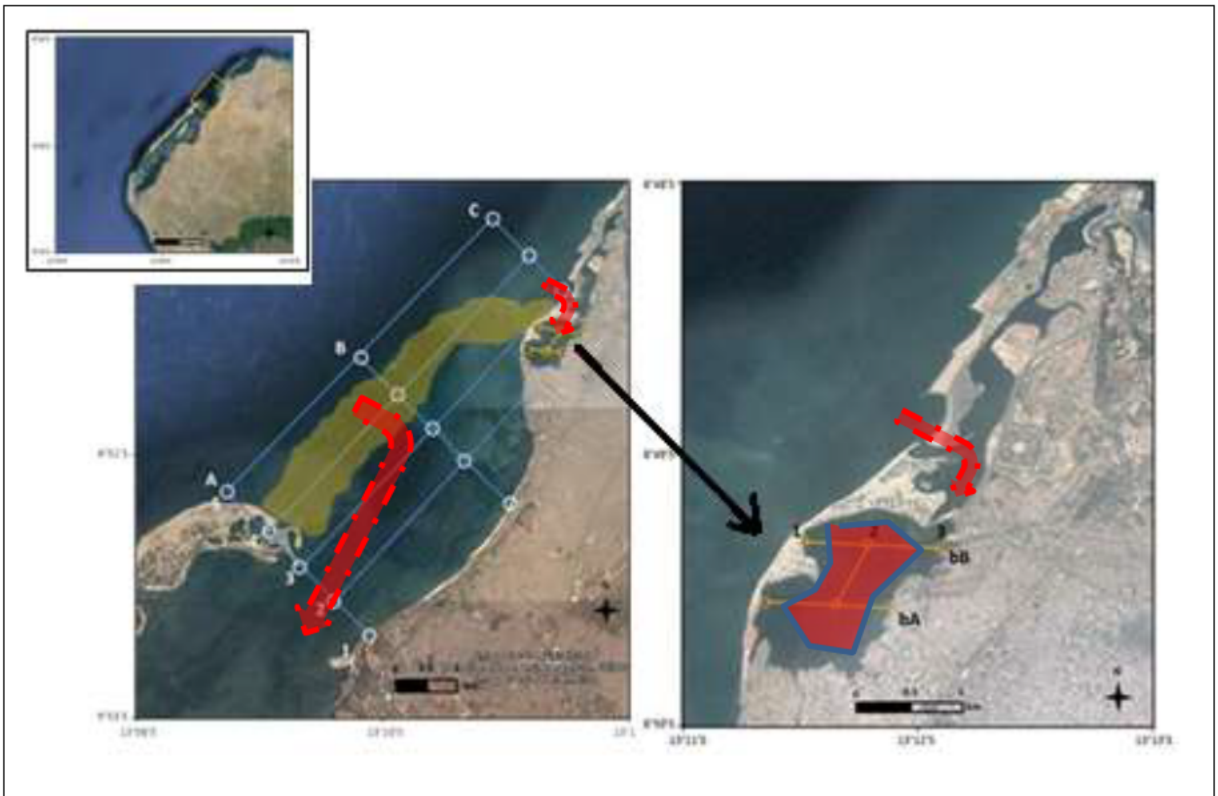


Figure 4.61: Ecological corridors and development point of fish species in the study area.

4.7.5. AQUATIC REPTILES

The species of marine turtles such as the Green Turtle (*Chelonia mydas*), and the Olive Ridley Turtle (*Lepidochelys olivacea*) do not exist in the waters of the Mussulo Basin, and near the Corimba region, in different stages of the life cycle, and in a certain period. To be noted that the lagoon system of Mussulo is considered a development location for these marine reptiles. The characteristics described for the Mussulo Basin, namely the shallow waters associated with the coastline of mangroves, where there is a muddy and sandy seabed, rich in debris, benthic animals, mollusks, and crustaceans comprise an adequate habitat for the *Lepidochelys olivacea*. There are references of the existence of a submerged vegetation, where the physical characters, and the shallow waters provide optimal conditions for the development of *Chelonia mydas*. Also the extension of the submerged sandy shoreline from the Extremity of Mussulo up to the Chicala isthmus is considered the food location of Green Turtles, which are frequently sighted.

It should be noted that this system is still one of the few development points for the Green Turtle (*Chelonia mydas*) in the Angolan coast; being a protected species by the national legislation, and mentioned in the IUCN Red List of Threatened Species.

Figure 4.62 shows the nesting points of sea turtles on the Atlantic side of the northern end of Mussulo, as well as the migration corridor to the inside of Mussulo Bay. Moreover, the adjoining sedimentary bank between Mussulo and Chicala is a feeding place for green turtles.

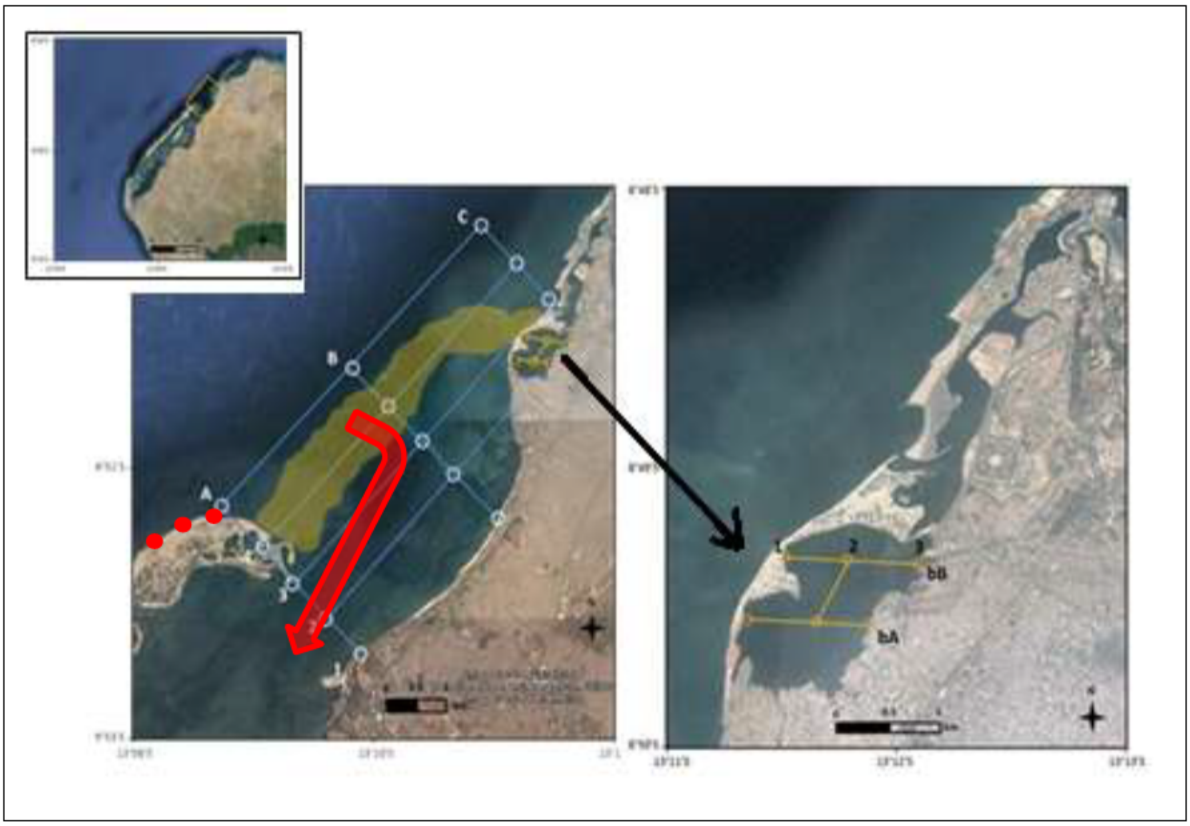


Figure 4.62: Nesting records and ecological corridors of sea turtles in the analysed system.

4.7.6. MARINE AND COASTAL BIRDS

The study region is adjacent to a major lagoon, the Mussulo Lagoon, with an extremely high biodiversity of birdlife. On the other hand, the small lagoon formed by sand banks in Chicala, also comprises a habitat for the fundamentally migratory birds to rest, and feed. In this context, it is natural the almost perpetual existence of birds associated with coastal environments along the full extent of the study area. On a general view, water birds cover here the most significant populations. Among them, migratory birds, some common and other rare, which use the lagoon system as breeding, feeding and/or resting spot and whose protection status is shown in **Table 4.15**.

Although no thorough study was conducted on the birdlife in the project insertion area, and since there are sufficient references of studies for this biodiversity segment of the region, some data was recorded, and comments were made at the time of the field surveys. Birds such as the openbill stork (*Anastomus lamelligerus*), white pelican (*Pelicanus onocratalus*) (see Figure 4.63), yellow beak stork (*Anastomus lamelligerus*), black beak stork (*Mycteria ibis*), Damara tern (*Sterna balaenarum*), royal tern (*Sterna maxima*) (see Figure 4.64), grey-headed gull (*Larus cirrocephalus*), are some examples of birds associated with coastal environments and which use the Mussulo lagoon system, and are listed by the IUCN red list as threatened species (see **Table 4.15**).

Figure 4.63: Presence of white pelicans (*Pelicanus onocratalus*) in the Mussulo Lagoon system.

Figure 4.64: Presence of royal tern (*Sterna maxima*) off the coast of the studied area.

The lagoon system also hosts large concentrations of long-tailed cormorant (*Phalacrocorax africanus*), grey herons (*Ardea cinerea*), black-headed herons (*Ardea melanocephala*), little egrets (*Egretta garzetta*), sacred ibis (*Threskiornis aethiopica*) (see Figure 4.65), among others, which use the mentioned system as breeding and feeding spot, as well as the quieter parts of the coastal zone of Futungo de Belas.

Associated with merely terrestrial and urban environments, given the change shown by the study area, common and wide geographical distribution species can be found. However, some special birds, for their endemism unique in the Angolan territory, such as the red-backed mousebird (*Colius castanotus*), should be taken into account, since these birds have been observed near agricultural areas (with fruit trees) present at the perimeter.

Figure 4.65: Presence of grey herons, little egrets and sacred ibis on the coastline of the studied area.

In general, migratory birds, some common and other rare, use the system as breeding, feeding and/or resting spot, mainly in the Northern end of the Mussulo Isthmus (see Figure 4.66), along the coast with direct connection to the open ocean, Saco dos Flamingos in the Southern end, Ilhéu dos Pássaros, Cazanga Island, and Cassende Mangrove on the continent. Figure 4.66 shows the main points of bird gathering associated with coastal and marine environments, where the Northern end of the Mussulo Isthmus represents a resting point, the area around the fishing port is regarded as a feeding point for opportunistic birds and the Chicala Bay can be seen as a resting and feeding point for birds, temporarily, and largely composed by migratory birds.

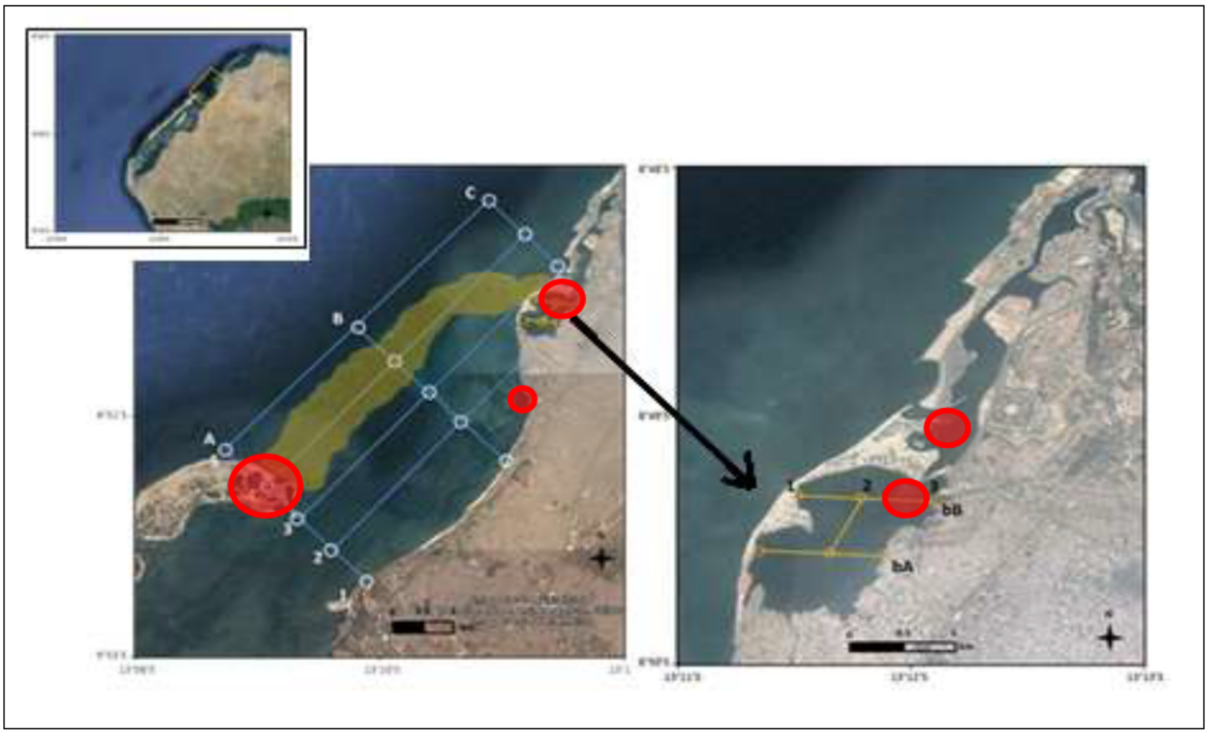


Figure 4.66: Resting and feeding points for birds associated with marine and coastal environments between the Mussulo-Corimba-Chicala complex.

Part of the birds sighted is migratory, using the system as an area to feed and/or rest. On the other hand, the existence of waste associated with the fishing activity, provides an opportunity for the birds to feed themselves (see Figure 4.67) or for resting (see Figure 4.68).

Figure 4.67: Presence of gulls, and sterns in the Chicala region, and cormorants in Corimba.

Figure 4.68: Resting and feeding of birds near the mangroves.

The following list (**Table 4.15**) may be considered as the most complete and updated available for the Project insertion zone, since the data collected over several field visits have been included and all the existing bibliography has been consulted. A total of 126 bird species has been registered.

Table 4.15: List of birds present at the Mussulo lagoon system.

Nat	Birds	*Scientific Name*	Conservation state	Protected
A	Cape gannet	*Sula capensis*	Endangered	Y
A	Cape cormorant	*Phalacrocorax capensis*		Y
A	Great cormorant	*Phalacrocorax carbo*		Y
A	Great white pelican	*Pelecanus onocrotalus*	Endangered	Y
A	Pink-backed pelican	*Pelecanus rufescens*	Endangered	Y
A	Grey heron	*Ardea cinerea*		Y
A	Purple heron	*Ardea purpurea*		Y
A	Goliath heron	*Ardea goliath*		Y
A	Black-headed heron	*Ardea melanocephala*		Y
A	Squacco heron	*Ardeola ralloides*		Y
A	Night heron	*Nyctocorax nyctocorax*		Y
A	Striated heron	*Butoroides striatus*		Y
A	Black heron	*Egretta ardesiaca*		Y

Nat	Birds	*Scientific Name*	Conservation state	Protected
A	Great white egret	*Egretta alba*		Y
A	Cattle egret	*Bubulcus ibis*		Y
A	Little egret	*Egretta garzetta*		Y
A	Intermediate egret	*Egretta intermedia*		Y
A	Hamerkop	*Scopus umbretta*		Y
A	Openbill stork	*Anastomus lamelligerus*		Y
A	Yellow-billed stork	*Mycteria ibis*	Endangered	Y
A	African spoonbill	*Platalea alba*		Y
A	African sacred ibis	*Threskiornis aethiopica*		Y
A	Flamingo	*Phoenicopterus ruber*	Endangered	Y
A	Lesser flamingo	*Phoenicopterus minor*	Endangered	Y
A	Cape teal	*Anas capensis*		Y
A	African fish eagle	*Haliaetus vocifer*	Endangered	Y
A	Osprey	*Pandion haliaetus*		Y
AT	Palm-nut vulture	*Gypohierax angolensis*		Y
T	Black-winged kite	*Elanus caeruleus*		Y
T	Black kite	*Milvus migrans*		Y
T	Common kestrel	*Falco tinnunculus*		Y
T	Common buttonquail	*Turnix sylvatica*		Y
A	Greater painted-snipe	*Rostratula benghalensis*		Y
A	Pied avocet	*Recurvirostra avocetta*		Y
A	Collared pratincole	*Glareola pratincola*		Y
A	Bar-tailed godwit	*Limosa laponica*		Y
A	Whimbrel	*Numenius phaeopus*		Y
A	Curlew	*Numenius aquata*		Y
A	Oystercatcher	*Haematopus ostralegus*	Endangered	Y
A	Black-winged stilt	*Himantopus himantopus*		Y
A	Water thick-knee	*Burhinus vermiculatus*		Y
A	Ruddy turnstone	*Arenaria interpes*		Y
A	Common ringed plover	*Charadrius hiaticula*		Y
A	Kittlitz's plover	*Charadrius pecuarius*		Y
A	Three-banded plover	*Charadrius tricollaris*		Y
A	White-fronted plover	*Charadrius marginatus*		Y

Nat	Birds	*Scientific Name*	Conservation state	Protected
A	Caspian plover	*Charadrius asiaticus*		Y
A	Lesser sand plover	*Charadrius mongolus*		Y
A	Red knot	*Calidris canutus*		Y
A	Curlew sandpiper	*Calidris ferruginea*		Y
A	Sanderling	*Calidris alba*		Y
A	Little stint	*Calidris minuta*		Y
A	Ruff	*Philomachus pugnax*		Y
A	Grey plover	*Pluvialis squatarola*		Y
A	Common greenshank	*Tringa nebularia*		Y
A	Green sandpiper	*Tringa ochropus*		Y
A	Common redshank	*Tringa totanus*		Y
A	Marsh sandpiper	*Tringa stagnatilis*		Y
A	Common sandpiper	*Actitis hypoleucus*		Y
A	Pomarine jaeger	*Stercorarius pomarinus*		Y
A	Parasite jaeger	*Stercorarius parasiticus*		Y
A	Kelp gull	*Larus dominicanus*		Y
A	Sabine's gull	*Larus sabini*		Y
A	Grey-headed gull	*Larus cirrocephalus*	Endangered	Y
A	Lesser black-headed gull	*Larus fuscus*		Y
A	Royal tern	*Sterna maxima*	Endangered	Y
A	Sandwich tern	*Sterna sandvisencis*		Y
A	Gull-billed tern	*Gelochelidon nilotica*		Y
A	Arctic tern	*Sterna paradisea*		Y
A	Common tern	*Sterna hirundo*		Y
A	Caspian tern	*Sterna caspia*	Endangered	Y
A	Damara tern	*Sterna balaenarum*	Endangered	Y
A	Black tern	*Chlidonias niger*		Y
T	Namaqua dove	*Oenas capensis*		Y
T	Red-eyed dove	*Streptopelia semitorquata*		Y
T	Ring-necked dov	*Streptopelia capicola*		Y
T	Laughing dove	*Streptopelia senegalensis*		Y
T	Red-faced mousebird	*Urocolius indicus*		Y
T	Red-backed mousebird	*Colius castanotus**		Y

Nat	Birds	*Scientific Name*	Conservation state	Protected
T	Lilac-breasted roller	*Coracias caudata*		Y
T	Didric cuckoo	*Chrysoccocyx caprius*		Y
T	Square-tailed nightjar	*Caprimulgus fossii*		Y
T	African grass owl	*Tyto capensis*		Y
T	Senegal coucal	*Centropus senegalensis*		Y
T	White-browed coucal	*Centropus superciliosus*		Y
T	Anfricn palm swift	*Cypsiurus parvus*		Y
T	Little bee-eater	*Merops pusillus*		Y
T	Blue-cheeked bee-eater	*Merops persicus*		Y
T	Crowned hornbill	*Tockus alboterminatus*		Y
T	Southern yellow-billed hornbill	*Tockus leucomelas*		Y
A	Pied kingfisher	*Ceryle rudis*		Y
AT	Woodland kingfisher	*Halcyon senegalensis*		Y
T	Striped kingfisher	*Halcyon chelicuti*		Y
T	Rufous-naped lark	*Mirafra africana*		Y
T	Barn swallow	*Hirundo rustica*		Y
T	Long-legged pipit	*Anthus pallidiventris*		Y
T	Yellow-bellied greenbul	*Chlorocichla flaviventris*		Y
T	Dark-capped bulbul	*Pycnonotus tricolor*		Y
T	Rufous-tailed palm thrush	*Cichladusa ruficauda*		Y
T	White-browed scrub robin	*Cercotrichas leucophrys*		Y
T	Bubbling cisticola	*Cisticola bulliens*		Y
T	Desert cisticola	*Cisticola aridulus*		Y
T	Spotted flycatcher	*Muscicapa striata*		Y
T	Purple-banded sunbird	*Nectarinia bifasciata*		Y
T	Southern white-crowned shrike	*Eurocephalus anguitimens*		Y
T	Lesser grey shrike	*Lanius minor*		Y
T	Brown-crowned tchagra	*Tchagra australis*		Y
T	Black-crowned tchagra	*Tchagra senegala*		Y
T	Swamp boubou	*Laniarius bicolor*		Y
T	Fork-tailed drongo	*Dicrurus adsimilis*		Y
T	Pied crow	*Corvus albus*		Y
T	Cape glossy starling	*Lamprotornis nitens*		Y

Nat	Birds	*Scientific Name*	Conservation state	Protected
T	Northern grey-headed sparrow	*Passer griseus*		Y
T	Southern grey-headed sparrow	*Passer diffusus*		Y
T	House sparrow	*Passer domesticus*		Y
T	Holub's golden weaver	*Ploceus xanthops*		Y
T	pectacled weaver	*Ploceus ocularis*		Y
T	Lesser masked weaver	*Ploceus intermedius*		Y
T	Village weaver	*Ploceus cucullatus*		Y
T	Red-billed quelea	*Quelea quelea*		Y
T	Blue waxbill	*Uraeginthus angolensis*		Y
T	Golden-backed bishop	*Euplectes aureus**		Y
T	Bronze mannikin	*Spermestes cucullatus*		Y
T	Pin-tailed whydah	*Vidua macroura*		Y
T	Yellow-fronted canary	*Serinus mozambicus*		Y
T	Lark-like bunting	*Emberiza impetuani*		Y

Notes:

* Endemic Angolan species

1) Nature. The first column distinguishes organisms according to their markedly aquatic or terrestrial nature, depicted with A or T respectively.

2) Group. The second column shows the organism group, with its vernacular name.

3) Scientific name. Here, the scientific name is referred to according to the latest nomenclature in use.

4) Conservation state. Here, species are classified according to their condition known by the IUCN.

5) Legal condition in Angola (currently). Y – Protected; N – Not protected.

4.7.7. MARINE MAMMALS

The existence of marine mammals along the Angolan coast is common, and even frequent the presence of large cetaceans, such as the Humpback Whale (*Megaptera novaeangliae*), between August and November, off the Corimba coast. However, due to the existence of a significant sand bank between the Extremity of Mussulo and Chicala, they are not sighted near the beach.

Dolphins such as the Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) may also be sighted from time to time, including inside the Mussulo Bay.

4.1.8. ECOSYSTEM SERVICES

The project insertion area and its influence are directly connected to the Corimba and Chicala Bays, and indirectly to the Mussulo Bay. The Mussulo Bay offers unique conditions of the Angolan coast, providing a high value of the patrimonial and bioecological perspective. It is a system that offers conditions for developing countless species of ichthyological component, with respect to reproduction and development; it is a system that serves as a feeding point for sea turtles, as well as adult animal mating and immature animal development, and where a large number of birds finds reproduction, feeding and resting points.

The Corimba Bay, in turn, enables the connection between the offshore of the Mussulo-Corimba-Chicala system, with the Mussulo Bay, in which, due to its characteristics associated with sandbanks and holder of algae prairies, it provides feeding habitat for green turtles. In addition, it allows their migration as well as fish to the Mussulo Bay, and from the bay to the offshore towards the high sea.

Associated with the passage channels, it is also considered a feeding place for several predator species related to the Ichthyological fauna, which find a food source in the small migrating shoals. These shoals of small fish, also provide food for countless birds, many of which are migratory, either from the Palearctic, or from the northern hemisphere, which find resting points at the northeast end of the Mussulo isthmus. Still in the Corimba Bay, and due to the fishing zone existing there, the opportunistic presence of birds is noted in the neighbourhood.

The Chicala Bay, although showing a remarkable advanced state of environmental degradation, comprises a development site for countless species of fish, which promotes a feeding point for many migratory birds too.

With regard to the offshore, there is little information about the associated benthos, but it is believed that its condition is extensive to a large area, allowing a maturation of any surgically intervened environment, in a positive sense, associated with recolonisation by the existing biological community.

Given the foregoing and based on environmental surveys, one may consider the mentioned habitat, and directly affected by the Project, as follows:

- Corimba land-sea ecotone – Little sensitivity
- Corimba Bay – Low to medium sensitivity
- Chicala Bay - Low to medium sensitivity
- Offshore – Low sensitivity which should be confirmed with additional environmental surveys

This argument is due to the ecosystem current salubrity condition and to the activity intervention period expected to be short and with no significant change that goes against a specific loss of biodiversity, with the possibility of a reestablishment of the ecological functionality in a fast short time.

Thus, and having analysed Performance Standard 6, it may be considered that, in general, the Project insertion area is a **natural habitat** with certain elements showing an anthropic modification (e.g., landfill activities for the construction of the Southwest Marginal road, coastal protection or even expansion of the Mussulo Island).

The area at issue is formed by viable associations of vegetal and/or animal species of predominantly native origin that, over the years, particularly in the last thirty years, has been subject to an anthropic activity but that did not result in a significant modification of the primary ecological functions and the composition of the species in the area.

Thus, and considering the nature of the Project, a significant impact is not expected on local biodiversity and ecosystem services. However, as described in this section, there are important elements of the ecosystem services which will be temporarily affected but whose functions will be re-established in future. These elements include earmarking of the bird feeding and resting zones, as well as fish and sea turtles, wherefore a Biodiversity Management Plan will be drawn up which will set the mitigation, monitoring and biodiversity compensation measures[23] so as to minimize the work impact on the Project insertion area as well as to restore the environment that will be affected by an unplanned event.

The analysis made in Chapter 5 on the relevant threats to biodiversity and ecosystem services focused on marine environment changes (either by means of turbidity or by changes in the shore line due to landfill), temporary change in nutrient load and potential for pollution due to movement of marine vessels.

4.8. SOCIOECONOMIC BASELINE

For the Baseline planned for the collection of relevant information of the study area, for the socioeconomic component of the Combined Environmental and Social Impact Study, socioeconomic surveys, and a consultation with the population were undertaken, between 2011 and 2016.

The objective of the socioeconomic survey is the Baseline of the intervention zone, at a productive, demographic, and social level, aiming at a better perception of the population, and its opinions on the project, the economic activities, and the social infrastructures.

[23] These measures will only be implemented when the implementation of prevention, minimization and recovery measures is no longer available.

The main objective of the public consultation is to allow all stakeholders, and parties affected by the actions of the project, namely the construction of the road, to obtain the required minimum information on its implementation, and provide feedback, recommendations, and concerns.

The zone of Marginal da Corimba Project encompasses the coastal area that extends from Chicala up to the Pier, as previously mentioned, and integrates four neighborhoods of the Samba district, namely, Samba Pequena, Camuxiba, Samba Grande, and Corimba (see Figure 4.69) as well as a small part of the Futungo commune where there are some neighborhoods where Phases 1 and 3 will be implemented. These surveys have also considered a registering made in 2011 and updated in 2012.

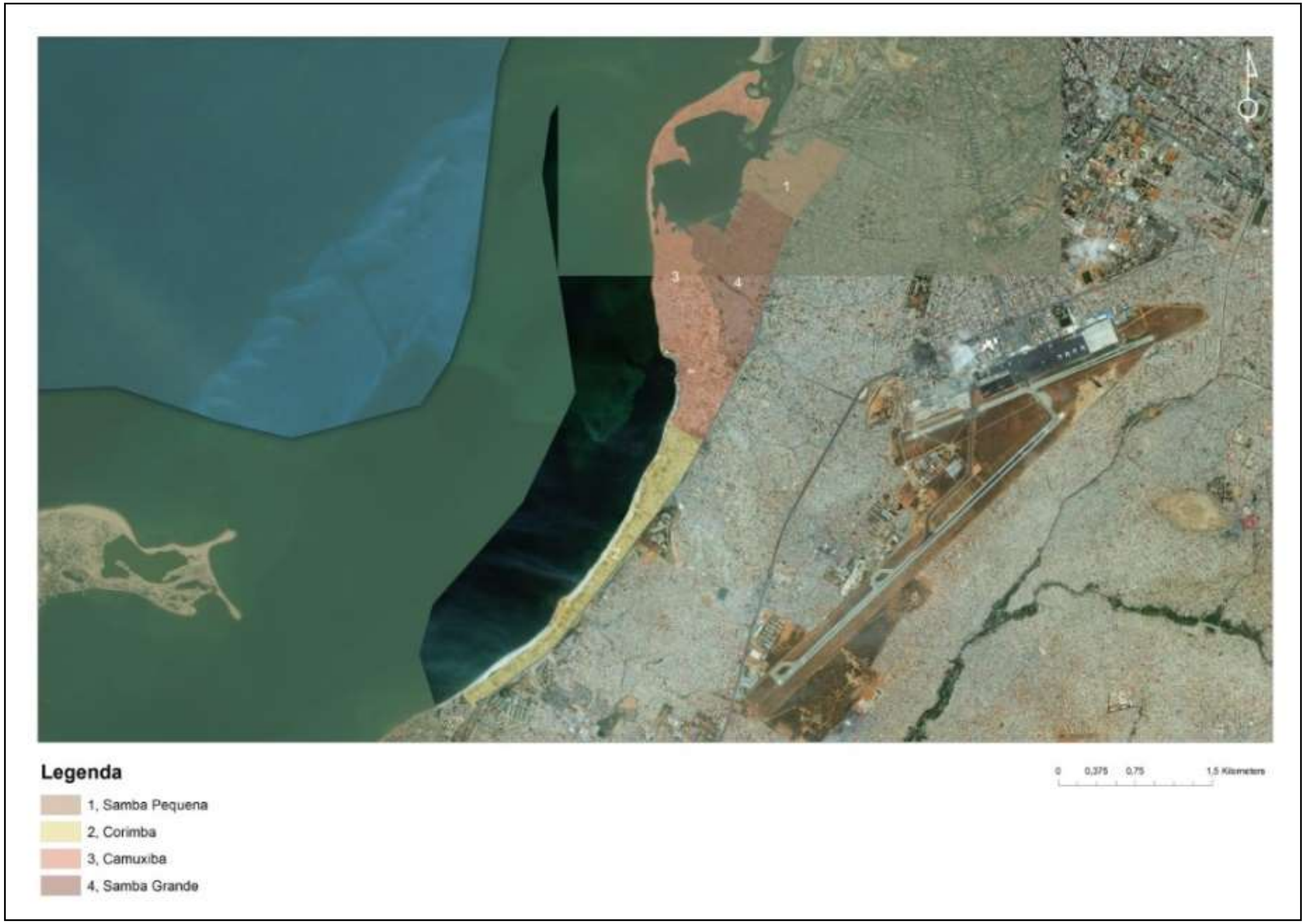


Figure 4.69: Neighborhoods included in the social survey.

The coastal zone of Camuxiba and Corimba neighborhoods is highlighted, for probably being the one that will be most affected by the Project activities.

4.8.1. METHODOLOGY

Keeping in mind the project outline, three sources of required information were defined, for an accurate Baseline, i.e. sources of secondary information, collection of qualitative data (conduct In-depth Interviews and Discussion Groups), and lastly the collection of geographic data (records of key elements in communities).

For Phases 1 and 3 data were obtained based on the application of various quantitative and qualitative techniques. Within the quantitative analysis, 945 household interviews were carried out. The questionnaire applied included demographic and housing issues and allowed to make population and household analysis. Fieldwork took place from 20 to 31 August 2011 according to defined sampling plan. The collected sample has a 95% confidence level and a +/- 3,2% error margin.

The collection of data for the area which includes Phase 4 was undertaken in April 2015 from the Samba Urban District Administration, to obtain information on the communities. Later on, in 2016, meetings were held with various institutions in order to obtain more recent information in particular the communities living near the Mabunda market.

It should be noted that the public consultation, and the socioeconomic survey were informal, since no public announcement was made for the meetings outside the living area of the potentially affected populations. The consultation sessions (collection of qualitative data) were held in the format of Discussion Groups, and In-depth Interviews during the socioeconomic survey process.

Discussion Group is a technique used to collect information through an interactive conversation with a group of 6 to 10 people, and the support of a facilitator, an observer, and a note-taker. This technique allows the exploration of confluent, divergent, or complementary perceptions, opinions, beliefs, and attitudes between the group, on a product, services, concepts, or social aspects. They can be introduced in dynamic, participative, and interactive discussion groups, to stimulate the debate of ideas on the subject(s) presented. The following discussion groups were held as per Table 4.16.

Table 4.16: Discussion Groups.

Discussion Groups	No. of Participants	Date
Non-resident Fishermen	12	05/05/2015
Resident Fishermen	11	05/05/2015
Middle-class	12	05/06/2015
Lower-class	6	05/07/2015
Residents	15	06/09/2011
Fishermen	11	07/09/2011
Taxi drivers	9	08/09/2011

On the other, an In-depth Interview is based on the accomplishment of individual interviews led by a facilitator, and has the main objective to assess the opinion of the key-informer(s) on the subject-matter(s), allowing the development of their knowledge regarding the subject, and the collection of relevant contributions for the research. The following In-depth Interviews were held, as per **Table 4.17**.

Table 4.17: In-depth Interviews.

In-depth Interviews	Date
Samba Urban District Administration	05/13/2015
Traditional Authorities	05/19/2015
Chairman of the Neighborhood Committee	05/19/2015
COAPescas	05/06/2015
Paradise Ocean Hotel	05/05/2015
Calor Tropical Hotel	19/05/2015

Lastly, the collection of geographic data using a GPS was undertaken, between the 13th of April and the 08th of May in the four neighborhoods that comprise the study area. Currently, the spatial information plays an important role in the perception and analysis of the territory. As such, it is critical that all reviews performed are corroborated with geographic data, not only as a means to locate the communities, but also as a means to understand the dynamics, and the position of the territory under review.

4.8.2. LAND OCCUPATION

Since there is no specific nomenclature on the use and occupation of the urban territory in the current legislation, the following review structure was adopted:

- Housing Zones:
  - High-density Residential Zone;
  - Medium-density Residential Zone;
  - Low-density Residential Zone;
  - High-income Residential Zone;
  - Middle-income Residential Zone;
  - Low-income Residential Zone;
- Zones of Commerce and Services:
  - Major Commercial Area;
  - Formal Markets;
  - Informal Markets.
- Industrial Zones;
- Touristic Zones;
- Exclusive Zones (exclusively beaches);
- Port Zones.

Housing Zones:

With the field survey performed, it was possible to divide the study up into four major zones, where the following characteristics predominate:

- Zone 1: center and north part (Samba Grande and Samba Pequena neighborhoods), a predominance of high-density and low-income residential zones was verified;
- Zone 2: southern zone (Camuxiba and Corimba neighborhoods), a predominance of medium-density and middle-income residential zones;
- Zone 3: Where low-density and high-income residential zones can be found, located in the shoreline of the Camuxiba and Corimba neighborhoods.
- Zone 4: It is the zone near the Capossoca dock corresponding to Phases 1 and 3 of the Project and is already located in the Futungo commune.

Most of the area intended for Phases 1 and 3 consists of lower-class residential areas (see Figure 4.70) as well as middle-class. These areas are discontinued near the coastal strip by middle-class residential spots (see Figure 4.71).

Figure 4.70: Lower-class houses.

Figure 4.71: Middle-class houses.

The classes were defined based on the criteria of territorial expressiveness, i.e., e.g. the areas identified as low-income do not mean that a set of middle-income houses do not exist, however given its residual context they were grouped in a low-income macroscale.

The intervention area exhibits different realities, as displayed in Figure 4.74.

Zones of Commerce and Services

Zones of Commerce

The commerce is abundant in the study zone, however mostly informal. The predominance of stores in the proximity (see Figure 4.72) of the houses (commonly designated as "janela aberta"), and the alignment of commercial stores was observed along the main traffic highways (Figure 4.75):

- *Mabunda* Market (see Figure 4.73): they are informal, and represent the most commercially dynamic spots, and the center of the economic activity of the study area. The fish market "Avó Mabunda" (promoted by the Provincial Government of

Luanda, namely the Samba Urban District Administration) destined for the sale of products was constructed, however it's still not being be used;

- Supermarket chain Bom Preço: it is the only large commercial unit;
- Paparoka Store: it is formal, and a project of the Central Government incorporated in the Program to Fight Hunger and Poverty, and aims to promote entrepreneurship in the local populations, and the sale of regional products;
- Fernandes Supermarket: it is a medium-sized beverage warehouse, with distribution in various areas of the city.

Figure 4.72: Minimarket in the Capossoka area.

Figure 4.73: Detail of the Mabunda market.

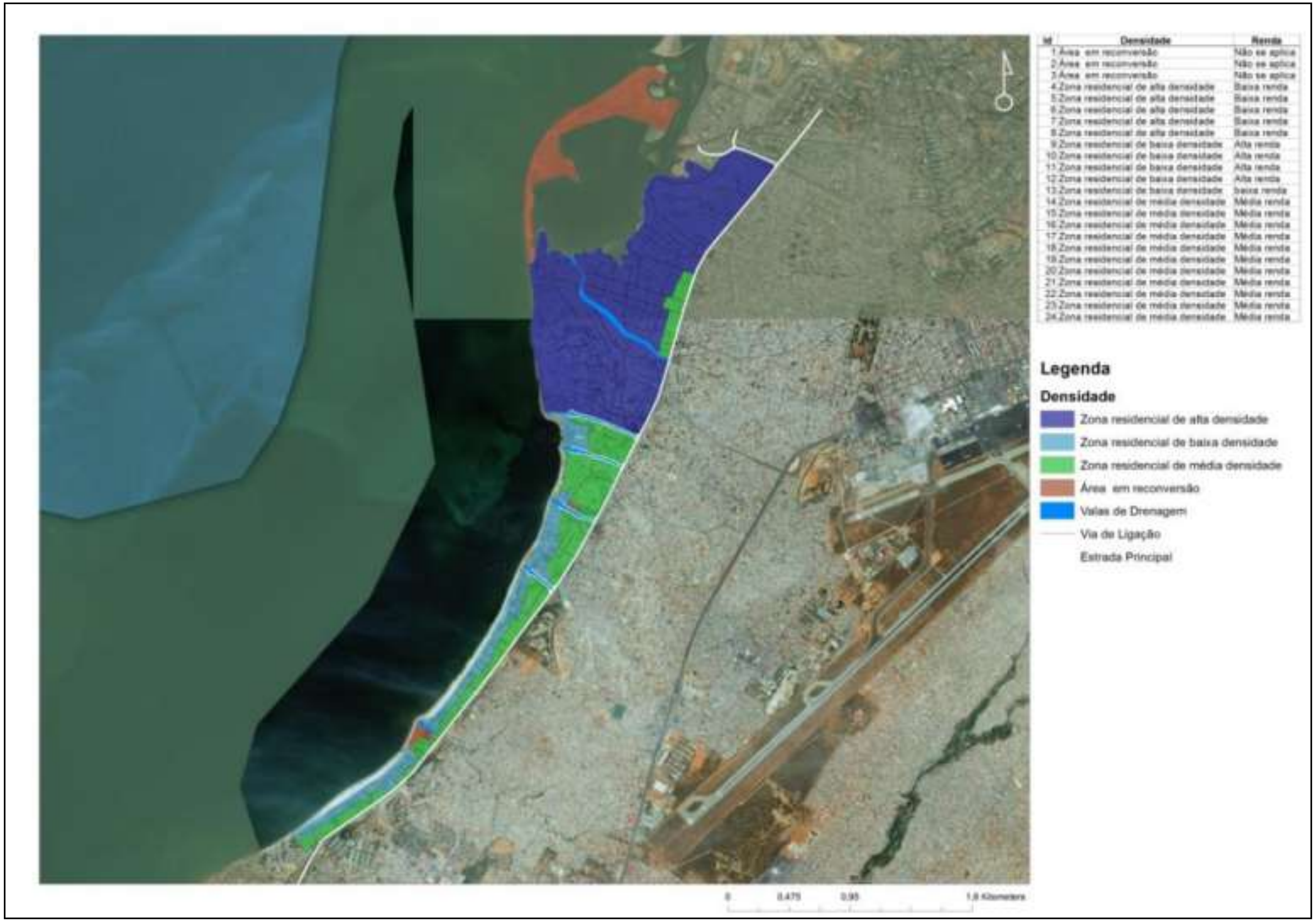


Figure 4.74: Housing zones.

Figure 4.75: Zones of Commerce.

Industrial Zones

Only the areas occupied with industries of a relevant size for the territory under study were considered in the definition of industrial zones. Thus, the existence of a few units was verified, but only three (Figure 4.77) located in the Camuxiba neighborhood were identified:

- COAPescas (Commerce, Agriculture, and Fisheries);
- Trirumo Alumínios;
- Ice Factory (Rogério P. Araújo e Filhos, *LDA*).

From the units used as reference, the importance of COAPescas in the productive and economic sector is highlighted. It is a company of the fishing sector that provides an industrialized system for preserving and freezing the fish, as well as a mechanized system for the transportation of goods, from its private port to the freezer building.

Figure 4.76: Detail of the COAPescas jetty.

Figure 4.77: Industrial Zones.

Special Zones (Exclusively Beaches)

Three main beaches were identified in the study area (**Erro! A origem da referência não foi encontrada.**). In addition to bathing and commerce, it was verified that the populations built some houses on the coastline near the sea. These houses are disorganized and at risk. The beaches identified are as follows:

- Areia Branca: located to the north of the study area, it is part of an area under reconversion, and with little housing. The strong accumulation of solid wastes, and the inception of the construction work, namely earthworks, prevent it from having viable conditions for the bathing practices;
- Mabunda: located in the central zone of the study area, it is used as a fishing harbor and market (both informal). Most of the economic activity associated with the fishing sector occurs in this site;
- Praia Amélia: located to the south of the intervention area, is still visited for bathing, being considered a leisure area, where several (informal) restaurants were developed.

It should be noted that in the Areia Branca zone, due to the influence of tides, especially during *calemas*, the beach zone disappeared in the past months causing the destruction of houses existing on the coastline (see Figure 4.78).

Figure 4.78: Houses damaged by *calemas*.

Port Zones

Two areas were identified for being used as a harbor (see Figure 4.81):

- The COAPescas Pier: is a private infrastructure, being the only one that allows trawlers to moor;
- The Mabunda Pier: does not have any supporting infrastructure for the landing of fishermen; the same is performed on the beach in an informal manner, and has an informal market for direct sales of the catches;
- There are still vessel anchoring structures in the in the Capossoka Pier area, namely:
    - Passenger Sea Terminal of Capossoca
    - Civil Nautical Club (Associação do Mar) (Figure 4.79)
    - Military Nautical Club
    - Draimar hydraulic landfill (Figure 4.79).

This zone faces major problems with the discharge of solid wastes in its full extent. This is similar in the remaining coastline.

Figure 4.79: Civil Naval Club and Draimar landfill.

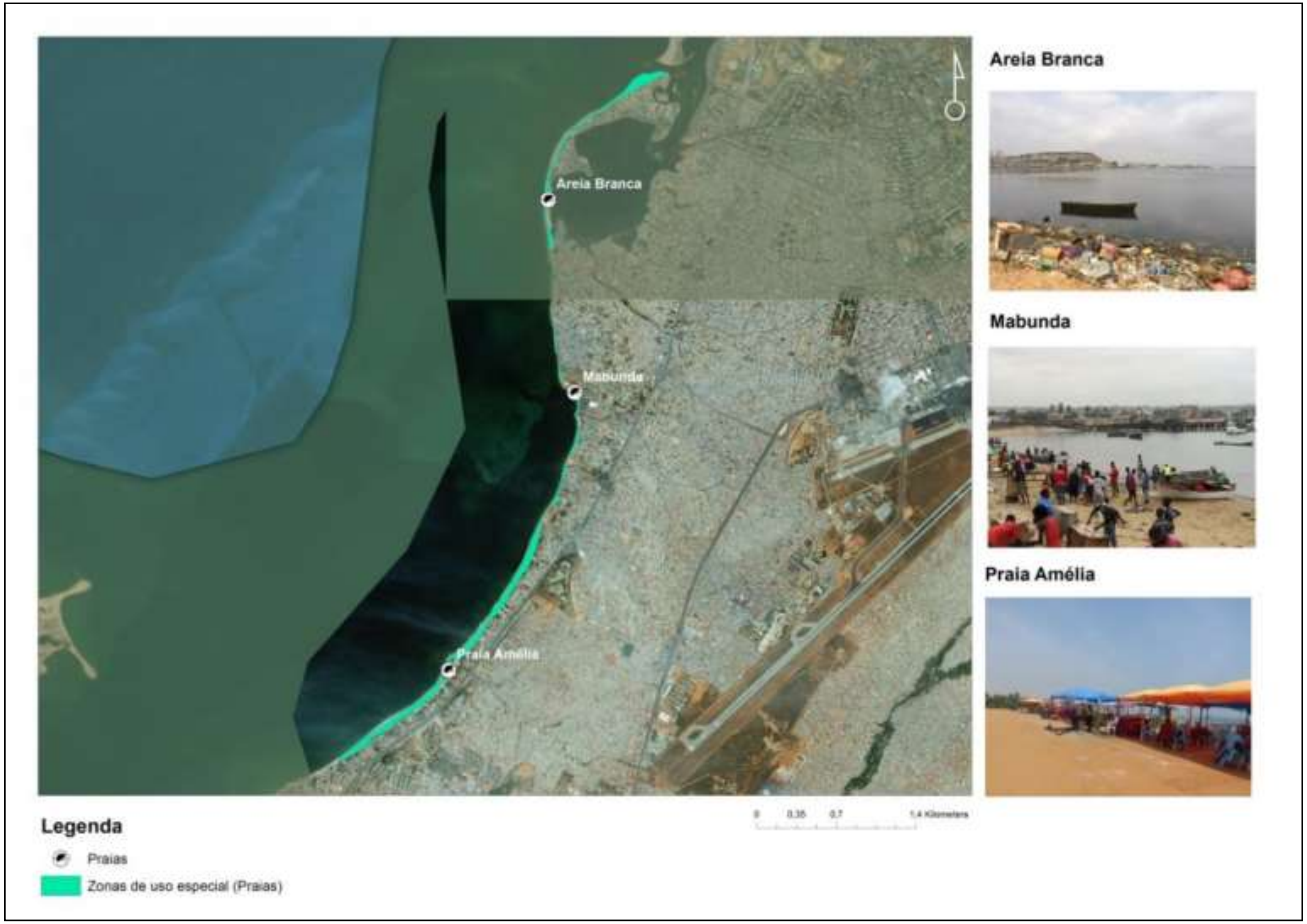


Figure 4.80: Special use zones (beaches only).

Figure 4.81: Port Zones.

Touristic Zones

Ten hotel units were identified, and occupy nearly three (3) hectares of the study area, distributed along four neighborhoods, to the exception of Samba Pequena. The hotel units exhibit distinct categories and typologies, being the focus on the middle-class and high-class.

To be noted that the Hotels Sunset, Hotel Calor Tropical (Figure 4.82), Rancho El Toro, and Kudissanga are no longer inside the study area.

Figure 4.82: Detail of the hotel Calor Tropical.

Most restaurants and grocery outlets began to settle in the perimeter of Futungo about 5 to 6 years ago. In the Capossoka zone trade is provided by canteens and small convenience stores. This growth results from high attendance of tourists, mostly on weekends, and increase of the resident population.

In the case of shops and restaurants it is about small scale spaces with an essentially local influence area. The two existing exceptions are the Restaurant "O Embarcadouro" and the *Belas Hotel* (see Figure 4.83). From the interviews conducted, it is found that most businessmen are now facing difficulties due to the differential range of demand, either over the week, or in the two annual seasons. The demand, mainly seasonal, varies between weekdays/ weekends and the *cacimbo*/rainy seasons. The increase happens at the weekend and during the rainy season, due to the flow of visitors to Mussulo.

Figure 4.83: Restaurants in the vicinity of the Project.

From the perspective of businessmen, two major problems of the perimeter are insufficient drinking water supply and fickle electricity supply. Problems related to street vendors are also referred to since they create unfair competition and generate greater insecurity.

Some urban interventions in the area may be possible. The widespread expectation is that urban interventions may enable the increase of visitors and consumers, taking advantage of the geographical location and bathing conditions. Aspects such as accessibility to the beaches, improvement in electricity and drinking water supplies are highlighted as fundamental for boosting any local economic activity.

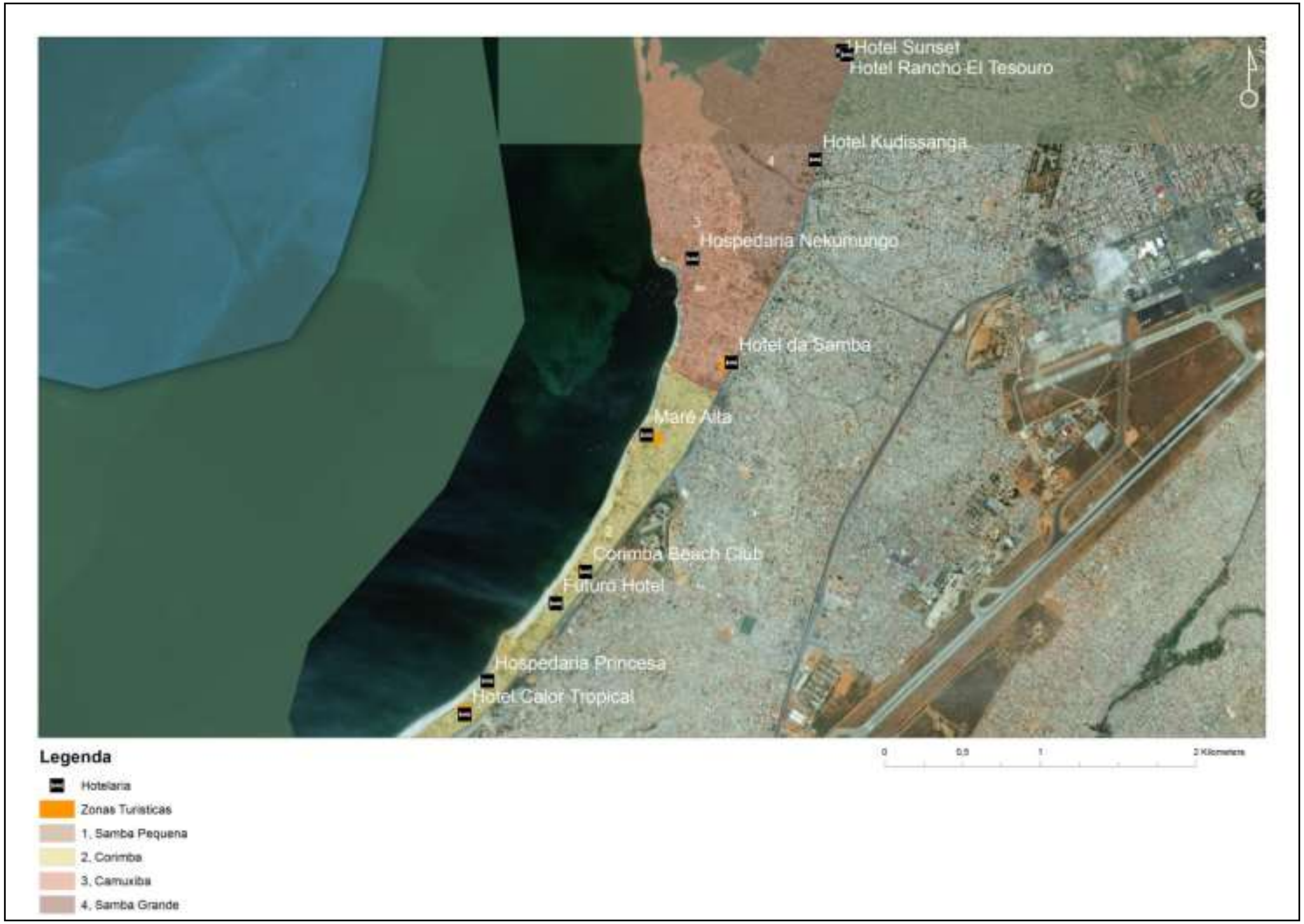


Figure 4.84: Tourist Zones.

4.8.3. BASELINE OF THE POPULATION

The occupation of the Samba seafront is old, and dates back to the foundation of the city of Luanda. The first inhabitants of Corimba were fishermen that settled near the coast, given that the bay offered privileged conditions for artisanal fishery, as it also occurred to the islanders of the Island of Luanda. It was the fishermen who settled in this region that gave the name to the Camuxiba Neighborhood, which means "Heroes of the Sea".

The Samba coast was also seen as a place of worship, which resulted in the name *Kussamba* that means "To Pray" in the *Kimbundo* dialect, leading afterwards to the name Samba.

Even before the independence, immigrants from Cape Verde, and São Tomé and Principe also settled in this coast, beginning their fishing activity; a dominant practice in their lands of origin. The fishermen, and the immigrants are the ones that continue to keep alive the diverse cultural identity, and the main economic activity of Corimba, fishery.

After the independence of the country, a new social class began to acquire lands, and construct houses with a privileged view of the sea; benefiting from the paradisiacal beach with numerous coconut palm trees that extends along the coast. In addition, with the inception of the armed conflict, a new migratory flow caused significant repercussions in this region. Family relatives of the local residents, and others, by affinity, also took refuge in this perimeter, settling mainly in the Camuxiba, Samba Grande, and Samba Pequena Neighborhoods. The improvised landfills created space for the new houses, in spite of the floods that predominate in this zone during the rainy season, due to the increase in the water level in the water tables at a shallow depth.

With Peace, a mass displacement of population occupying the neighborhoods of Luanda looking for new living conditions became a reality. The Samba neighborhoods were not spared, and the urban chaos reached incommensurable proportions. With this urban disorder, housing in extremely precarious conditions increased, many streets were made impassable due to the disorderly exploitation of all land parcels.

As initially described, the fishing community is the oldest community of the coastal zone of Corimba, representing the main share of the population. With a secular tradition transmitted from generation to generation, in addition to the native population in this coastal area, from Corimba to Camuxiba, all resident or non-resident individuals, old or new fishermen that consider nowadays fishing as a source of viable livelihood in Luanda are welcomed. The commercial port of Mabunda, and the adjacent market have been the main driving force of this activity, and with it, the constant growth of this population.

4.8.3.1. Ways of Life

Fishing is the main source of livelihood for the population in the neighborhoods located in the studied area, as previously mentioned. Men and women play different critical roles in the fish marketing chain. This activity is frequently carried out by the entire family, having each member a job to perform.

The population that does not depend on fishing for their livelihood works in public services, i.e. schools, health centers, and administration; others are small traders, including the transport of people and goods by sea.

However there are many unemployed, and youngsters out of the school system. With the lack of vacancies in schools, and the lack of school opportunities, many youngsters make their livelihood doing odd jobs near the port, and providing support to the fishermen, i.e. pulling *chatas* (planked boats), dragging nets, carrying goods, and others; as well as in the neighborhoods, near the residents, providing any supporting service, i.e. collecting water, selling bread and other basic products in the streets from door to door.

In the informal trade system the sale in small markets created in the neighborhoods, the door-to-door sale of various products predominates, i.e. basic living essentials, clothes, toys, and prepared meals. Another form of predominant informal trade is street sales, either of bread, vegetables, fresh fish delivered by the fishermen. Food booths along the beaches also represent an activity that has been developing in recent years.

In the informal trade system the fishing industry, commercial furniture, or car dealers stand out. Stores of lesser size sell food products, such as supermarkets, tools, construction material, and clothing stores.

The income gained from the fishing activity depends on the fishing season. Since there are species of fish more profitable than others, e.g. sardine, *Cabuenha* carp, and *Malongo* fish, because they are more accessible to the majority of the population, and therefore are sold easier, in greater quantities. The horse mackerel also has a good commercial value, due to its quality, to the detriment of its abundance.

The economic chain of the fishing activity (Figure 4.85) includes not only the fishermen, but also approximately 2.000 fishwives that await the delivery of the fish with means of transportation, to be distributed by other resellers across the province of Luanda, or to direct consumers.

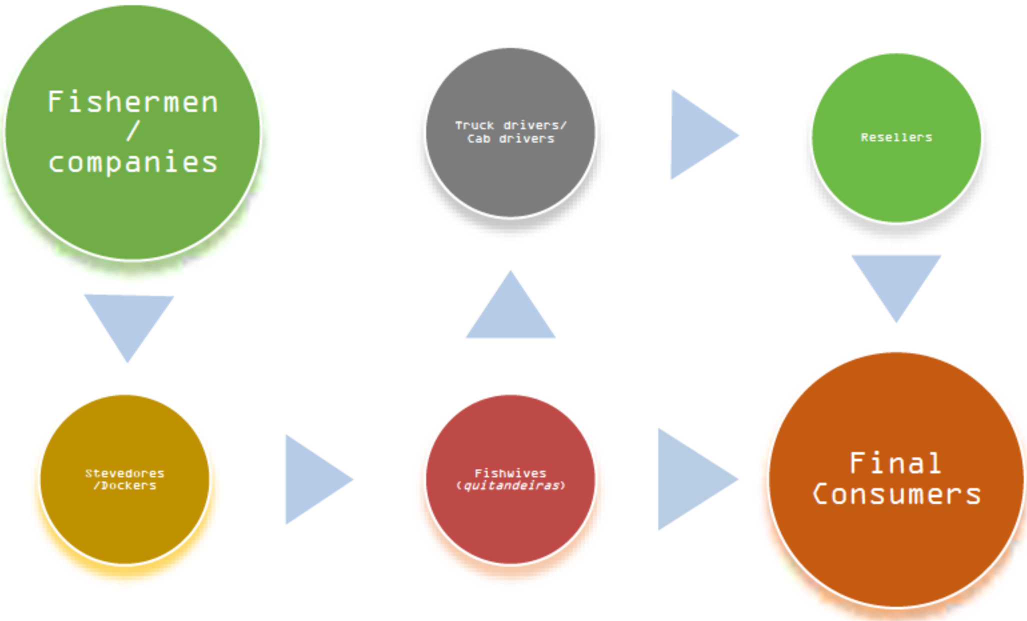


Figure 4.85: The economic chain of the fishing activity.

The Port of Mabunda is considered of high economic importance to the livelihood of the population involved in the activity, and to the supply of the markets across the province of Luanda, and other provinces of the Country, particularly those to the North and East.

The Port is the main driving center for fishing activity in the coast of Samba, being impossible not to illustrate the complex commercial chain of this activity, due to its extent, and the involvement of a variety of people who support this economic activity (Figure 4.86).

Figure 4.86: The commercial chain of the Port of Mabunda.

The fish is caught by individual fishermen, and the fishing industry installed in the Port of Mabunda. The individual fishermen perform artisanal fishing with small boats. COAPescas is the company that uses large-sized boats, and performs industrial purse-seine fishing. The company owns a total of 9 fishing vessels of which, one is 25 metres long, three are 22 metres long and five are 18 metres long (Figure 4.87). Each vessel has 35 sailors working. COAPescas has a cooling complex in the area where there are freezing, processing and distribution activities. This unit has a processing and storage capacity of 190 tons of sardine and 90 tons of horse mackerel per day. The total number of workers at the factory is 140, working in two shifts.

Some of the fishermen have their own boats; others are associates that use the boats of an owner to which they must pay a percentage of their income. There are small and medium-sized vessels in the region amounting to 200, consisting basically of canoes and barges. Major ship-owners in the region with large vessels include:

- Alfredo Calado (Calado Brothers): own two 17-metre long fishing vessels;

- Alberto Fernandes: owns an 18-metre long fishing vessel (Soraya);
- Domingos Vintém (Rito Pescas): owns an 18-metre long fishing vessel (Santa Rita);
- Rodolfo Leitão: owns an 18 -metre long fishing vessel (Ombaca);
- Sérgio Casimiro (Marfish): owns a 22-metre long fishing vessel;
- Fernando Jorge (Jorgemar): owns three vessels. Namely:
    - Two 13-metre long fishing vessels (Camanongue and Deusa do Mar);
    - A 19-metre long fishing vessel (Carunjamba);

Figure 4.87: COApescas vessel and detail of its jetty.

The fish is, in turn, distributed directly to fishwives who clean and sell it. Some fishwives sell it in the Port market and in the Mabunda market, and others have an agreement with a bush taxi (*candongueiro*) or vans for the transportation of the fish, delivering it to various markets, or selling it directly to other consumers across the province of Luanda. The Mabunda market is divided into four sectors with the following number of saleswomen:

- Sector 1 (coordinated by Mrs. Clementina) has 17 saleswomen
- Sector 2 (coordinated by Mrs.Fató) has 22 saleswomen
- Sector 3 (coordinated by Mrs. Kuenda) has 8 saleswomen
- Sector 4 (coordinated by Mrs. Rosália) has 26 saleswomen

The number of saleswomen, fishermen, and consumers, who concentrate along the coast of Corimba, also in turn drive the local economy, satisfying the local, formal, and informal traders. The port of Mabunda thus play an important role by stimulating the local economy, and the livelihood of the population, and it is considered one of the most important factors for the development of the neighborhood and the Samba coast. However it lacks profound intervention, given the severe hygiene problems, and issues in the management of the wastes produced by the fishermen, by the fishwives when cleaning the fish, and by the adjacent market, which jeopardizes the quality of the fish.

4.8.3.2. SUPPORT NETWORKS

The main social support networks are among the oldest people. The main support ties are family relatives, due to the growth of various generations in the same neighborhoods.

There are some important support ties in the development of the fishing activity, between the different social participants that comprise the local commercial chain.

The cultural and historical identity of the coastal fringe of Samba is practiced, and kept alive by the *Bessanganas*, and the Carnival Group. The continuity of cultural practices constitutes an important pillar of social support among the resident communities.

4.8.4. HOUSING CONDITIONS

The area was kept under a major urban pressure in the last few decades, as previously mentioned, which fostered the growth of non-programmed and illegal areas. Currently it is possible to find three housing typologies (see Figure 4.88), namely:

- Precarious low-income family units known as *Musseques* (high and medium-density zones);
- Middle-income single-family housing (medium-density residential zone);
- High-income single-family housing (medium-density residential zone).

There is a dominancy of musseques along the study area, where there are precarious construction and accessibility conditions. Furthermore, the wastes produced by the market, the fishing activity, and the overall population devastates the coast daily, being also observed non-degradable waste being discharged into the sea by the drainage ditches.

Figure 4.88: Housing in the study area. A) *Musseque*; B) Middle-income family unit; and C) High-income family unit.

Baseline of the Neighborhoods

The demographics[24] made available by the Samba Urban District Administration exhibit the following estimates regarding the distribution of population in each neighborhood:

- Samba Pequena – 52,662 inhabitants
- Samba Grande – 57,682 inhabitants
- Camuxiba – 69,567 inhabitants
- Corimba – 61,627 inhabitants

Of the four neighborhoods that characterize the coast of Samba, the Camuxiba Neighborhood is currently perceived as the most problematic. With nearly 69,000 inhabitants, it has a high population density. The water and power supply networks do not provide what is required for the number of households, many of which were constructed under precarious conditions.

[24] Data from the estimates collected in 2013, and made available by the Chairman of the Neighborhood Committee of the Samba Urban District.

In the area of Capossoka (between Phases 1 and 3, see Figure 4.89) and based on the registration carried out, there is an estimated population of 3.892 inhabitants spread over 978 houses, of which 190 have annexes.

Figure 4.89: Detail of the neighborhood near Capossoka.

According to the residents, Corimba is, at this moment, completely deprived of running water. This occurred after an intervention in the water distribution piping system, which led them to consider that there was a bypass of a pipe that supplies the neighborhood. This situation is still waiting an explanation from the public water company (EPAL-E.P.).

In the remaining neighborhoods, the water is supplied regularly by EPAL, with recurrent periods of disruption, with the exception of the houses recently constructed illegally, and that did not enter into a contract with the entity.

The inhabitants who live without water have to buy it informally from those who have tap water and use this advantage to sell and transport it. The population spends nearly 15,000 Akz of water consumption per month. The alternatives found to the difficulties that exist in the provision of the basic supply networks, led the populations to take extremely costly and illegal measures to subsist.

The construction of drainage ditches in the 90´s was the construction work that improved significantly the Samba neighborhoods.

The influx of population to the neighborhoods remains. The migrants continue to join the communities of the coastal fringe of Samba, others come closer to the city, given that the rent prices are lower than in the center of Luanda, others to begin working in fishing activities, deemed as a form of livelihood accessible for those who are unemployed.

Another aspect that shows the diversity of this region is the existence of different social classes (Figure 4.90), from the poorest to the high social class, without differentiated areas in terms of land occupation.

Figure 4.90: Different social classes in the study area and their housing: A) Low-income Housing; B) Medium-income Housing; C) Shacks used by the fishermen in their activity; e D) High-income Housing.

Contrary to the influx of population, an outflow of population to other areas of the city has been acknowledged, namely to new urban centers such as Kilamba and Cacuaco. These are families that are departing to look for better housing conditions, and to become home-owners.

Household

The predominant typology of the households is a large family, although there are households with less family members. In the lower class, the majority ranges between 7 and 8 members. In the middle class group the majority varies between 3 and 5 members.

None of the low-class and middle-class interviewees confirmed to have a second home in the city. However it was stated that the high-class population do have alternative residences in others areas of the city.

4.8.5. MOBILITY

The road network (Figure 4.91) is comprised of a main highway (Samba Road) which connects all the neighborhoods of the study zone, paved, and in good state of conservation, and secondary roads (dirt roads) that connect the neighborhoods, with various structural problems, namely:

- Absence of pavement;
- Incorrect sizing;
- Floods and consequent obstruction of the road.

The secondary roads not always guarantee access to all houses, given that the population often has to walk through backroads and alleys between houses to arrive home. This situation along with the existing delinquency in these neighborhoods causes extreme insecurity in the communities.

Figure 4.91: Road network in the study area.

4.8.6. SOCIAL EQUIPMENT

Social equipment are considered the buildings where the activities destined for the provision of services of public interest, and indispensable to the quality of life of the populations are located; namely school, health and sport units, and social work and rehabilitation units.

In contrast, other social infrastructures were identified in the surveys, such as public service buildings, and places of worship (religious buildings), of which churches and public administration buildings are highlighted.

It was not possible to have access to the official listing with the number of existing school units from the department of education in the influence zone of Phase 4. Hence, the identification was accomplished based on the geographic survey. In conclusion, information on the following school units was collected:

- Elementary School and Middle School (1st Cycle) No. 1004;
- Elementary School and Middle/Secondary School (1st & 2nd Cycle) No. 1002;
- Elementary School No. 1008 (included in the *Santa Teresinha* Parish);
- Elementary School No. 1009;
- Elementary School No. 1006.

In Figure 4.95 it is possible to verify the spatial distribution of the existing school units in the influence zone of Phase 4. The predominance of schools units in the Corimba neighborhood, and their total absence in the Camuxiba neighborhood was verified. The population is satisfied with the existing supply, as indicated by the community, however they also indicated that it is insufficient when compared to their demand, and that many times parents/their representatives are forced to enroll the children in private schools. Also as regards to education, there are very few private nursery schools, and no (Children´s) Activity Centers were mentioned, or the existence of children´s parks/playgrounds. In addition to these, two private vocational/technical schools were identified, and can be confirmed in Figure 4.96.

In the area of Phases 1 and 3 the school network in the perimeter consists of 18 schools. The facilities conservation state varies from reasonable to good. Regarding the registered schools, 67% integrates the elementary level (see Figure 4.92 and Figure 4.93).

Figure 4.92: Elementary School 1134 (outside).

Figure 4.93: Elementary School 1134 (inside).

It should be noted that there are two sites in the perimeter which although geared to training, are also used as cultural facilities – National School of Public Administration (ENAD) and Sonangol Cultural Centre (see Figure 4.94 and **Table 4.18**).

Figure 4.94: Location of the Schools included in the Perimeter of the Futungo de Belas.

Table 4.18: Characterization of Schools.

Name of the School	Type of equipment	Condition
School Professores Alunos	Elementary School	Good
School 1034	Elementary School	Good
Colégio Bule	Elementary School	Good
College Tia Lucinda	Elementary School	Good
College Mãe Amável	Elementary School	Reasonable
Colégio de Aplicação 28 de Agosto	Secondary School	Good
Faculty of Letters	Higher Polytechnic Institute	Reasonable
PUNIV Futungo	Medium Polytechnic Institute	Good
Sonangol Cultural Centre	Cultural Centre	Reasonable
Good Life School	Elementary School	Good
Jot Ssissa School	Elementary School	Reasonable
School 1007	Elementary School	Reasonable
National School of Public Administration	Training Centre	Good
School 1005	Elementary School	Reasonable
Zozo Camana School	Elementary School	Good
College Novo Horizonte Batalha	Elementary School	Reasonable
Cabritos School	Elementary School	Bad
College Epizalque	Secondary School	Reasonable

Id	Tipologia	Designação
1	Unidade Escolar	Escola do Ensino Primário n.º 1008
2	Unidade Escolar	Escola do Ensino Primário nº1006
3	Unidade Escolar	Escola do Ensino Primário e do I e II Ciclo n.º1002
4	Unidade Escolar	Escola do Ensino Primário n.º1009
5	Unidade Escolar	Escola do Ensino Primário e do I Ciclo n.º1004

Figure 4.95: School Units.

Figure 4.96: Professional Training Unit.

As for the health equipment, the Samba Health Center was identified as being the only health infrastructure that serves the four neighborhoods under study (see **Erro! A origem da referência não foi encontrada.**).

The center is located near the current Samba Road, and serves all neighborhoods in the surroundings; not only the neighborhoods within the intervention area, but also those located to the east of the road. This revealed to be a critical issue by the community, due to the inefficiency and inefficacy of the health unit when responding to the needs of the population, given that it cannot see or treat all patients that seek the unit, nor does it have sufficient means of diagnosis and medicines for such purpose. It has an average of 500 potential patients per day.

Near the Futungo de Belas perimeter there is a public health unit, recently inaugurated – Futungo de Belas Health Centre. Inside the perimeter there is only a private Health Centre – São Miguel Medical Centre. Due to the proximity, the population resorts to other health facilities located in Morro Bento. Among them, the São José Health Unit, the Santa Pedra Health Unit, the Vinde a Mim Health Unit and the Multiperfil Clinic stand out.

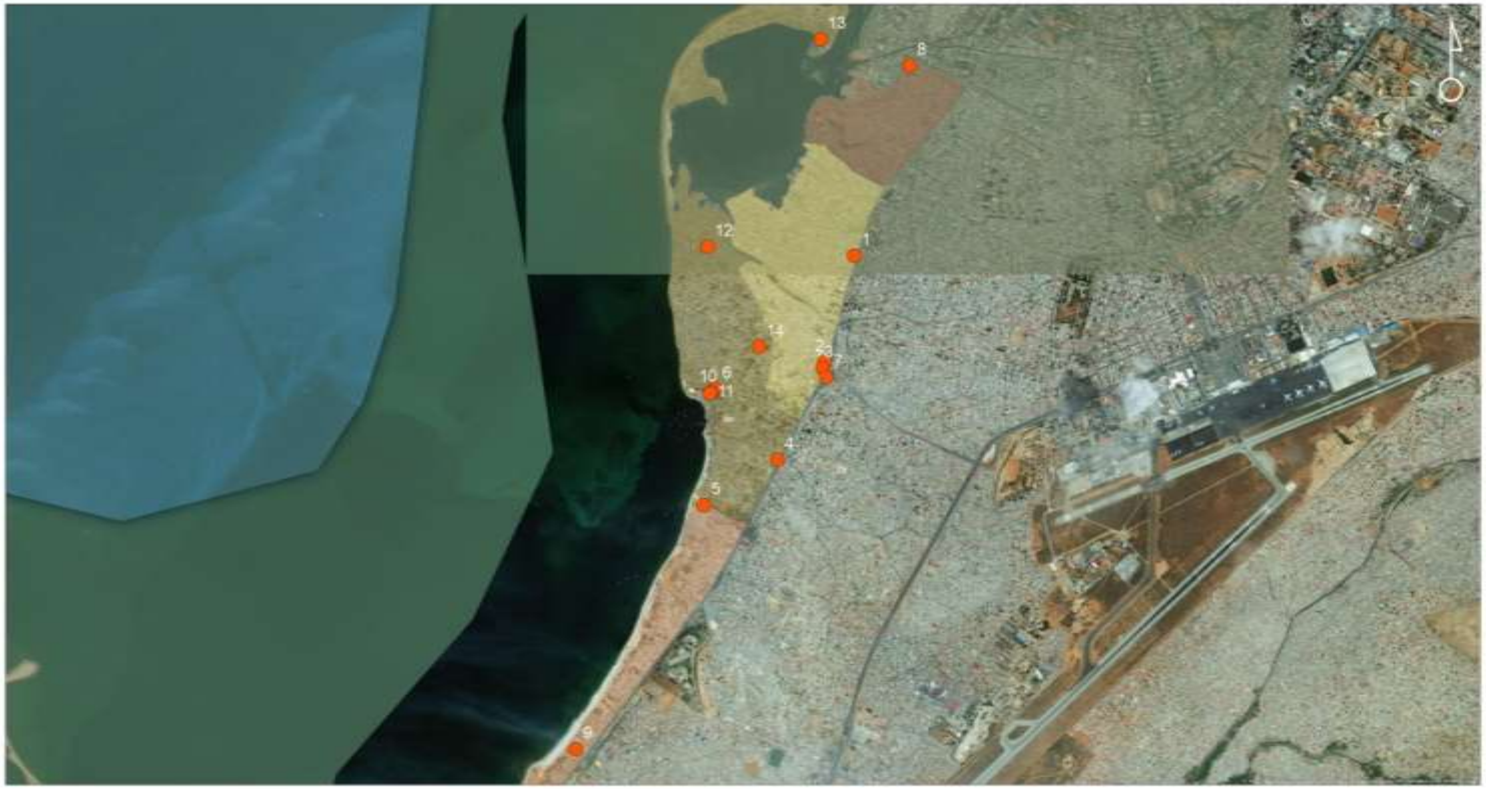
Given that the location of the administrative division of Samba is in the Corimba neighborhood, it was possible to verify the existence of various infrastructures of the local government. Such fact is visible in Figure 4.98.

The following public buildings can be found in the intervention area:

- Administrative Commission of Samba Urban District;
- Identification and Registration Office of Samba;
- Police Station of Corimba;
- Angolan Association of Former Combatants and Veterans *(*Comissão dos Antigos Combatentes e Veteranos da Pátria) of Samba;
- MPLA Party Committee of Camuxiba;

- Mobile Police Station of Camuxiba;
- 7th Registration Office of Luanda;
- Administrative Commission of Ingombota Urban District;
- Embassy of Greece;
- Luanda Port Authority;
- Maritime and Fiscal Police Station of Samba;
- Police Station of Camuxiba;
- Border Patrol Station;
- “One-Stop-Shop”/”Single Desk” for Entrepreneurs.

Figure 4.97: Health Units.



Legenda

- Edifícios Públicos
- Camuxiba
- Corimba
- Samba Grande
- Samba Pequena

Id	Tipologia	Designação
1	Edifício Público	Comissão Administrativa do Distrito Urbano da Samba
2	Edifício Público	Repartição de Identificação e Registos
3	Edifício Público	Posto Policial da Corimba
4	Edifício Público	Comissão dos Antigos Combatentes e Veteranos da Pátria da Samba
5	Edifício Público	Comité MPLA
6	Edifício Público	Esquadra Móvel da Polícia
7	Edifício Público	7ª Conservatória de Luanda
8	Edifício Público	Comissão Administrativa do Distrito Urbano da Imgonbota
9	Edifício Público	Embaixada da Grécia
10	Edifício Público	Capitania do Porto de Luanda
11	Edifício Público	Esquadra Fiscal e Marítima da Samba
12	Edifício Público	Esquadra Policial da Camuxiba
13	Edifício Público	Posto Policial de Fronteira
14	Edifício Público	Balcão Balção Único do Empreendedor

0 0,3 0,6 1,2 Kilometers

Figure 4.98: Public Buildings.

There is a total of eight (8) religious buildings in the study area. These spaces are important as an element that congregates the communities, and communicates with them. The Catholic Church of *Santa Teresinha* is the oldest building in Camuxiba*,* and it is emphasized due to the social activities that it develops next to the communities.

No sports collective equipment, or of public social rehabilitation and assistance were identified. However, the existence of one basketball sports group was mentioned during the interviews.

With respect to the cultural activities, the existence of a music school was mentioned: the musical group Capossoka, and a carnival group, which is strongly represented in the Carnival parties. This cultural association also welcomes the residents of the Prenda Neighborhood.

Id	Tipologia	Designação
1	Igreja	Igreja Evangélica de Angola
2	Igreja	Paróquia de Santa Teresinha
3	Igreja	Igreja IEBA
4	Igreja	Igreja do Bom Deus - Camuxiba
5	Igreja	Igreja Universal do Reino de Deus
6	Igreja	Assembleia de Deus
7	Igreja	Paróquia São Joaquim
8	Igreja	Igreja Episcopal

Figure 4.99: Religious Buildings.

4.8.7. LOCAL PRODUCTIVE SECTOR

Fishing

Fishing represents the main productive activity of the seafront of Samba. It is estimated that nearly 800 fishermen and more than 2.000 fishwives are active. Communities comprise mainly people aged over 45, with a low presence of young people (see Figure 4.101). Young people (sons of fishermen) are soon integrated in tertiary services offered by the city, not getting involved in the family fishing business. There has been a fishing diversity on site which boosts the demand by customers (see Figure 4.100).

Figure 4.101: Local fishermen.

Figure 4.100: Species of fish caught

The fishing activity is mostly communally developed without fishing associations, with net and hook. It is guaranteed every day, mornings and evenings, on weekdays, by a fisherman owning a vessel who negotiates the working day with other 3 or 4 local fishermen. After fishing, the caught amount is divided among fishermen, and may yield, in the most productive days, 10.000 Kwanzas per fisherman. In exceptional terms this value can reach 45.000 Kwanzas per fisherman. The frequency of the mentioned earnings decreases over the week, for shortage of fish in the bay.

In most working days, fish is caught for domestic consumption, and there is no excess production for local sale. The following stands out from the interventions carried out: "this is just for remedy, now… not to weaken." When there is surplus, the sale is made by local sellers. The box price depends on fish and fish size. On ''lucky'' days, it is possible to catch 15 fish boxes. On normal days, 2 to 3 boxes are caught per day. Each box has a capacity of 30 kg and the price per sold box varies according to kind and size, ranging from 5 to 8 thousand Kwanzas. The mullet box is the cheapest one (3.000 Kwanzas) and the sea bream box is the most expensive one (8.000 Kwanzas).

The beach access is being restricted, either by the growing coastal urbanization (middle/upper class), or by the intention of having access gates (as with the Cateba beach) or even by the landfill for construction of the Southwest Marginal road (see **Erro! A origem da referência não foi encontrada.**).

Figure 4.102: Landfill created during the Southwest Marginal works.

According to the opinion of fishermen, the amount of fish has been reducing over the years, for two reasons:

- The used fishing techniques;
- Growing urbanization and degradation of the bay water quality - as mentioned in the conducted survey "the area has changed greatly, especially in terms of urban growth”.

Among the techniques used, the misjudgment made by fishermen regarding the use of grenades should be stressed (they are used by young people for more than 20 years) as well as the dredging works carried out in the bay. The species caught that are mentioned by fishermen include: mullets, twaite shads, sardines, large-eye dentex, barracudas, soles and, in less quantity, groupers, sea breams and moray eels. The major problems identified by fishing communities are:

- Aging of the population;
- Lack of work for shortage of fish;
- Alcoholism.

It is known that there is an awareness of community demobilization and eviction projects and great expectation on the granting of land/houses in other places or amounts adjusted to the construction of houses.

There is a processing industry in the fishing sector, COAPescas, next to the Port of Mabunda, that it is also engaged in fishing activities in the open sea. There are also individual businessmen with a small number of boats that also perform their activity in the open sea, and many other fishermen that continue the artisanal fishing tradition in the Bay, from *Coreia* (Samba Pequena) up to Corimba.

Sea transportation

The group of sea carriers in the Capossoka Pier area comprises employed persons, to whom a vessel to carry passengers is granted, and the latter are required to pay a weekly amount to the vessel owner (see Figure 4.103). Most of the drivers and assistants live in Mussulo.

Figure 4.103: Transport of passengers to Mussulo

Industry

The only industrial complex that has a strong influence in the development of the Fishing Sector is Coapescas.

Coapescas is located near the Port of Mabunda. It is operational since 2004, and employs nearly 650 workers; being many of them local. It works directly with 140 fishermen who buy bait to fish in the open sea, and benefit indirectly the fishwives that acquire the fish to resell in the city. Nearly 90% of the fish is cleaned and frozen in the boats.

Services

Samba is well supplied with a variety of commerce. The main services available along the coast of Samba are small and medium-scale commercial establishments, from hardware stores, supermarkets, and canteens with food products, furniture stores, and car dealers, such as the well-known Hyundai stand. In addition to the commerce, some banks are also represented in the main street of Samba, and various public services.

However there is a major lack of social care services support, such as (Children´s) Activity Centers (ATL) for the young students. There are some nursery schools, although they are private.

The hotel sector, with restaurants and leisure, is another type of service that predominates in the coast of Samba.

4.8.8. Values, Vulnerabilities and Concerns

During the public consultation the feedback of the populations potentially affected by the implementation of the Project of Marginal da Corimba Master Plan were taken into account.

The main values emphasized regarding the coast of Samba by each party interviewed, are basically governed by the location near the sea, and near the center of the city of Luanda. The characteristics of the bay that are favorable to artisanal fishing, and the cultural values are also emphasized as an integral part of this region, as it is described in more detail in Table 4.19 below.

Table 4.19: Values emphasized by the population.

Aspect	Description
Population	
Location	The majority of the population depends on fishing for their livelihood. Therefore it is important for them to remain near the coast, and facilitated access to the sea.
Proximity to the urban center	Those that do not depend on fishing also admit to be an advantage living near the urban center to work, and for their activities.
Social and cultural value	The existence of old families characterizes the region, keeping alive the historical and cultural practices and heritage that are part of the social and cultural identity of Corimba.
Safe bathing zone	Population that bathes on the beach feels safe with the shallow depth of the sea, and the absence of currents.
The fishing activity	The fishing activity was mentioned as a good barometer of delinquency in the region.
Fishing Sector	
The Bay benefits artisanal fishing	The fishermen develop their activity in this region, due to the facilitated access to the sea, and the conditions the bay provides for artisanal fishing.
Proximity to the urban center	The proximity to the urban center improves product sales, and distribution.
Social and cultural value	The fishing activity also has a strong cultural and social value that should also be valued in the urban centers.
Zone protected from the rip tides	This zone is considered privileged due to the natural sand barrier that prevents rip tides from reaching the coast, as it occurs in the Island of Luanda.
Hotel Sector	
Location	The proximity to the ocean, and the ocean view is a plus for the businesses. It is considered the main attraction point for their customers.

Aspect	Description
Proximity to the urban center	This proximity allows the businesses to offer a type of differentiated service to their customers that need to be in Luanda, with the advantage of having facilitated access, and less traffic to the airport.

The resident community interviewed considers that the population engaged in fishing activities is more vulnerable to the intervention of the Project of Marginal da Corimba Master Plan, than those who depend on other activities. In turn, the need for improvement in the coast of Samba is, to a great extent, associated with the lack of basic sanitation, and urban disorder. However, the vulnerabilities are presented differently in each group interviewed (see Table 4.20).

Table 4.20: Vulnerabilities emphasized by the population.

Aspect	Description
Population	
Basic Sanitation	There are serious difficulties in the management of solid wastes by the population. In one hand the regular collecting capacity is considered poor, frequently due to the inaccessibility of the equipment to some residential zones, and to the lack of an appropriate garbage segregation and treatment system *in loco* by the population. The wastes are discharged daily into the sea, and accumulated in specific points along the streets, preventing many times traffic access in the secondary and tertiary roads of the neighborhoods.
Urban Disorder	The disorderly growth of houses in locations not anticipated for residential purposes, put at risk the life of their owners who built them in risk zones, block certain roads, and create alleys that increase the insecurity felt by the populations.
Constraints in water drainage	They have been causing floods on the roads, preventing the circulation and flooding houses.
Houses built in risk zones	The illegal construction of houses in zones affected by the increase in the level of the water table during the rainy season, aggravates flood events in residential zones, and the water drainage. There are still houses built near the sea on narrow landfills that do not provide stability to the houses, or to their residents.
Degradation of the Infrastructures	Water, power, and sewage networks.
Fishing Sector	
Basic Sanitation	The major quantities of waste that slide through the drainage ditches

Aspect	Description
	into the sea, in addition to the waste that is thrown by the inhabitants, put the marine fauna at risk, and the quality of the fish sold in the market.
Urban Disorder	The disproportionate and disorganized growth causes constraints in the access to the port, and between the neighborhoods.
Poor Power Distribution Network	The lack of a stable power network limits, to a great extent, the development capacity of the industrial sector.
Hotel Sector	
Basic Sanitation	The fragile public solid waste collection system, affects the image of the services that are offered to the customers.
Roads	Roads not paved make it difficult for the customers to move, and have access to the enterprises.
Power Distribution Network	The lack of a stable power network increases, to a great extent, the maintenance expenses of hotel complexes, turning them dependent on the generators, and the price fluctuations of the fuel.
Fragilities and deficiencies in the water distribution network of tap water.	Currently the Corimba Neighborhood is without tap water, which increases the maintenance expenses of the enterprises interviewed. The remaining neighborhoods continue to be supplied with water by EPAL, and the enterprises have storage tanks to mitigate the impact caused by the disruptions that regularly occur in the distribution network.

One of the biggest concerns of the population is the possibility of having to be transferred to other areas of Luanda. However at this point there are two different situations; the population that lives in rented houses, and do not depend on the fishing activity for survival, and the population that live in their own house. The ones that live in rented houses, or illegal houses, and that live in a very precarious financial situation, will have difficulty to find another house near the urban center at an accessible price. The population that live in their own house, and whose activity does not depend on the fishing sector is less vulnerable prior to the intervention. The possibility of being able to maintain their jobs after being displaced is their main concern.

Another concern is the possibility of losing the Porto of Mabunda, or of it being relocated. With this change two situations become a concern: eradication or decrease of the fishing activity, and the distance to the Harbor, when compared to the neighborhoods where they now live. The first concern may have an impact on the access to fresh fish at a low cost, given their financial capacity; and increase criminality and delinquency, due to the displacement of many young workers that did odd jobs in the port, in the market, and even in the fish company. In the second scenario, the distance to the Port can result in an increase of the cost of the fish, due to the freight value of the product to the center of the city, and the commute of workers and customers.

The main concerns for the overall population are the following:

- Increase in robbery/assault and delinquency due to the unemployment of young workers;
- Generation of more poverty if no reintegration policies are enforced;
- Displacement of the population.

The main concerns for the fishing sector are the following:

- Loss of the social and cultural value of the coastal zone of Corimba;
- Food safety;
- Unemployment;
- Increase in insecurity and delinquency;
- Modifications in the marine fauna.

For the hotel sector, the main concern is the following:

- Decrease in the activity and business volume.

4.8.9. SUGGESTIONS AND EXPECTATIONS

The Resident Community considers that a revitalization program should take into account improvements in the public spaces of the neighborhoods where they reside, particularly in the Camuxiba neighborhood. This includes the improvement in the housing conditions, and in the basic sanitation and supply networks. Significant improvements in the waste management and collection system are also anticipated by the population. They also consider that new spaces destined for new pressing activities that generate employment for the local population, and tourism should be incorporated.

They suggest the creation of spaces destined for social services that are needed in the Neighborhoods, e.g. schools, health centers, and social care centers.

Leisure areas and places of knowledge should also be created, e.g. library, video library, cultural center, green spaces, boardwalk/promenade, sports fields, and leisure areas on the beach. The population also requests an intervention in the neighborhoods, by opening new roads, to eliminate the existing alleys, and the narrowing of the public routes.

The fishing sector specifically suggests that a Revitalization Program should implement infrastructures for the development of this sector, with conditions that do not compromise the surrounding communities, and improve the quality of the fish sold. It suggests that any intervention should be duly monitored, so that the improvements to the level of revitalization of the public spaces and infrastructures be effective, without any additional constraints. For the hotel business sector, a revitalization program should focus on the accomplishment of improvements in the existing urban perimeter, before proceeding with the expansion of new blocks on the current hydrographic basin, namely, the revitalization of the Port of Mabunda.

The local administration also considers that a revitalization program that foresees the creation of a new reclaimed area, with direct impact on the existing communities, should anticipate specific measures that contribute to the improvement of the living conditions of these populations, since there will be expectations and concerns that should be met. The administration also requests to be informed promptly of any intervention project foreseen for the coastal fringe of Samba, in order to prepare and mobilize the population for any intervention, as well as to contribute with risk mitigation strategies.

4.8.10. STAKEHOLDERS ENGAGEMENT

The participation of the parties directly affected during the planning, and development of the program is desired by all at different levels. The community represented by the resident and non-resident fishermen, and others wish to have an active role, and be notified of regular meetings, to keep informed, provide feedback, and raise awareness among other residents. The fishing industry is also available and interested in providing feedback, if there is an interest.

The hotel companies are also available and willing to provide some feedback, but more importantly, expect to be informed of the program´s progress, to be able to follow up, and adapt to each phase.

In turn, the municipal administration expects to have an active role in the follow-up of the program. They wish to receive prompt information to be able to prepare the communities, and hold town hall meetings. The administration considers it plays a privileged role in the mediation of the communication between the intervention programs, and the local population, as well as a strong ability to mobilize the population.

More recently, on 15, 16, 17 and 30 March 2016, public consultation meetings were held in order to present the three Project Phases and get contributions from participants. These meetings were attended by a total of 50 people representing the State, the private sector, the communities, fishermen and fishwives (see Figure 4.104).

Figure 4.104: Detail of the various consultation meetings held in March 2016.

4.8.11. RESULTS OF THE PUBLIC CONSULTATION

The study performed reveals that the population desires to benefit from an intervention in the revitalization of the coastal fringe of Samba - Corimba. The problems that are confirmed at the urban planning level, and put the quality of life at serious risk, and the housing conditions are urgent, and raise the desire of the population to see this situation improved. A revitalization program with direct impact in this area in turn creates expectations to the improvement of the living conditions of the population that lives in the coastal zone of Samba.

The coastal strip that extends from the Samba Pequena Neighborhood up to Corimba is considered one of the most vulnerable zones of the city by the municipal administration, due to the overpopulation of neighborhoods, the lack of urban planning, the traffic jam, aggravated by a great weakness, and the inability to manage the domestic and commercial wastes accumulated along the traffic routes. The roads are affected by the waste produced by the neighborhoods located along the drainage ditches, which are used to deposit all types of waste, including broken equipment that is discharged into the sea. The fragilities that also exist in the basic sanitation networks, and the difficulty to drain the rainwater, increase the vulnerability of the neighborhoods, and the resident population.

Therefore it is concluded that any revitalization program of the coastal strip, particularly when involving new housing and residents in this region, should also consider the rehabilitation of the existing neighborhoods that will be directly affected by the Project. Thus responding to the expectations generated, and the concerns felt by the population, due to the extremely urgent need to address certain poor housing conditions.

The proximity to the urban center of Luanda is one of the main reasons the population density in this coastal area is so high. Another motive lies in the generational bond of the older residents to the fishing activity. Nowadays, the new fishermen are college/high school graduates, as a result of the lack of opportunities in their vocational areas, in other branches of activity.

The fishing activity is thus considered an extremely important sector, and should be preserved. Its development in this region is considered a plus, given that it is a professional activity accessible to the majority of the population of Luanda, not only of Corimba, with direct impact on a wide network of workers of different occupational areas, entirely dedicated to support this activity, e.g. cab drivers, truck drivers, resellers, among others.

The land reclamation, included in the revitalization plan under study, is one of the concerns stressed by all the interviewees. The potential threat to the species of fish that reproduce in shallow maritime zones, as verified currently in the Bay of Mabunda, Corimba, was emphasized. These maritime zones are those that offer the best conditions for artisanal fishing (gillnetting), and where the commercially cheapest fishes live, e.g. Sardine, *Cabuenha* carp, and *Malongo* fish. The maritime characteristics for the preservation of the fauna, and the type of fishing undertaken by many of the fishermen is a preponderant aspect, and should be addressed to preserve this activity, and not jeopardize the livelihood of a major part of the population, regarding the income of those engaged in that activity, and food safety.

Another risk factor emphasized regarding the territorial expansion from the ocean (land reclamation) is the difficulty to maintain the required conditions for the Fishing Harbor. There is a natural zone that blocks the rip tides, not allowing them to affect the coast. The land reclamation is perceived by the population as a risk, by disrupting this natural protection barrier. Without this natural protection, the maritime Port cannot provide the required conditions for the boats.

The third factor of concern pointed out by the population is the safety of those who visit the beaches. The population is fearful of the sea depth, since they consider that the land reclamation (expansion of the coast) may put the population that enjoys bathing at risk.

All the residents interviewed defended that it is important to have free access to the beach. However one of the directors of the hotel venture proposed the existence of two categories: free access and limited access by granting concession areas to the tradesmen who develop their activities near the sea, to safeguard the cleanliness and preservation of the appropriate beach, without overburdening the administration community services.

There are divergences of opinions regarding the Project of Marginal da Corimba Master Plan*,* between the social classes interviewed. The fishing community, and the lower-class residents showed to be more apprehensive regarding the program, due to the fact that their livelihood is directly at risk, not only because of the relocation of the harbor, and the structure of the commercial network, and of what supports their activity; but also the modifications that may occur in the coast, and potentially affect the marine fauna, and the availability of the current commercially important fish species. The lower-class residents also showed their specific concern regarding the potential displacement of people, since they recognize that they are more vulnerable due to their housing conditions, and are not home-owners. These residents depend on the proximity to the center of Luanda to perform their job activities. However they desire better housing conditions in an organized neighborhood. The middle-class residents revealed to be more optimistic regarding the revitalization program. However they expect to benefit from the rehabilitation of the public spaces in the neighborhoods where they live. Given their sensitivity to the standards of living, and their access to activities that promote the well-being and the quality of life of the population, they eagerly desire the creation of new outdoor leisure areas, and more open spaces for activities, cultural venues, and places of knowledge.

Public consultation sessions held in 2016 have allowed all participants, through rational and pragmatic discussion, to make a joint approach to the Project in order to identify solutions to the problems identified and synergies for the implementation of the Project with the least possible impact on the local population. Table 4.21 shows the main questions and concerns raised during the meetings held.

Table 4.21: Concerns of stakeholders in the meetings held in March 2016.

Date	Expressed Concerns
15/03/2016	❖ During the implementation of the project will there be maintenance of the fishing activity at Mabunda beach as well as related activities (treatment, salting, drying and trading of fish)? ❖ Which will be the framing method of fishermen and traders in the future Fishing Port? ❖ The Fishing Port construction project should be sized to accommodate all traders who are selling at Mabunda market so as to avoid the presence of informal markets outside the Port.
16/03/2016	❖ Phase 1 dredging and landfill activities may affect the activities held by the Military Nautical Club and will also have an impact on the construction of the future Marina General Rui de Matos which should be built in order to serve the Military Nautical Club.

Date	Expressed Concerns
	❖ How will artisan fishermen and fishing industry companies have access to the sea while the project is in progress? ❖ Will there be resettlement of local populations? ❖ Will the Fishing Port Project have fish processing units? Will salting and drying of fish be allowed in the Port? ❖ How will land ownership be treated, whose responsibility lies now under the jurisdiction of the Captaincy of the Port of Luanda since the territorial extent will be expanded?
17/03/2016	❖ How will the Southwest Marginal construction project be conciliated with the Corimba Marginal Project, seeing that with the planned landfill, the future Southwest road will no longer be considered a main road? ❖ What measures will be taken for waste water treatment from the Samba Urban District drainage ditches? ❖ Will artisan fishermen of Mabunda beach be rehoused during dredging and hydraulic landfill works? ❖ Provision should be made to create a safe place to avoid constant movement of artisan fishermen and traders of Mabunda market. ❖ The new Fishing Port should include appropriate areas for treatment of fish (fish salting and drying).
30/03/2016	❖ Does the Marginal da Corimba Project include green and leisure areas along the way? Will shade trees or ornamental species be planted? ❖ Which infrastructures are planned or designed in the Project? ❖ The project will have an impact on improving the drainage of rainwater, taking into account the presence of stagnant waters that currently exist due to the malfunction of the drainage ditches. ❖ Does the Project include treatment of the Samba lagoon waters?

4.9. AIR QUALITY

Although no specific tests have been undertaken in the project area, due to the fact that the coastal perimeter under study is part of the urban environment, with a main residential and commercial focus, where the absence of industries that generate atmospheric pollution is highlighted; the air quality in Marginal da Corimba, can be considered satisfactory.

However it should be considered near the coastline, in the region of the existing fishing harbor, where the lack of hygiene is notorious, mainly associated with the leftovers from the cleaning of the fish by the fishwives in particular, and result in a particularly uncomfortable condition, due to the dissemination of unpleasant odors associated with decaying organic matter. In turn, in the lagoon region of Chicala, the discharge of effluents and sewage also disseminate bad odors in that region, especially at nighttime, when the microbial activity is greater, and the release of methane is noticeable.

It should also be noted that car traffic, particularly in the roads that surround the perimeter, as well as the existence of power generators likely to emit pollutants that contribute to the greenhouse effect can also be referenced. They are also associated with the conditions of the local air quality, in specific moments, unpleasant odors in some alleys that result from domestic effluents and stagnated waters. The lack of pavement in the internal roads (neighborhoods), and the absence of green areas results in a cloud of dust from road traffic, particularly during the dry season.

4.10. SOUND ENVIRONMENT

In 2011 spot measurements were performed for two days in different parts of the Mussulo lagoon system (Figure 4.105). The analysis was performed by using a noise measuring equipment consisting of a Brüel & Kjær precision sound level meter, model 2250. A Brüel & Kjær, model ZC 0026, pre-amplifier and a Brüel & Kjær 4191 microphone with a set up windshield have been coupled to that equipment.

Seeing that the site has now some human occupation which uses the space in various ways, noise emission is likely to happen which may interfere with the sound condition of the area. Furthermore, the movement of vessels along the bay, the movement of motor vehicles and the use of generators in areas of higher population density, is a source of noise emission on site with impact on the environment. The results of measurements carried out can be seen in Table 4.22. These figures show, by their average quantitatives in the perimeter, values that can range from comfortable, up to interference in hearing loss if exposure exceeds 8 hours per day.

Figure 4.105: Measurements points

Table 4.22: Sound environment measurements conducted in the study area.

Place	*Day*	*Time*	*Leq value(dB)*
A) Ponta do Prior	*13.11.2011*	*11.00h – 11.45h* *15.00h – 15.45h*	*50 – 85* *55 – 85*
B) Ponta da Canganza	*13.11.2011*	*12.00h - 12.45h* *16.00h – 16.45h*	*55 – 65* *50 – 65*

Place	*Day*	*Time*	*Leq value(dB)*
C) Ilhéu dos Pássaros	*13.11.2011*	*13.00h – 13.45h* *17.00h – 17.45h*	*45 – 70* *40 – 55*
D) Buraco	*12.11.2011*	*10.35h - 10.55h* *16.35h – 16.55h*	*50 - 65* *50 – 75*
E) Saco dos Flamingos	*12.11.2011*	*10.00h – 10.20h* *16.00h – 16.20h*	*40 – 60* *40 – 60*

In 2015 noise measurements were performed, trying to understand succinctly the sound environment of the study area along the coast of Corimba. To reduce the time period between measurements, skipping the traffic influence, it was decided to perform a survey of the sound environment using a boat, lean against the coast near the sampling points. Five (5) sampling points were defined, and equally distributed within a 7-kilometer radius, according to the project boundaries (see Section 2.2). An additional point (Point 3) previously defined was achieved during the measurements, given that the site displayed an intense movement of people (see Figure 4.107). Figure 4.106 lists the sampling points of the sound environment, whereas Table 4.23 indicates their coordinates.

Table 4.23: Geographic coordinates of the sampling points for the noise survey.

Point	GPS Coordinates	
	Latitude	Longitude
Point 1	8°52'35.9"S	13°11'11.9"E
Point 2	8°52'16.9"S	13°11'37.5"E
Point 3	8°51'22.8"S	13°12'11.5"E
Point 4	8°50'56.9"S	13°12'14.8"E
Point 5	8°50'15.1"S	13°12'08.3"E
Point 6	8°49'42.3"S	13°12'17.1"E

A Hand-held Analyzer – Model 2250-L from Bruel & Kjaer, duly calibrated, and fixed to a tripod (Figure 4.107) was used during the noise survey. This equipment is a Class 1 sound level meter that complies with the IEC standard 61672: 2003 of Electronics and Acoustics – Sound level meters.

Figure 4.106**:** Sampling points – sound environment.

Figure 4.107: Sampling of the sound environment.

4.10.1. DATA PROCESSING

The SYSCOM Instruments - MR Communication software was used for the data processing. This software analyzes and creates the graphical representation of the data collected in the field with accuracy. The equivalent sound pressure level (Leq) is the basic indicator of noise. The unit of measurement is decibel (dB), and it is defined as the logarithm of the ratio of the verified sound pressure to the reference value.

The following descriptors were used for this monitoring:

- **L_{peak}:** The greatest absolute instantaneous sound pressure during a stated time interval;
- **L_{90}**: The noise level is exceeded for 90% of the time. This is the measure of the higher noise level during the measurement period, e.g. during 1 hour of measurement, the L90 of 50 dBA means that the noise level was superior to 50 dBA for more than 54 minutes.

4.10.2. RESULTS

The sampling results are listed in Table 4.24. Points 3 and 4 displayed the highest levels of Laeq, being Point 3 in the *Mabunda* beach (gathering of fishermen), and Point 4 in the *Mabunda* Port (where the fish sales and purchases are performed).

Table 4.24: Results of the noise survey.

Point 1		Point 2		Point 3		Point 4		Point 5		Point 6	
Time	11:26 AM	**Time**	11:35 AM	**Time**	11:47 AM	**Time**	11:55 AM	**Time**	12:08 PM	**Time**	12:19 PM
Laeq	62.3	**Laeq**	66.8	**Laeq**	68.2	**Laeq**	68	**Laeq**	57.7	**Laeq**	52.1
LAF90	55.9	**LAF90**	56.7	**LAF90**	57.9	**LAF90**	61.2	**LAF90**	51.8	**LAF90**	50.1
Lcpeak	107.1	**Lcpeak**	96.1	**Lcpeak**	107.7	**Lcpeak**	97.5	**Lcpeak**	84.5	**Lcpeak**	81.4

The data collected is compared, to provide an example, with the World Bank guidelines (World Bank: General Environmental Guidelines, 1998) on the maximum noise levels in residential and industrial receptors, during the daytime, and with the standards of the Brazilian Association of Technical Standards (ABNT) on noise assessment in residential areas, aiming for the community well-being (NBR 10151). These levels are listed in **TABLE 4.25**.

Table 4.25: Maximum Noise Levels, In Db.

Regulations	Receptor	Daytime (7:00 AM-10:00 PM)
World Bank	Residential; institutional, educational	55
	Industrial, Commercial	70
NBR 10151	Mixed area, predominantly residential	55
	Mixed area for commercial and administrative purposes	60
	Mixed area for recreational purposes	65

4.11. LANDSCAPE

The landscape is no longer a mere aesthetic background for human activities, and became another resource, and as such was included in the territorial planning processes, and the different legislations on environmental protection. The landscape is regarded as an element comparable to the others, e.g. fauna, vegetation, soils, water quality, etc. Likewise it needs protection and it is susceptible to being used, modified, and can be considered during the assessment of the capacity and fragility of a territory, as a result of the installation of certain infrastructures and/or the development of certain activities. The landscape analysis methodology is focused on determining the potential effects that the project may have on the environment, from a landscape standpoint. Hence the analysis of its visual field was undertaken, which is the surface where a set of points of reference can be seen, or reciprocal, the visible area from a point of reference, or group of points.

The boundaries of the study area comprise the coastal fringe that extends from Corimba and Samba, up to the Chicala region, as well as its surroundings. In this region the existence of a higher zone in the interior part, which given its geomorphology leans towards the coastal part, is appraised. However, direct observation in many locations is obstructed by the existence of constructions, which restricts the panoramic view of the ocean, mainly when standing on the same visual field.

Quality is defined as the intrinsic condition of the landscape that makes it valuable. It refers to the interest, appreciation, or pleasure that the observer attains. This can be divided up in two:

- **Aesthetic** q**uality**: it is the condition of the landscape that makes it be considered beautiful, attractive, exciting, or evocative.
- **Visual quality**: it is the condition of the landscape that brings value to it, when it shows with effectiveness the interest of the scenario, and when wide and deep views can be achieved.

Considering the aesthetic landscape, given the indirect economic value that Marginal da Corimba may prove to have, one can assert that it is of high quality. However, given the current scenario, where a set of constructions without adequate sanitation or urban patterns, associated with the inappropriate performance of activities along the shore, devalue this part of the coastal fringe from an aesthetic standpoint.

Considering the visual landscape, given the existing land use, if the perspective will be in the direction of the sea, or from higher spots for the panoramic view of the interior of *marginal*, a functional disorder is noticed, which interferes with the visual landscape, hence downgrading its landscape value (Figure 4.108).

Figure 4.108: Current visual landscape facing the sea - coastal zone of Chicala, Samba, and Corimba.

4.12. PROTECTED AREAS

The project is located near the Integral Natural Reserve *Ilhéu dos Pássaros*, however, it is important to stress that part of the Cazanga island, namely the Southern tip, due to its high ecological value, has been suggest by the Environmental Department of the Faculty of Science in 2006 to be integral part of the protected areas system of the Mussulo lagoon. Notwithstanding by applicable law in the country, all the islands are considered as reserves.

As for the mangroves, its importance is referred to in numerous articles, evidencing the particularities they provide to the composition and maintenance of certain ecosystems. In connection to them and, somehow depending on them, numerous representatives of fauna are included, both marine and terrestrial.

This complex network of ecological relations, renders mangroves rather complex and sensitive ecosystems of great importance in ecological balance, making it a favourable nursery for the development of many species of animals and plants, as well as a feeding and protection place for crustacean, molluscs and fish species with commercial value. Apart from these functions, mangroves also contribute to the survival of birds, reptiles and mammals, many of which integrating the lists of threatened or endangered species.

It should be stressed that some of the bird species reported for the Mussulo lagoon system, are cataloged by the IUCN red list, as threatened species or critically endangered and included in the CITES and CMS Appendices.

The study area has a special meaning for being part of the coastline of the Mussulo Bay which is characterized as a wetland and for the flora and fauna associated with it. According to IUCN (1992), wetlands, in the Angolan context, include all areas affected by water either naturally or artificially, permanently or temporarily, or even by stagnant or flowing waters, by fresh, brackish or salty water; they also include the marine water areas in inter-tidal and sub-tidal zones not exceeding 6 metres in depth, including sandy beaches, marshlands and lagoons or sheltered bays.

By the Ramsar Convention, it is considered a site of international importance for preservation of biodiversity, because it maintains vulnerable species, endangered and threatened ecological communities; it maintains vegetal and animal species populations important to keep biological diversity of the biogeographic region; it maintains animal species when they are in a critical stage of their biological cycle, offering shelter; and it maintains a significant proportion of fish species, stages of the biological cycle, interactions of species or populations that are representative of the benefits and/or values of wetlands and thus contribute to the biological diversity of the region.

CHAPTER 5

IMPACT ASSESSMENT AND MITIGATION MEASURES

5. IMPACT ASSESSMENT AND MITIGATION MEASURES

This chapter describes the environmental and social impact assessment of Marginal da Corimba Master Project, with the characterization and identification of such impacts, and lists the mitigation measures for the potential negative impacts that result from the implementation of the Project.

The Project will result, due to its characteristics and dimension, in (positive and negative) environmental and social impacts; in which intensity is not uniform for all the assessed components. Therefore, this summary of the impact assessment aims to establish a common baseline for the integration of the information generated, in order to facilitate its use in the decision-making process; making it possible to identify the interactions, and the establishment of comparisons between the environmental and social components.

The potential impacts were assessed according to the activities to be performed within the scope of the Marginal da Corimba Project described in Section 1.5 of this Combined ESIS, and in Chapter 2 (Project Description). The following are the three (3) main components assessed in this chapter:

- Dredging, and land reclamation of the area of Marginal da Corimba (Phases 1, 3, and 4);
- Drainage infrastructures, including the extension of the existing drainage ditches;
- Coastal protection.

This assessment of each component is accomplished taking into account the specific activities of each one; since the pressure they exert on the environment is different, and consequently result in differentiated impacts. The impact assessment described in this chapter was specifically performed only in reference to the implementation/construction process, given that the operation of Marginal da Corimba Project will be subjected to a process of usage, after the construction of the spaces, and the implementation of other construction phases that are outside the scope of this Combined ESIS.

5.1. ADOPTED METHODOLOGY

The adopted methodology for the environmental and social impact assessment in this study employed matrices of impact interaction. Matrices are one of the most commonly used tools in environmental impact studies, given that they can summarize the assessment, and identify the relationships that exist within the project actions, and the environmental impacts that result from it.

Therefore the matrix proposed by Christopher M.R. Pastakia in the Danish Water Quality Institute in Denmark, and published under the title “Rapid Impact Assessment Matrix” (RIAM) was adapted and employed. It should be noted that this matrix has been used since 1998 in several countries of Europe, Asia, South America, and Africa.

The principle of the RIAM Method is to distribute selected variables into four environmental components with influence on the environment, and on the quality of life of the people under assessment, namely:

a) **Physical / Chemical Component (PC):** pertains to all the physical and chemical aspects that can modify the environment, including the non-renewable resources, and the physical degradation of the environment. The air and noise quality, the quality of the effluents and wastes to be produced are aspects to be considered in this component
b) **Biological / Ecological Component (BE):** pertains to all biological and ecological aspects that can modify the environment, including the non-renewable resources, impacts on the biodiversity, intra and inter-specific relationships, and the impact of pollution on the ecosystem.

c) **Social / Cultural Component (SC):** includes the individual, social, cultural and religious human aspects. In this component the ethnic differences are contemplated, as well as the religious habits, the cultural structure of the local society, and its habits and customs.

d) **Economic / Legal Component (EL):** aims to identify, and quantify the consequences of economic activities, as well as the complexity of the project´s management operations from a legal standpoint, such as: creation of local job opportunities, procurement of local goods and services, power and water consumption, road traffic, protected areas, etc.

With the addition of variables in the four matrix components, the quantification of each variable results in an environmental classification of all components, which are later assessed in an integrated manner. For this assessment, the analysis is divided up into two groups as listed in Table 5.1 and Table 5.2.

Table 5.1: Environmental Components of Group A.

A1 – Spatial Scale / Importance		A2 – Magnitude of Change	
Score	***Classification***	***Score***	***Classification***
4	Important to international interests	**+3**	Major positive change
3	Important to regional/ national interests	**+2**	Significant positive change
2	Surrounding areas (Limited to 5 km of the project)	**+1**	Positive change
1	Important only to the local environment	**0**	No change in *status quo*
0	No importance	**-1**	Negative change
		-2	Significant negative change
		-3	Major negative change

Table 5.2: Environmental Components of Group B.

	B1 – Permanence	B2 - Reversibility	B3 – Cumulative Effects
Score	*Classification*	*Classification*	*Classification*
1	Short-term (0 to 1 year)	No change	No change
2	Short-term (1 to 5 years)	Reversible	Non-cumulative/Single
3	Medium-term (5 to 15 years)	Irreversible	Cumulative / Synergistic
4	Long term (>15)		
5	Permanent		

The **Environmental Impact Classification** (EIC) calculated for each variable may vary between -132 and +132, being this calculation performed with the use of the following equation:

$$\mathbf{EIC = (A1 \times A2) \times (B1 + B2 + B3)}$$

Hence, according to the resulting environmental classification and its specific category, it is possible to obtain a description of the importance of the impact caused by the action, given a certain variable of the condition under assessment. The environmental classification with its distinct categories and descriptions according to the impacts is listed below in Table 5.3.

Table 5.3: Description of the categories vs impacts.

RIAM Environmental Classification	Description of the category vs impacts
84 to 132	Major positive impacts
48 to 83	Significant positive impacts
25 to 47	Moderate positive impacts
13 to 24	Medium Positive impacts
1 to 12	Slight positive impacts
0	No impact
-1 to -12	Slight negative impacts
-13 to -24	Medium Negative impacts

RIAM Environmental Classification	Description of the category vs impacts
-25 to -47	Moderate negative impacts
-48 to -83	Significant negative impacts
-84 to -132	Major negative impacts

The criteria of importance of the impacts, in an analysis of the assessment result may be described in a summarized and easy to understand form, as listed below:

Major positive impacts: very significant improvement in the existing condition. Extremely relevant improvement in the status of a resource, or population. Total satisfaction of a predictable/required need in the long run

Significant positive impacts: a quite significant improvement in the existing condition. Considerable improvement in the status of a resource or population. Total satisfaction of a predictable/required need in the medium term.

Moderate positive impacts: significant improvement in the existing condition. Improvement in the status of a resource or population. Partial satisfaction of a required need.

Medium Positive impacts: improvement in the existing condition. Slight improvement in the status of a resource, or population. Partial satisfaction of a need.

Slight positive impacts: slight significant improvement in the existing condition. Very slight improvement in the status of a resource or population. Partial satisfaction of a need.

No impact: no recorded impacts on the environment, and the population.

Slight negative impacts: impact on resources of little importance, or a low-degree impact. No loss of usage.

Medium Negative impacts: impact on resources of local importance, or a low-degree impact. Changes in usage

Moderate negative impacts: impact on resources of local and regional importance, or an irreversible medium-degree impact. Loss of usage.

Significant negative impacts: impact on resources of regional and national importance, or an irreversible medium-degree impact. Significant loss of usage.

Major negative impacts: impact on resources of national and international importance, or an irreversible high degree impact of major magnitude. Significant loss of usage.

With this methodology, the intention was to adopt a scale of impacts with a sufficient number of values, to enable the representation and establishment of distinctions between the different conditions under assessment, without, however, becoming overwhelming, so as to introduce errors in the assessment process while interpreting insignificant (according to the accuracy of the available information) differences of the impact value.

5.2. IMPACT ASSESSMENT

The impact assessment process is focused on the potential impacts that are considered in this study the most important, and those potentially caused by the Project activities. The potential impacts and their assessment are described in the following section. Table 5.17,

Table 5.17: **Environmental impacts of the "dredging and land reclamation" component.**

tivities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase	
			Environmental classification of the project without mitigation measures	Environmental cla the project after t measures

			Importance A1	Magnitude A2	Permanence B1	Reversibility B2	Cumulative effect B3	Environmental classification CA	Importance A1	Magnitude A2	Permanence B1	B
	PHYSICAL AND CHEMICAL COMPONENT											
t of vessels/boats, and dredgers -Dredging nd reclamation tion of pile walls, and ent of embankments nt of machines, and vehicles of materials borrowed m other parts ction of effluents tion of solid waste e of workforce materials, and services	**Climate**	Changes to the local microclimate	2	-2	2	3	3	-32	1	-1	1	1
	Geology / Geomorphology	Changes to the coastal geomorphology	2	-2	2	3	2	-28	2	-2	2	3
	Soils	Changes to the mechanical characteristics, and permeability	0	0	2	1	1	0	0	0	2	1
		Erosion	1	-1	2	2	2	-6	1	-1	2	2
		Contamination of the soils	0	0	2	1	1	0	0	0	2	1
		Loss of potential for other purposes	1	-2	2	3	3	-16	1	-2	2	3
	Sedimentology	Changes to the sediment transport	3	-2	3	3	3	-54	2	-2	2	3
	Hydrography	Changes in the hydrodynamic levels and currents	2	-2	2	2	2	-24	2	-1	2	2
	Water quality	Physical contamination	2	-3	1	2	2	-30	2	-3	1	2
		Chemical contamination	2	-2	2	2	2	-24	2	-1	2	2
		Biological contamination	2	-2	2	2	2	-24	2	-1	2	2
	Air Quality	Change in the air quality at local level (increase in the concentration of air pollutants)	2	-3	2	2	3	-42	2	-2	2	2
		Increase in respiratory diseases and allergies	1	-1	2	2	2	-6	0	0	2	1
	Noise and vibration	Noise in the project area	2	-2	2	2	3	-28	2	-1	2	2
		Noise in the existing access roads	1	-1	2	2	3	-7	1	-1	2	2
		Noise in the marine environment	2	-2	2	2	3	-28	2	-1	2	2
		Noise discomfort experienced by the employees, and passers-by	0	0	2	1	1	0	0	0	2	1
	ECOLOGICAL AND BIOLOGICAL COMPONENT											
	Coastal and marine biodiversity	Destruction, or loss, and impact on the vegetation	Not Applicable									
		Attraction, or alienation of fauna, and behavioural changes	2	-1	2	2	3	-14	1	-1	2	2

tivities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase									
			Environmental classification of the project without mitigation measures						Environmental cla the project after t measures			
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B
		Disturbance and/or alienation of marine species	2	-2	3	2	3	-32	2	-1	2	2
		Disturbance and/or alienation of birdlife, and herptofauna	2	-1	2	2	3	-14	2	-1	2	2
	Habitat	Impact on the entire, or part of the marine habitat	2	-2	3	2	3	-32	2	-2	2	2
		Impact on the entire, or part of the coastal habitat	2	-2	3	2	3	-32	2	-2	2	2
	SOCIAL AND CULTURAL COMPONENT											
	Population	Impact on the public health	0	0	2	0	0	0	0	0	2	0
		Improvement in social conditions, and income	0	0	2	0	0	0	0	0	2	0
		Unemployment, or job change	1	-1	2	2	2	-6	1	-1	2	3
		Loss of propriety	0	0	2	0	0	0	0	0	2	0
		Changes in lifestyle	1	-2	2	2	2	-12	1	-1	2	3
	Planning, and use of the land	Attractiveness of the urban space	N/A									
		Real estate speculation	N/A									
	Landscape	Changes to the visual quality of the landscape	2	-1	2	2	3	-14	2	-1	2	2
		Conflicts / functional disorganization	1	-1	2	2	2	-6	0	1	2	1
	ECONOMIC AND LEGAL COMPONENT											
	Socioeconomic framework	Socioeconomic Progress	2	1	2	2	2	12	N/A			
		Impact on employment	2	1	2	2	3	14	N/A			
		Changes in the quality of life of the population	2	-1	2	2	2	-12	1	-1	2	2

tivities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase									
			Environmental classification of the project without mitigation measures						Environmental cla[ssification of] the project after th[e mitigation] measures			
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B[2]
		Overload of the road infrastructures	2	-1	2	2	3	-14	2	-1	2	2
		Overload of the sanitation infrastructures	2	-1	2	2	3	-14	2	-1	2	2
		Overload of the power sources	0	0	2	0	0	0	0	0	2	0
		Overload of water supply sources	0	0	2	0	0	0	0	0	2	0
		Overload of the waste collection infrastructures	1	-1	2	1	1	-4	0	0	2	0
	Legal framework	Compliance with the National Development Plan - PND (2013-2017) and the Luanda Metropolitan Master Plan (PDGML)	3	2	2	0	2	24	N/A			
		Impact on the ecosystems (protected areas)	2	-3	2	2	2	-36	1	-1	2	2
		Impact on protected or endemic species	1	-1	2	2	3	-7	1	-1	2	1

Table 5.18: Environmental impacts of the "drainage infrastructures" component.

tivities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase									
			Environmental classification of the project without mitigation measures						Environmental cla the project after t measur			
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B
	PHYSICAL AND CHEMICAL COMPONENT											
ehicles, and machinery ation of materials, and equipment s, and modelling of the soil on of the power grid n, and construction of rainage system the existing drainage ditches of effluents, and solid waste of the systems fitted to e old systems e of workforce d water consumption	Climate	Changes to the local microclimate	0	0	2	1	1	0	0	0	1	1
	Geology / Geomorphology	Changes to the coastal geomorphology	0	0	2	1	1	0	0	0	2	1
	Soils	Changes to the mechanical characteristics, and permeability	1	-1	2	2	1	-5	1	-1	1	1
		Erosion	0	0	2	1	1	0	0	0	2	1
		Contamination of the soils	1	-1	2	1	1	-4	0	0	1	1
		Loss of potential for other purposes	0	0	2	1	1	0	0	0	2	1
	Sedimentology	Changes to the sediment transport	2	-1	3	2	3	-16	2	-1	3	2
	Hydrography	Changes in the hydrodynamic levels and currents	1	-1	2	2	3	-7	1	-1	2	2
	Water quality	Physical contamination	1	-1	2	2	2	-6	1	-1	1	1
		Chemical contamination	1	-1	2	2	2	-6	1	-1	1	1
		Biological contamination	1	-1	2	2	2	-6	1	-1	1	1
	Air quality	Changes to the local air quality (increase in the concentration of atmospheric pollutants)	1	-1	2	2	2	-6	1	-1	1	1
		Increase in the incidence of respiratory diseases, and allergies	0	0	2	1	1	0	0	0	1	1
	Noise and vibration	Noise in the project area	1	-1	2	2	2	-6	1	-1	1	1
		Noise in the existing access roads	1	-1	2	2	2	-6	0	0	1	1
		Noise in the marine environment	1	-1	2	2	2	-6	1	-1	2	1
		Noise discomfort experienced by the employees, and passers-by	0	0	2	1	1	0	0	0	1	1
	ECOLOGICAL AND BIOLOGICAL COMPONENT											

tivities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase									
			Environmental classification of the project without mitigation measures						Environmental cla the project after tl measur			
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B:
	Coastal and marine biodiversity	Destruction, or loss, and impact on the vegetation	N/A									
		Attraction, or alienation of fauna, and behavioural changes	1	-1	2	2	3	-7	1	-1	2	2
		Disturbance and/or alienation of marine species	1	-1	2	2	3	-7	1	-1	2	2
		Disturbance and/or alienation of birdlife, and herptofauna	0	0	2	2	1	0	0	0	2	2
	Habitat	Impact on the entire, or part of the marine habitat	0	0	2	2	1	0	0	0	2	1
		Impact on the entire, or part of the coastal habitat	0	0	2	2	1	0	0	0	2	1
	SOCIAL AND CULTURAL COMPONENT											
	Population	Impact on the public health	0	0	2	2	1	0	0	0	2	2
		Improvement in social conditions, and income	0	0	2	2	1	0	0	0	2	1
		Unemployment, or job change	0	0	2	2	1	0	0	0	2	1
		Loss of propriety	0	0	2	2	1	0	0	0	2	1
		Changes in lifestyle	0	0	2	2	1	0	0	0	2	1
	Planning, and use of the land	Attractiveness of the urban space	N/A									
		Real estate speculation	N/A									
	Landscape	Changes to the visual quality of the landscape	1	-1	2	2	2	-6	1	-1	2	1
		Conflicts / functional disorganization	1	-1	2	2	2	-6	1	-1	2	1
	ECONOMIC AND LEGAL COMPONENT											

tivities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase									
			Environmental classification of the project without mitigation measures						Environmental cla the project after tl measur			
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B:
	Socioeconomic framework	Socioeconomic Progress	0	0	2	1	1	0	0	0	2	1
		Impact on employment	0	0	2	1	1	0	0	0	2	1
		Changes in the quality of life of the population	0	0	2	1	1	0	0	0	2	1
		Overload of the road infrastructures	2	-1	2	1	1	-8	1	-1	2	1
		Overload of the sanitation infrastructures	0	0	2	0	0	0	0	0	2	0
		Overload of the power sources	0	0	2	0	0	0	0	0	2	0
		Overload of water supply sources	0	0	2	0	0	0	0	0	2	0
		Overload of the waste collection infrastructures	0	0	2	0	0	0	0	0	2	0
	Legal framework	Compliance with the National Development Plan - PND (2013-2017) and the Luanda Metropolitan Master Plan (PDGML)	3	2	2	0	2	24	N/A			
		Impact on the ecosystems (protected areas)	0	0	2	0	0	0	0	0	2	0
		Impact on protected or endemic species	0	0	2	0	0	0	0	0	2	0

Table 5.19: Environmental impacts of the "costal protection" component.

, **Erro! A origem da referência não foi encontrada.**, describe the environmental and social impact assessment for the implementation phase of the Project, based on what is defined in the scope of the Combined ESIS (see Section 1.5).

It should be noted once again that the impact assessment here described was undertaken only in reference to the implementation/construction process, given that the operations will be subjected to an all process of usage after the construction of spaces, and the implementation of other construction phases that are outside the scope of this Combined ESIS.

The mitigation measures that can be incorporated into the Project to avoid, reduce, or compensate the impacts will be described at the end of the impact assessment, taking into account the best practices, whether in the methodological sense, or in the feasible sense.

5.2.1. PHYSICAL AND CHEMICAL COMPONENT

- **Climate**

Description of the Environmental Impacts

An impact assessment of the construction of Marginal da Corimba Project, as regards to the climate parameters in the study area, confirms that no significant impacts are anticipated on the climate.

The microclimate changes will result from the loss of sunlight reflection area, and the evaporation of the major area being reclaimed. Therefore, due to the major ocean area being reclaimed, resulting in approximately 310 hectares, the impacts of the "dredging and land reclamation" component actions correspond to the decrease in evapotranspiration, and a potential decrease in the atmospheric humidity in the current coastline as regards the microclimate.

Due to the dredging actions and the transport of material to the land reclamation site, greenhouse gases will be released into the atmosphere. A study is currently underway as regards the contribution of the project to the emission of greenhouse gases.

Impact Assessment

Moderate negative impacts are anticipated due to the impacts that result from the construction phase of the "dredging and land reclamation" component. There will be loss of usage, with a significant negative magnitude of change, with the spatial scale restricted to a 5-kilometer radius of the project, i.e. within the Area of Direct Influence, short-term duration (for the construction phase, which is expected to be executed over a maximum 2-year period), irreversible, and cumulative. No impacts are anticipated on the climate or microclimate for the construction phase of the "drainage infrastructures" component, given that the activities are occasional, and only related to the extension of the existing drainage ditches.

The impacts that result from the construction phase for the "coastal protection" component will form the basis of slight negative impacts, with an impact of little importance on the resources, or a low-degree impact. There will be no loss of usage, since the coastal protection infrastructures will be constructed in the land reclamation site that will be created. The spatial scale of these impacts will be restricted to the Project site, the magnitude of change, although negative, will be low, reversible, however cumulative, taking into account the construction work anticipated in the PDGML, and the typical circulation of vessels/boats in the Project´s zone of influence.

Mitigation Measures

Given the potential impacts that may occur on the climate, in a microclimate context, the following measures should be taken into consideration (see Table 5.4).

Table 5.4: Mitigation measures associated with the impacts on the Climate.

Impacts on the	Mitigation Measures
Climate	1. Restrict the intervention in the project area to a strict minimum, i.e. do not take actions not planned in the project. 2. Restrict the trips for the transportation and dredging of the material required for land reclamation and coastal protection, complying with the Traffic Management Plan. 3. Keep in good working conditions all equipment and generators used in the construction work.

Residual Impacts

Taking into consideration the mitigation measures, particularly for the "dredging and land reclamation" component, there will be a decrease of the Environmental Impact Classification (EIC) for this descriptor. However slight residual impacts will still occur, given the continuous emission of greenhouse gases.

- **Geology, and Geomorphology**

Description of the Environmental Impacts

It is anticipated that during the construction phase,, due to the movement of approximately 32 million m^3 of dredged material, and the use of rocky materials for the stability and coastal protection, up to a total amount of 1,556,150 tons, the coastal geomorphology will be modified, including the sea floor from where the materials borrowed will be removed.

The impacts on the coastal geomorphology result in various secondary impacts, and are generally little understood, and require further research (refer to the Environmental and Social Monitoring Programme in Chapter 6 of this report). Studies on environmental changes caused by the construction of land reclamation areas [25] show that the existence of a reclaimed area will result in a perceivable modification of the beach layout in adjacent areas, with the significant possibility of erosion in some coastal areas, and accretion in others. The

[25] *Gibling, Colin. Construction Process and Post-Construction Impacts of the Palm Jumeirah in Dubai, United Arab Emirates, Memorial University, 2013.*

erosion process of land surfaces created, or of slopes and pile walls, due to the action of rainwater and its runoff may result in silting.

The dredging of an opening channel in the Chicala Lagoon will modify the current lagoon structure, and transform it in a completely different environment, so it is extremely important to constantly monitor the changes that occur in this site. The impacts on the geomorphology are directly associated with subsequent modifications to the bathymetric system of the zone, and coastal modeling. The changes in the bathymetry of the zones from where the sand is being borrowed will have consequences for the local coastal dynamics (currents, ripples, and sediment transport).

Impact Assessment

Moderate negative impacts are anticipated for the "dredging and land reclamation" component, with a significant negative magnitude of change, and a spatial scale restricted to a 5-kilometer radius of the project site, short-term, irreversible, and cumulative, keeping into account other dredging activities anticipated for the region, including the actions underway in Mussulo.

No impacts on the geomorphology and geology are anticipated associated with the activities performed in this descriptor for the "drainage infrastructures" and the "coastal protection" components, as they will be allocated to one biotype (land reclamation zone) based on the anthropic principle. These zones will serve to consolidate the land reclamation site, and prevent and control future silting and erosive processes.

Mitigation Measures

Given the potential impacts that may occur on the geology and geomorphology, the following measures should be taken into consideration (see **Erro! A origem da referência não foi encontrada.**).

Table 5.5: Mitigation measures associated with the impacts on the Geology and Geomorphology.

Impacts on the	Mitigation Measures
Geology and Geomorphology	4. Prevent the unnecessary land reclamation of the areas outside the construction zone. 5. The exploration volume should be correctly calculated; avoiding the extraction, and, or unnecessary use of borrowed sand. 6. Selection of dredging methods based on the "Best Available Technique Not Entailing Excessive Costs" principle (BATNEEC), i.e. use an approach based on the adoption of more effective techniques, for an operation on an adequate scale, that are available on the market, and where the benefits obtained are greater than the costs required to obtain them. 7. Monitor the sedimentation by the coastal dynamics near the Fishing Harbor to be constructed in the future. 8. Take into consideration the micron-basin of the region, channeling effectively the storm water of the land reclamation area. 9. Monitoring of critical points, and where erosion is more likely to occur, and the application of measures to control them, namely: a. Repair of the points at risk (including repairs in the geotextile mat). b. Removal of landslides that may occur. c. The ridges that appear in the pile walls should be filled with resistant material, to avoid the aggravation of the deepening.

Residual Impacts

Since the impacts on the geology and geomorphology cannot be avoided, and even when taking into consideration the mitigation measures, there will be residual impacts on the "dredging and land reclamation" component during the construction phase; being the classification of potential impacts as moderate negative changes.

- **Soils**

Description of the Environmental Impacts

The risks associated with erosion, contamination of the soils, and loss of potential usage for other purposes, were considered using a qualitative approach for this descriptor, and taking into consideration the characteristics of the project area, as well as the adequacy of the soils for the various types of usage proposed.

During the construction period there will be a strong probability of soil contamination by accidental spills of contaminants (bituminous substances, oils, fuels, and other chemicals) into the soil.

Due to modifications in the hydrodynamic processes, and in the sediment transport, erosion or accretion is likely to occur in the coastline, and may even be perceived outside the project area. These impacts are closely associated with the descriptor geology and geomorphology.

Impact Assessment

Slight negative impacts are anticipated for the potential impact of erosion of the "dredging and land reclamation" component, with a negative magnitude of change, with a spatial scale restricted to a 5-kilometer radius of the project, short-term, reversible, and non-cumulative. Negative impacts are anticipated for the impacts of potential usage for other purposes The spatial scale of these impacts will be restricted to the project site, the magnitude of change, although negative, will be significant, short-term, irreversible, and cumulative.

Because it is a man-made soil, i.e. it is artificial, the impacts here assessed are of lesser importance, however they are likely to occur even on a smaller scale. Slight negative impacts are anticipated within the environmental impact classification during the construction phase of the "drainage infrastructures" component, for changes in the mechanical characteristics and permeability. The spatial scale of these impacts will be restricted to the project site, the magnitude of change, although negative, will be low, short-term, reversible, and non-cumulative. The impacts of soil contamination will be slightly negative during the construction phase. These impacts will only be important to the local condition, with a negative magnitude of change, short-term, and reversible.

Slight negative impacts are anticipated as regards the contamination of the soil for the "coastal protection" component, with an impact of little importance on the resources, or a low-degree impact. The spatial scale of these impacts will be restricted to the project site, the magnitude of change, although negative, will be low, short-term, reversible, and non-cumulative. Given that with the completion of the construction work for the coastal protection component, the likelihood of erosion in the pile walls constructed decreases, slight positive impacts are anticipated, with the spatial scale restricted to the site where protection is being applied, the magnitude of change, although positive, will be low, short-term, reversible, and non-cumulative.

Mitigation Measures

Given the potential impacts that may occur on the soils, the following measures should be taken into consideration (see Table 5.6).

Table 5.6: Mitigation measures associated with the impacts on the Soils.

Impacts on the	Mitigation Measures
Soils	12. In higher gradient areas, the land movements require safety measures, in order to avoid landslides. In the event it becomes necessary, support structures and soil retention structures should be provided, until the land reclamation site is stabilized. 13. Plan the future afforestation of the access roads to ensure water retention, and avoid the erosive phenomena, and waterproof the area and green zones. 14. The maintenance of the machinery used in the construction work (heavy machinery, and vessels/boats) should be performed in sites previously defined in the Waste Management Plan (preferentially in a dry dock in case of vessels/boats that require major repairs). 15. The wastes from the maintenance of the machinery should be stored, and disposed in sites appropriate for such purposes, to avoid contamination of the soil. 16. The wastes that result from the construction work (or works associated with it) should be stored, and disposed in sites appropriate for such purposes, in compliance with the Waste Management Plan to be applied to the Project. 17. If the need to transport liquid/solid wastes arises, their transportation should be performed with extreme caution, and follow specific safety rules for their storage, and transportation, to avoid accidental spills. 18. The channel to be opened in the Lagoon should take into account: **a.** The predominant orientation of the general circulation (currents, and tides; promote the circulation, and water renewal). **b.** The predominant orientation of the sediment transport (minimize the erosion/accretion zones). c. Consider enough width to prevent constraints on the circulation (promote the circulation, water renewal, and avoid "blind alleys").

Residual Impacts

The residual impacts are considered minor or negligible, if the mitigation measures are well applied.

- **Sedimentology**

Description of the Environmental Impacts

The assessment of this descriptor is based on the potential modifications in the sediment transport along the coast, due to the areas being affected by the dredging, consolidation of the land reclamation site, and coastal protection in Phases 1 and 3.

The depth will increase (changes in the bathymetry) in the site to be dredged, and the changes in the sea bottom profile also cause changes in the site dynamics. Moreover, it will result in changes to the physical environment, such as tidal currents, currents, swell, and consequent changes in the sediment transportation. The impacts are very specific for each study zone, and extremely difficult to isolate in terms of the natural or anthropogenic origin (e.g. rise in the mean sea level, or land reclamation). The effects depend on the scale, and frequency of the dredging, land reclamation, and local conditions of the zone under intervention (total system dimension, hydrodynamics, and sediment transport processes).

The changes to the sediment transport processes in the dredged and reclaimed area can cause changes in the erosion pattern of adjacent areas, which may consequently create new intertidal or subtidal habitats.

Moreover, the expansion of the drainage ditches will result in changes, due to the increase in the flow of the water being drained in zones where it did not exist. With the creation of breakwaters for coastal protection in Phases 1 and 3, currents will be diverted, given that the impacts are not known at this moment, and the system requires monitoring as a whole to ascertain the changes that may occur.

Impact Assessment

Significant negative impacts are anticipated for the "dredging and land reclamation" component, with a spatial scale important to regional interests, long-term, irreversible, and cumulative.

Negative impacts are anticipated for the construction of the "drainage infrastructures" component, with a spatial scale restricted to the circumscribed areas, significant negative magnitude of change, long-term, reversible, and cumulative.

Negative impacts are anticipated for the construction of the "coastal protection" component, with the spatial scale restricted to the circumscribed areas, a medium negative magnitude of change, long term, reversible, and cumulative.

Mitigation Measures

Given the potential impacts that may occur on the sedimentology, the following measures should be taken into consideration (see Table 5.7).

Table 5.7: Mitigation measures associated with the impacts on the Sedimentology.

Impacts on the	Mitigation Measures
Sedimentology	19. Take into account the dispersion, or the containment capacity of the land reclamation zone. 20. Monitor the changes in maritime currents. 21. Monitor the occurrence of new sand banks, or erosion zones along the coastal zone (including potential areas outside the enterprise, namely the Island of Luanda).

Residual Impacts

It is possible for the impact classification to be less detrimental, considering part of the mitigation measures; however it will still be difficult to foresee future impacts. The residual impacts were considered as medium negative changes.

- **Hydrography and Water Quality**

The identification of impacts on the hydrography and water quality aimed to determine the potential effects that the Marginal da Corimba Project may cause in the system.

Description of the Environmental Impacts

There are potentially various sources of pollution in the Project area, including the disposal of untreated sewage, and wastewater from households, storm water disposal, maintenance operations for vessels/boats, and fish processing/treatment. The quality of the water in the area where the dredging waste is deposited is likely to be less affected by pollutants or sources of contamination.

The dredging and land reclamation will cause the resuspension of the bottom sediment, in which contaminants and nutrients may exist, affecting the water quality, and causing the decline in oxygen, and consequently the asphyxia/death of some species. The impacts occur mainly when the sediment is contaminated by chemicals, solid waste, oils, and fats, as it is in the case of the study area located in the region of Samba Pequena, Samba Grande, and Camuxiba. An increase in the turbidity of the water is anticipated during the execution of the construction work.

The toxic products, and contaminants released by the disturbed sediment can dissolve, or suspend, and contaminate, or cause major mortality of species of ecological and fishing importance, of indirect and/or direct form for the region where the dredging will be performed. These impacts will be temporary. In one modified environment, the opportunistic species are the first ones to recolonize the location, rapidly occupying the disturbed areas, giving continuity to the changes of the natural dynamics.

These arguments also oppose the dredging of an opening channel in the Lagoon that will increase the circulation in the sea water. However, in this panorama the impacts cannot be assessed given that due to the major circulation in the waters, changes in the system will occur.

With the significant changes in the hydrodynamic processes and currents in the system, secondary impacts are likely to occur on the sediment transport, which may result in contamination by polluted sediment in the shoreline.

Impact Assessment

The impacts of changes to the hydrodynamic processes and currents will result in negative impacts for the descriptor hydrography of the "dredging and land reclamation" component, with a medium magnitude of change, with a spatial scale restricted to the circumscribed areas, reversible, however cumulative. As for the "drainage infrastructures" and "coastal protection" components, the impacts will be classified as slightly negative. The spatial scale of these impacts will be restricted to the enterprise site, the magnitude of change, although negative, will be low, short-term, reversible, and cumulative.

Impacts of chemical and biological contamination are anticipated on the descriptor water quality of the "dredging and land reclamation" component, with a medium negative environmental classification, and a medium magnitude of change, with a spatial scale restricted to the circumscribed areas, short-term, reversible and non-cumulative. As for the physical contamination, moderate negative impacts are anticipated, with a significant negative magnitude of change, short-term, reversible, and non-cumulative.

The impacts of physical, chemical and biological contamination on the descriptor water quality will result in slight negative impacts in the "drainage infrastructures" component. The spatial scale of these impacts will be restricted to the project site; the magnitude of change will be negative, short-term, reversible, and non-cumulative.

The impacts of physical and chemical contamination will also result in slight negative changes for the "coastal protection" component. No biological contamination is anticipated on this component.

Mitigation Measures

It is important to note that the changes in the hydrodynamic processes and currents cannot be avoided due to the Project design, however it is recommended to monitor the currents in the Project area, and in the Mussulo-Corimba-Chicala System. The mitigation measures for the impacts on the water quality are listed below in Table 5.8.

Table 5.8: Mitigation measures associated with the impacts on the Hydrography and Water Quality.

Impacts on the	Mitigation Measures
Hydrography	22. Monitor the currents and the hydrodynamic processes in the Project area, and in the Mussulo-Corimba- Chicala System.
Water Quality	23. The maintenance of the machinery should be undertaken in an appropriate and waterproofed site. The waste that results from this process must be duly stored, and further transported to an appropriate site for final disposal. Their transportation should comply with what is described in the Waste Management Plan. 24. Particular attention should be given to the maintenance of vessels/boats, as well as their refueling.

Residual Impacts

The residual impacts are considered slight negative impacts.

➢ Air Quality

Description of the Environmental Impacts

The impact assessment performed in this descriptor is mainly based on the identification of the main sources likely to cause degradation of the air quality, and consequently environmental problems.

Considering that the dredging site in Phases 1 and 3 is 10 nautical miles distant, and will be assisted by a vessel with the capacity to transport 4,870 m^3 of material; approximately 135 trips will be required in Phase 1, and 204 trips in Phase 3, to transport a total of 1,321,978 m^3. For the transportation of 40,000 tons per week of rocky material, approximately 1,300 trips per week will be required (approximately 190 per day), when considering the option of using a truck with a maximum capacity of 30 tons for their transportation. As a consequence of these trips, greenhouse gases will be released into the atmosphere, as well as particulate material, and other pollutant gases, thus temporarily decreasing the air quality in the region during the execution of the construction work.

The probability of adverse impacts is anticipated on the health of workers who can breathe the exhaust fumes and the suspended dust, even tough being insignificant, and on a small scale.

The production of dust will also occur during the modeling of the land reclamation site. The decline in the air quality may also cause impacts on the health of the surrounding population, and the construction workers, namely an increase of the tendency to allergic and respiratory diseases, migraines, among others.

Impact Assessment

For the "dredging and land reclamation" component the impacts with changes to the local air quality will result in moderate negative impacts. The spatial scale of these impacts will be restricted to the project site. The magnitude of change will be major and negative, however short-term, reversible, and cumulative. The increase in the incidence of respiratory diseases and allergies in workers specifically on the site is anticipated, with a negative magnitude of change, short-term, reversible and non-cumulative, resulting in a slight negative impact.

No increase in the incidence of respiratory diseases is anticipated for the "drainage infrastructures" component, and the impacts with changes to the local air quality will result in slight negative impacts.

The impacts with changes to the local air quality will result in moderate negative impacts in the "coastal protection" component, restricted to the circumscribed area, with a medium negative magnitude of change, short-term, reversible, and cumulative. Only an increase in the incidence of respiratory diseases in workers is anticipated, resulting in slight negative changes, with a negative magnitude of change, short-term, reversible, and with cumulative effects.

Mitigation Measures

Given the potential impacts that may result in modifications to the air quality standards, the following measures should be taken into consideration (see Table 5.9).

Table 5.9: Mitigation measures associated with the impacts on the Air Quality.

Impacts on the	Mitigation Measures
Air Quality	25. Perform a periodic maintenance of engines, and generators; and ensure that this is performed correctly, to control the emissions of gases from combustion engines in the construction site. 26. Transport the inert waste, including rocks, and construction materials in covered vehicles. 27. Humidify the ground during the driest and windiest periods, and promote the sprinkling of water in access routes, and in construction areas, to avoid the dispersion of dust. 28. Establish a speed limit for the traffic of vehicles in the construction site, taking into consideration that the potential emission of dust increases with speed. 29. Optimize the routes of vessels/boats, and heavy vehicles responsible for the transportation of the dredged materials, and rocky materials.

Residual Impacts

Even with the implementation of mitigation measures, due to the great number of trips of heavy vehicles and vessels/boats for the Project´s construction work, moderate negative impacts are anticipated.

- **Noise and Vibration**

Description of the Environmental Impacts

The impacts caused by the noise and the vibration will be connected to the pressures of equipment use, and the methodologies associated with the construction work in the first instance, and the overall population flows, which through road traffic, maritime traffic, and other aspects associated with the construction work of the Project will increase the noise levels.

A change in the sound environment mainly associated with the movement of machinery, and vehicles used in the construction process will occur. Given the nature of the Project, the main sources of noise emission are equipment such as compressors, pneumatic hammers, pneumatic drills, and compactor wheels, in addition to the vessels/boats and heavy vehicles.

The noise and vibrations generated by the construction work performed at sea will result in a potential alienation of some marine species, and disturbances in their way of life.

Impact Assessment

Moderate negative impacts are expected during the assessment of the “dredging and land reclamation” component as regards to the impacts that result from the noise in the project area, and in the marine environment , with a medium negative magnitude of change, with a spatial scale restricted to a 5-kilometer radius of the project, short-term, reversible, however cumulative. No impacts of noise discomfort experienced by the employees and passersby are anticipated; however an increase in the noise in the existing access roads is anticipated, with slight negative impacts.

The “drainage infrastructures” component will go through slight negative impacts, with medium negative changes, short-term, reversible, and cumulative. No impacts of noise discomfort experienced by the employees, and passersby are anticipated.

Slight negative impacts are anticipated on the descriptors for the “coastal protection” component with slight negative changes, short-term, reversible, and cumulative. No impacts of noise discomfort experienced by the employees, and passersby are anticipated.

Mitigation Measures

Given the potential impacts that may result in modifications to the noise and vibration, the following measures should be taken into consideration (see Table 5.10).

Table 5.10: Mitigation measures associated with the impacts on the Noise and Vibration.

Impacts on the	Mitigation Measures
Noise	30. All the equipment and machinery to be used in the construction work should be kept in good working conditions onshore and offshore. 31. Select construction techniques, and processes that generate less noise. 32. Assess and optimize the number of trips of heavy vehicles, and vessels/boats during the construction work. 33. Inform the neighboring population, by means of a Communication Plan, the use of construction processes and techniques that generate loud noise, and perform them preferentially during daylight.

Residual Impacts

Taking into account the mitigation measures proposed, the residual impacts will result in slight negative changes in all of the Project´s activities.

5.2.2. ECOLOGICAL AND BIOLOGICAL COMPONENT

➢ **Coastal and marine biodiversity**

Description of the Environmental Impacts

The main objective of the identification of impacts on the coastal and marine biodiversity in that exist in the area is to assess which will be the main modifications in this descriptor.

The coastal and marine biodiversity will be potentially affected due to the dredging activities and the creation of the land reclamation site, which will result in noise and vibrations. Special attention should be given to the species of sea turtles that use the area as a route to their spawning grounds, the birds that use the area for resting and feeding, and the crustaceans and other existing benthic animals on the site.

The dredging will overall result in a decline of the number of species, and benthic individuals, frequently involving modifications in the dynamic standards, and in the distribution of these animals. The physical disturbances associated with the removal, and relocation of sediment will result, in addition to the destruction of benthic habitats, in the mortality of these organisms, through wounds caused by mechanical action during the dredging activities, or by asphyxia while being sucked by the dredge.

Moreover, during the work in this component, the noise, and other effects of these interventions will result in the dislocation of species of fish, crustaceans, and other species to areas under less disturbance action, resulting in a modification to the spatial distribution of species, with a decline in the population density in areas near the project. This alienation may indirectly affect the population that uses the adjoining area to extract biological resources.

Impact Assessment

The impact on the marine ecology and marine organisms in the Project zone may be attributed to various aspects of the dredging program, namely (1) water contamination, (2) destruction of the habitat, and the (3) impacts resulting from the collision with turtles.

As indicated in previous impact assessments, the potential impact resulting from water contamination is considered low up to insignificant. Thus, it may be concluded that the total impact on the marine ecology and marine organisms is low. On the other hand, although the loss of marine habitats is considered inevitable, the total extent of the impact area is considered very limited.

The impacts of the “dredging and land reclamation” component (disturbance/alienation of the herpetofauna, birdlife, as well as behavioral changes) will result in negative impacts, with a spatial scale restricted to a 5-kilometer radius of the Project area (circumscribed areas), with a medium negative magnitude of change, short-term, reversible, and cumulative. The disturbance and/or alienation of marine species will be considered a moderate negative impact, with a spatial scale restricted to the circumscribed areas, with a significant negative magnitude of change, reversible and cumulative.

The impacts resulting from the dredging activities, specifically on large-sized marine organisms (turtles) are difficult to foresee. The presence of these species in the Project area is likely to occur and, consequently, there is always the potential for interaction with the dredging program.

Disturbances such as the alienation of fauna and marine species, resulting in behavioral changes are anticipated for the "drainage infrastructures" component, being classified as slight negative impacts, with slight negative changes, important to the local condition, short-term, reversible, and cumulative. The disturbance and/or alienation of the birdlife and herpetofauna is also not expected to occur in this component.

The disturbance and/or alienation of the birdlife and herpetofauna, and the alienation of the fauna and marine species, resulting in behavioral changes are anticipated, for the "coastal protection" component, being classified as slight negative impacts, with a slight negative magnitude of change, important to the local condition, short-term, reversible, and cumulative.

Mitigation Measures

Due to the potential impacts that may result in modifications to the coastal and marine biodiversity, the following measures should be taken into consideration (see Table 5.11). These mitigation measures are aligned with the Environmental Management Programme that provides more details on the activities to be implemented during the execution of the Project.

Table 5.11: Mitigation measures associated with the impacts on the Coastal and Marine Biodiversity.

Impacts on the	Mitigation Measures
Coastal and Marine Biodiversity	34. Adopt measures conducive to the safeguard of the marine environment, avoiding the dissemination of pollutants. 35. Manage and adequately control the produced waste. 36. Take into account the good navigation practices, and the maintenance of boats/vessels in the surroundings, respecting the fragilities of the ecosystem, and using techniques that prevent the mortality of turtles. 37. Adequately control the effluents likely to cause pollution, to avoid the contamination of the coastal zone. 38. Do not dispose surplus materials, debris, oils, and lubricants into the drainage lines and, or into the sea. 39. Control the noise of the dredging machines, vessels/boats, and vehicles used in the construction work. 40. Make available to the employees, contractors and population affected information on environmental education, as regards the existing biodiversity in the region of Corimba for their own protection.

Residual Impacts

During the construction phase of the "dredging and land reclamation" component it is anticipated that even with the implementation of mitigation measures, the impacts will result in slight negative changes.

- **Habitat**

Description of the Environmental Impacts

The main objective of the impact identification in the area is to assess which will be the main modifications, and impacts on the marine and coastal habitats. Although there is not an appropriate habitat for the reproduction of turtles (quiet beach areas) inside the Project zone, the turtles can use the area to feed themselves.

The Project site, particularly the inland area of the lagoon serves as a landing, and resting site for the migratory birds. As such, with the land reclamation of the oceanic part of the lagoon, their habitat will not reduce, with only a limited interference in the regional and local abundance of the existing species.

The loss of habitat for the benthic species, and ichthyofauna will occur, as a result of the land reclamation, in addition to the likelihood of burials. Many species will lose their site of procreation, and reproduction. Although the dredging program is a short-term program, it may take between 2-3 years to recover the affected benthos, after the physical disturbances.

Some exotic species may be introduced in the region, and be settled more easily, given the lack of competition in the habitat, due to the loss of local species. The return of these natural species can decrease due to their competition with these new species, and the modified dynamics of the environment.

Impact Assessment

The impacts that have a partial or total effect on the marine and coastal habitats are classified as moderate negative impacts , with a spatial scale restricted to the circumscribed areas, and a medium negative magnitude of change, medium-term (5 to 15 years), reversible, and cumulative.

Due to the fact that the impacts of the "drainage infrastructures" and "coastal protection" components are subsequent to the impacts of the dredging and land reclamation, it was not possible to assess the impacts for these components.

Mitigation Measures

Given the potential impacts that may result in modifications to the habitat, the following measures should be taken into consideration (see Table 5.12).

Table 5.12: Mitigation measures associated with the impacts on the Habitat.

Impacts on the	Mitigation Measures
Habitat	41. Consider and implement (when feasible) recovery plans for the habitat. 42. Keep the dredging activities exclusively in the zones defined in the project. 43. Avoid the accidental spill of oils and fuels on the marine environment.

Impacts on the	Mitigation Measures
	44. Monitor the repopulation of the benthic community.

Residual Impacts

Due to the type of activity, even with the implementation of the mitigation measures proposed, and the actions previously foreseen in the Project with the implementation of green areas, medium negative impacts are still anticipated.

5.2.3. SOCIAL AND CULTURAL COMPONENT

- **Population**

Description of the Environmental Impacts

The potential impacts on the population in the area of influence of Marginal da Corimba Project are assessed in this descriptor.

The movement of vessels/boats, and dredgers for the dredging, and land reclamation activities, will result in potential disturbances in the navigation of vessels/boats in the project area, thus affecting the lifestyle of the artisanal fishermen that use the area to fish, and the population that establishes local sea crossings. The existence of dredging vessels/dredgers in the area will also increase the risk of collisions between them.

A total area of 310 hectares will be reclaimed for the implementation of the Marginal da Corimba Project. This land reclamation will result in a retreat of 110 m from the sea, in a large area of its extent, and approximately 60 m in the Capossoka pier area, thus modifying the coastal geomorphology. This modification will potentially affect the movement of vessels/boats, and the artisanal fishing undertaken in the area, particularly in areas where the bathymetry is extremely reduced.

With the land reclamation activities of the Project area, the urban spaces will increase in value, and be more attractive, and the landscape of the site will be negatively affected. The land reclamation area will bring a sense of healthiness to the neighborhood, once this is clean (including the sea water in the lagoon, and coastal zone), which after the completion of the construction work will benefit the population.

The population will be potentially affected by the temporary loss of access to the residential zones of the surrounding areas, mainly of the lagoon area by sea. Another factor to be noticed is the restriction of use of the sea coast by the neighboring population in the project, and the changes in the bathing zone (depth, and currents), and potential disturbances in the activities developed in the Mabunda zone (fisheries and sales). Special attention should be given to the COApescas company, given that its fish processing activities will be significantly affected by the creation of the land reclamation site.

Impact Assessment

The potential impacts anticipated for the "dredging and land reclamation" component will be slight negative changes, being the spatial scale restricted to the project site; the magnitude of change, although negative, will be low and medium (changes in the way of life [26]), short-term, reversible, and non-cumulative. Exception only for the impacts on Coapescas activities that are expected to be significant, and therefore new forms of coexistence between the land reclamation activities, and Coapescas infrastructures should be explored.

During the construction phase of the "coastal protection" component, unemployment or job changes may potentially occur, with slight negative impacts, a spatial scale restricted to the project site, the magnitude of change, although negative, will be low, short-term, reversible, and non-cumulative.

[26] Taking into account the impacts on the ways of living of the populations in the zone, a Livelihood Restoration Plan will be developed, in which better forms to prevent the impacts on the fishermen, shipowners, and fishmongers/fishwives will be identified.

No impacts are anticipated as a result of the "drainage infrastructures" component.

Mitigation Measures

Given the potential impacts on the population, the following measures should be taken into consideration (see Table 5.13).

Table 5.13: Mitigation measures associated with the impacts on the Population.

Impacts on the	Mitigation Measures
Population	45. Keep the intervention period to a minimum, complying with the deadlines, avoid work at night time, and execute the construction work as planned. 46. Manage some activities as to avoid interferences with the normal operation of the neighboring activities. 47. Signal, and adequately block all access to the construction yard zones, and the construction work. 48. Assess and optimize the quantity, schedules, and traffic routes of the heavy vehicles and vessels/boats used in the construction work, based on the intensity of the local traffic, complying with the Traffic Management Plan. 49. Provide alternatives to the population affected (fishermen, fishwives, and industry), given the modifications undertaken in the intervention area, with a compensation plan, if required. 50. Create awareness among the construction workers on the rules of conduct, and good coexistence with the neighborhood. 51. Adequately signal the areas that will be subjected to an intervention. 52. Continue with the regular enquiries, and enforce rules of conduct on the workers involved in the process of transportation of materials. 53. Create awareness among the construction workers on the rules of conduct, and good coexistence, particularly regarding the transmission of contagious diseases. 54. Implement the Livelihood Restoration Plan. 55. Implement a Grievance Mechanism.

Residual Impacts

Insignificant residual impacts are expected after the implementation of the mitigation measures.

- **Planning, and use of the land**

Description of the Environmental Impacts

The impacts on the planning and use of the land are assessed based on the attractiveness of the urban, leisure, and commercial spaces, in addition to the real estate speculation of the land.

The assessment of the activities of Marginal da Corimba Project on the planning, and use of the land confirms that no impacts are anticipated during the Construction work. The urban space is only expected to be attractive after completion of the construction work, mainly as regards to the power, water, and sanitation infrastructures. As such, the impacts of this descriptor were not assessed.

- **Landscape**

Description of the Environmental Impacts

The impact assessment undertaken in this descriptor was based on the identification of aspects related with conflicts, and the functional disorganization of the landscape, as well as changes in its visual quality. The landscape of the implementation area of the Marginal da Corimba Project will be changed, mainly by the land reclamation of the area.

Currently, the Project area is strongly degraded, due to the solid waste irregularly disposed along the coast; moreover, the area was also disorderedly occupied. The area will be requalified and clean for the implementation of the Project, and after the completion of the construction work the area will be attractive.

Impact Assessment

Slight negative impacts are anticipated for the “dredging and land reclamation” component, due to the functional conflicts of the construction work. Modifications in the visual quality are anticipated, with medium negative changes, with a spatial scale restricted to the circumscribed areas, a low negative magnitude of change, short-term, reversible, and cumulative.

The "drainage infrastructures" and "coastal protection" components will potentially cause slight negative changes, due to changes in the visual quality of the landscape, important only to the local condition, slight negative change, short-term, no changes as regards to the reversibility, and non-cumulative.

Mitigation Measures

Given the potential impacts that may result in modifications to the landscape, the following measures should be taken into consideration (see Table 5.14).

Table 5.14: Mitigation measures associated with the impacts on the Landscape.

Impacts on the	Mitigation Measures
Landscape	56. Ensure the effective implementation, and regular maintenance of the landscape component, as proposed in the Project. 57. Develop and implement the landscape development plan, according to the needs, and local conditions for the next phases of the project. 58. Use fencing (hoarding panels) in the perimeter of the construction work, in order to ensure the safety of people, and balance the visual quality of the landscape.

Residual Impacts

Residual impacts are anticipated after the implementation of the mitigation measures, resulting in slight negative changes.

5.2.4. ECONOMIC AND LEGAL COMPONENT

➢ **Socioeconomic Framework**

Description of the Environmental Impacts

Given the importance of the project impacts on the socioeconomic aspects, this assessment focused on several components, namely employment, and sanitation infrastructures, during the phase when the platform for the land reclamation site will be created, and the drainage ditches will be extended.

The increase in the flow of people, and the search for services and products in the informal market that normally occurs in these areas will have a positive impact on the revitalization of the economy, and on the increase in job opportunities, and income. Therefore, the improvement of the quality of life of the population that will be benefited by the area surrounding the construction yard will subsequently occur, even if temporarily. Medium and long-term impacts are anticipated on the local economy with the revitalization of the Corimba coastline.

Another positive aspect associated with the Project is the implementation of the Development Strategy for the site, since the Marginal da Corimba Project is in accordance with the strategies and policies, namely the Luanda Metropolitan Master Plan (PDGML).

Impact Assessment

The potential revitalization of the economy, and impacts on employment are anticipated for the "dredging and land reclamation" component, with slight and medium positive impacts, respectively. Slight negative impacts on the quality of life of the population are also anticipated, and the overload of the road infrastructures with negative impacts, with a low magnitude of change, important to regional interests, reversible, and cumulative. The overload of the waste collection infrastructures is expected with slight negative changes.

Slight negative impacts are potentially anticipated for the "drainage infrastructures" component, due to the overload of the road infrastructures.

Slight negative impacts are anticipated during the construction phase of the "coastal protection" component, due to changes in the quality of life of the population, overload of the road infrastructures, and waste collection.

Mitigation Measures

Given the potential impacts that may result in modifications to the socioeconomic framework, the following measures should be taken into consideration (see Table 5.15).

Table 5.15: Mitigation measures associated with the impacts on the Socioeconomic Framework.

Impacts on the	Mitigation Measures
Socioeconomic Framework	59. Keep the intervention period to a minimum, complying with the deadlines, avoid work at night time, and execute the construction work as planned. 60. Manage the various activities, to avoid interferences with the normal operation of the neighbouring activities. 61. Signal, and adequately block all access to the construction yard zones. 62. Assess and optimize the quantity, schedules, and traffic routes of the heavy-duty vehicles used in the construction work, based on the intensity of the local traffic, complying with the Traffic Management Plan. 63. Signal and bring attention to the dredging activity, to prevent navigation incidents from occurring.

Residual Impacts

No significant residual impacts are anticipated after the implementation of the recommended mitigation measures.

- **Legal Framework**

Description of the Environmental Impacts

The impacts related with the legal framework are reflected in the compliance with the National Development Plan - PND (2013-2017), in addition to the strategies and policies, namely the Luanda Metropolitan Master Plan (PDGML). On the other hand, although there are no protected areas inside the perimeter, impacts are anticipated on the sensitive areas of the Project surroundings, such as the Mussulo Bay, and Ilhéu dos Pássaros, and on species that occur there, particularly birdlife species.

Impact Assessment

Moderate and slight negative changes will occur in the "dredging and land reclamation" component, due to the impacts on the ecosystems, and on the protected or endemic species, respectively.

No legal impacts are anticipated in the "drainage infrastructures", and "coastal protection components.

Mitigation Measures

Given the potential impacts that may result in modifications to the legal framework, the following measures should be taken into consideration (see Table 5.16).

Table 5.16: Mitigation measures associated with the impacts on the Legal Framework.

Impacts on the	Mitigation Measures
Legal Framework	64. Comply with the legislation on land use in force. 65. Comply with the environmental legislation in force, avoiding an impact on the species (birdlife), and on sensitive habitats (mangroves), particularly Ilhéu dos Pássaros and the Mussulo Bay;

Residual Impacts

No residual impacts are anticipated on this component.

Table 5.17: Environmental impacts of the "dredging and land reclamation" component.

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	PHYSICAL AND CHEMICAL COMPONENT													
-Movement of vessels/boats, and dredgers -Dredging -Land reclamation -Construction of pile walls, and containment of embankments -Movement of machines, and vehicles -Movement of materials borrowed from other parts -Production of effluents -Production of solid waste -Use of workforce - Search for materials, and services	**Climate**	Changes to the local microclimate	2	-2	2	3	3	-32	1	-1	1	1	2	-4
	Geology / Geomorphology	Changes to the coastal geomorphology	2	-2	2	3	2	-28	2	-2	2	3	2	-28
	Soils	Changes to the mechanical characteristics, and permeability	0	0	2	1	1	0	0	0	2	1	1	0
		Erosion	1	-1	2	2	2	-6	1	-1	2	2	2	-6
		Contamination of the soils	0	0	2	1	1	0	0	0	2	1	1	0
		Loss of potential for other purposes	1	-2	2	3	3	-16	1	-2	2	3	3	-16
	Sedimentology	Changes to the sediment transport	3	-2	3	3	3	-54	2	-2	2	3	3	-32
	Hydrography	Changes in the hydrodynamic levels and	2	-2	2	2	2	-24	2	-1	2	2	2	-12

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
		currents												
	Water quality	Physical contamination	2	-3	1	2	2	-30	2	-3	1	2	2	-30
		Chemical contamination	2	-2	2	2	2	-24	2	-1	2	2	2	-12
		Biological contamination	2	-2	2	2	2	-24	2	-1	2	2	2	-12
	Air Quality	Change in the air quality at local level (increase in the concentration of air pollutants)	2	-3	2	2	3	-42	2	-2	2	2	3	-28
		Increase in respiratory diseases and allergies	1	-1	2	2	2	-6	0	0	2	1	1	0
	Noise and vibration	Noise in the project area	2	-2	2	2	3	-28	2	-1	2	2	3	-14
		Noise in the existing access roads	1	-1	2	2	3	-7	1	-1	2	2	3	-7
		Noise in the marine environment	2	-2	2	2	3	-28	2	-1	2	2	2	-12
		Noise discomfort experienced by the employees, and passers-by	0	0	2	1	1	0	0	0	2	1	1	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	ECOLOGICAL AND BIOLOGICAL COMPONENT													
	Coastal and marine biodiversity	Destruction, or loss, and impact on the vegetation	Not Applicable											
		Attraction, or alienation of fauna, and behavioural changes	2	-1	2	2	3	-14	1	-1	2	2	2	-6
		Disturbance and/or alienation of marine species	2	-2	3	2	3	-32	2	-1	2	2	2	-12
		Disturbance and/or alienation of birdlife, and herptofauna	2	-1	2	2	3	-14	2	-1	2	2	2	-12
	Habitat	Impact on the entire, or part of the marine habitat	2	-2	3	2	3	-32	2	-2	2	2	2	-24
		Impact on the entire, or part of the coastal habitat	2	-2	3	2	3	-32	2	-2	2	2	2	-24
	SOCIAL AND CULTURAL COMPONENT													

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	Population	Impact on the public health	0	0	2	0	0	0	0	0	2	0	0	0
		Improvement in social conditions, and income	0	0	2	0	0	0	0	0	2	0	0	0
		Unemployment, or job change	1	-1	2	2	2	-6	1	-1	2	3	2	-7
		Loss of propriety	0	0	2	0	0	0	0	0	2	0	0	0
		Changes in lifestyle	1	-2	2	2	2	-12	1	-1	2	3	2	-7
	Planning, and use of the land	Attractiveness of the urban space	N/A											
		Real estate speculation	N/A											
	Landscape	Changes to the visual quality of the landscape	2	-1	2	2	3	-14	2	-1	2	2	3	-14
		Conflicts / functional disorganization	1	-1	2	2	2	-6	0	1	2	1	1	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	ECONOMIC AND LEGAL COMPONENT													
	Socioeconomic framework	Socioeconomic Progress	2	1	2	2	2	12	N/A					
		Impact on employment	2	1	2	2	3	14	N/A					
		Changes in the quality of life of the population	2	-1	2	2	2	-12	1	-1	2	2	2	-6
		Overload of the road infrastructures	2	-1	2	2	3	-14	2	-1	2	2	3	-14
		Overload of the sanitation infrastructures	2	-1	2	2	3	-14	2	-1	2	2	3	-14
		Overload of the power sources	0	0	2	0	0	0	0	0	2	0	0	0
		Overload of water supply sources	0	0	2	0	0	0	0	0	2	0	0	0
		Overload of the waste collection infrastructures	1	-1	2	1	1	-4	0	0	2	0	0	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	Legal framework	Compliance with the National Development Plan - PND (2013-2017) and the Luanda Metropolitan Master Plan (PDGML)	3	2	2	0	2	24	N/A					
		Impact on the ecosystems (protected areas)	2	-3	2	2	2	-36	1	-1	2	2	2	-6
		Impact on protected or endemic species	1	-1	2	2	3	-7	1	-1	2	1	1	-4

Table 5.18: Environmental impacts of the "drainage infrastructures" component.

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
-Traffic of vehicles, and machinery -Transportation of materials, and equipment -Earthworks, and modelling of the soil -Installation of the power grid -Preparation, and construction of the drainage system -Increase in the existing drainage ditches -Production of effluents, and solid waste -Connection of the systems fitted to the old systems -Use of workforce -Power and water consumption	**PHYSICAL AND CHEMICAL COMPONENT**													
	Climate	Changes to the local microclimate	0	0	2	1	1	0	0	0	1	1	1	0
	Geology / Geomorphology	Changes to the coastal geomorphology	0	0	2	1	1	0	0	0	2	1	1	0
	Soils	Changes to the mechanical characteristics, and permeability	1	-1	2	2	1	-5	1	-1	1	1	1	-3
		Erosion	0	0	2	1	1	0	0	0	2	1	1	0
		Contamination of the soils	1	-1	2	1	1	-4	0	0	1	1	1	0
		Loss of potential for other purposes	0	0	2	1	1	0	0	0	2	1	1	0
	Sedimentology	Changes to the sediment transport	2	-1	3	2	3	-16	2	-1	3	2	3	-16
	Hydrography	Changes in the hydrodynamic levels and currents	1	-1	2	2	3	-7	1	-1	2	2	3	-7

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	Water quality	Physical contamination	1	-1	2	2	2	-6	1	-1	1	1	1	-3
		Chemical contamination	1	-1	2	2	2	-6	1	-1	1	1	1	-3
		Biological contamination	1	-1	2	2	2	-6	1	-1	1	1	1	-3
	Air quality	Changes to the local air quality (increase in the concentration of atmospheric pollutants)	1	-1	2	2	2	-6	1	-1	1	1	1	-3
		Increase in the incidence of respiratory diseases, and allergies	0	0	2	1	1	0	0	0	1	1	1	0
	Noise and vibration	Noise in the project area	1	-1	2	2	2	-6	1	-1	1	1	1	-3
		Noise in the existing access roads	1	-1	2	2	2	-6	0	0	1	1	1	0
		Noise in the marine environment	1	-1	2	2	2	-6	1	-1	2	1	2	-5
		Noise discomfort experienced by the employees, and passers-by	0	0	2	1	1	0	0	0	1	1	1	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	ECOLOGICAL AND BIOLOGICAL COMPONENT													
	Coastal and marine biodiversity	Destruction, or loss, and impact on the vegetation	N/A											
		Attraction, or alienation of fauna, and behavioural changes	1	-1	2	2	3	-7	1	-1	2	2	3	-7
		Disturbance and/or alienation of marine species	1	-1	2	2	3	-7	1	-1	2	2	3	-7
		Disturbance and/or alienation of birdlife, and herptofauna	0	0	2	2	1	0	0	0	2	2	1	0
	Habitat	Impact on the entire, or part of the marine habitat	0	0	2	2	1	0	0	0	2	1	1	0
		Impact on the entire, or part of the coastal habitat	0	0	2	2	1	0	0	0	2	1	1	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	SOCIAL AND CULTURAL COMPONENT													
	Population	Impact on the public health	0	0	2	2	1	0	0	0	2	2	1	0
		Improvement in social conditions, and income	0	0	2	2	1	0	0	0	2	1	1	0
		Unemployment, or job change	0	0	2	2	1	0	0	0	2	1	1	0
		Loss of propriety	0	0	2	2	1	0	0	0	2	1	1	0
		Changes in lifestyle	0	0	2	2	1	0	0	0	2	1	1	0
	Planning, and use of the land	Attractiveness of the urban space	N/A											
		Real estate speculation	N/A											
	Landscape	Changes to the visual quality of the landscape	1	-1	2	2	2	-6	1	-1	2	1	1	-4

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
		Conflicts / functional disorganization	1	-1	2	2	2	-6	1	-1	2	1	1	-4
	ECONOMIC AND LEGAL COMPONENT													
	Socioeconomic framework	Socioeconomic Progress	0	0	2	1	1	0	0	0	2	1	1	0
		Impact on employment	0	0	2	1	1	0	0	0	2	1	1	0
		Changes in the quality of life of the population	0	0	2	1	1	0	0	0	2	1	1	0
		Overload of the road infrastructures	2	-1	2	1	1	-8	1	-1	2	1	1	-4
		Overload of the sanitation infrastructures	0	0	2	0	0	0	0	0	2	0	0	0
		Overload of the power sources	0	0	2	0	0	0	0	0	2	0	0	0
		Overload of water supply sources	0	0	2	0	0	0	0	0	2	0	0	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
		Overload of the waste collection infrastructures	0	0	2	0	0	0	0	0	2	0	0	0
	Legal framework	Compliance with the National Development Plan - PND (2013-2017) and the Luanda Metropolitan Master Plan (PDGML)	3	2	2	0	2	24	N/A					
		Impact on the ecosystems (protected areas)	0	0	2	0	0	0	0	0	2	0	0	0
		Impact on protected or endemic species	0	0	2	0	0	0	0	0	2	0	0	0

Table 5.19: Environmental impacts of the "costal protection" component.

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	PHYSICAL AND CHEMICAL COMPONENT													
-Modelling, and levelling of the pile wall -Application of the capping layer, and base course (use of materials borrowed from other parts) - Application of the geotextile mat -Superficial treatment (application of rocky materials) -Traffic of motor vehicles	Climate	Changes to the local microclimate	1	-1	2	2	3	-7	1	-1	2	2	3	-7
	Geology / Geomorphology	Changes to the coastal geomorphology	0	0	2	1	1	0	0	0	2	1	1	0
	Soils	Changes to the mechanical characteristics, and permeability	0	0	2	1	1	0	0	0	2	1	1	0
		Erosion	1	1	2	2	1	5	Not Applicable					
		Contamination of the soils	1	-1	2	2	1	-5	1	-1	2	1	1	-4
		Loss of potential for other purposes	0	0	2	1	1	0	0	0	2	1	1	0
	Sedimentology	Changes to the sediment transport	2	-1	3	2	3	-16	2	-1	3	2	3	-16
	Hydrography	Changes in the hydrodynamic levels and	1	-1	2	2	3	-7	1	-1	2	2	3	-7

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
		currents												
	Water quality	Physical contamination	1	-1	2	2	3	-7	0	0	2	1	1	0
		Chemical contamination	1	-1	2	2	3	-7	0	0	2	1	1	0
		Biological contamination	0	0	2	1	1	0	0	0	2	1	1	0
	Air quality	Changes to the local air quality (increase in the concentration of atmospheric pollutants)	2	-2	2	2	3	-28	2	-1	2	2	3	-14
		Increase in the incidence of respiratory diseases, and allergies	1	-1	2	2	2	-6	0	0	2	1	1	0
	Noise, and vibration	Noise in the project area	1	-2	2	2	2	-12	1	-1	2	2	2	-6
		Noise in the existing access roads	1	-2	2	2	2	-12	1	-1	2	2	2	-6
		Noise in the marine environment	1	-1	2	2	2	-6	1	-1	2	1	2	-5
		Noise discomfort experienced by the employees, and passers-by	0	0	2	1	1	0	0	0	2	1	1	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	ECOLOGICAL AND BIOLOGICAL COMPONENT													
	Coastal and marine biodiversity	Destruction, or loss, and impact on the vegetation	N/A											
		Attraction, or alienation of fauna, and behavioural changes	1	-1	2	2	3	-7	1	-1	2	2	2	-6
		Disturbance and/or alienation of marine species	1	-1	2	2	3	-7	1	-1	2	2	3	-7
		Disturbance and/or alienation of birdlife, and herptofauna	1	-1	2	2	3	-7	1	-1	2	2	2	-6
	Habitat	Impact on the entire, or part of the marine habitat	0	0	2	1	1	0	0	0	2	1	1	0
		Impact on the entire, or part of the coastal habitat	0	0	2	1	1	0	0	0	2	1	1	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
	SOCIAL AND CULTURAL COMPONENT													
	Population	Impact on the public health	0	0	2	1	1	0	0	0	2	1	1	0
		Improvement in social conditions, and income	0	0	2	1	1	0	0	0	2	1	1	0
		Unemployment, or job change	1	-1	2	2	2	-6	2	-1	2	2	2	-12
		Loss of propriety	0	0	2	1	1	0	0	0	2	1	1	0
		Changes in lifestyle	0	0	2	1	1	0	0	0	2	1	1	0
	Planning, and use of the land	Attractiveness of the urban space	N/A											
		Real estate speculation	N/A											
	Landscape	Changes to the visual quality of the landscape	1	-1	2	2	2	-6	1	-1	2	2	2	-6

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
		Conflicts / functional disorganization	1	-1	2	2	2	-6	1	-1	2	2	2	-6
	ECONOMIC AND LEGAL COMPONENT													
	Socioeconomic framework	Socioeconomic Progress	0	0	2	1	1	0	0	0	2	1	1	0
		Impact on employment	0	0	2	1	1	0	0	0	2	1	1	0
		Changes in the quality of life of the population	2	-1	2	2	2	-12	1	-1	2	2	2	-6
		Overload of the road infrastructures	2	-1	2	2	2	-12	1	-1	2	2	2	-6
		Overload of the sanitation infrastructures	0	0	2	1	1	0	0	0	2	1	1	0
		Overload of the power sources	0	0	2	1	1	0	0	0	2	1	1	0
		Overload of water supply sources	0	0	2	1	1	0	0	0	2	1	1	0

Project Activities and Pressures	Descriptors Target Indicators	Potential Impact	Implementation Phase											
			Environmental classification of the project without mitigation measures						Environmental classification of the project after the mitigation measures					
			Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental classification	Importance	Magnitude	Permanence	Reversibility	Cumulative effect	Environmental Impact Classification
			A1	A2	B1	B2	B3	CA	A1	A2	B1	B2	B3	EIC
		Overload of the waste collection infrastructures	1	-1	2	2	2	-6	1	-1	2	2	2	-6
	Legal framework	Compliance with the National Development Plan - PND (2013-2017) and the Luanda Metropolitan Master Plan (PDGML)	3	2	2	0	2	24	N/A					
		Impact on the ecosystems (protected areas)	0	0	2	1	1	0	0	0	2	1	1	0
		Impact on protected or endemic species	0	0	2	1	1	0	0	0	2	1	1	0

CHAPTER 6

ENVIRONMENTAL AND SOCIAL MANAGEMENT PROGRAM

6. ENVIRONMENTAL AND SOCIAL MANAGEMENT PROGRAM

The **Environmental and Social Management Program (ESMP**) aims to comply with the essential components for the mitigation of potential negative impacts that result from the **project phases** (construction and operation[27]), as a form of compliance with the applicable environmental legislation, namely Decree No. 51/04 of July 23rd, and Executive Decree No. 92/12, and it is supported by the information provided in the chapters that refer to the institutional and legal framework, the characterization of the situation of reference, as well as the potential impacts identified.

The Environmental and Social Management Program is described in Table 6.1. This Program aims to assist in the implementation of the mitigation measures, during the different phases of the project. It also determines the type of intervention, the responsibility of each stakeholder, as well as the completion time for each of the activities.

The recommendations of the mitigation measures, and those described in this Environmental and Social Monitoring Program will be critical for the performance of future environmental audits to the Project during its execution phase of approximately 2 years as well as to ensure that such impacts are negligible. The measures listed in the following tables only include those that are worthy of appraisal. Those whose potential impacts are insignificant, or extremely low are not represented.

This ESMP should be enforced and overseen by a technical team from the Project proponent (and assisted by environmental consultancy companies, where required), and by contracted Health, Safety and Environment (HSE) teams. The following points

[27] The operation phase is not detailed in this Combined ESIS since, at this stage, the contemplated infrastructure will be the basis for the construction of social facilities that will need further investigation with regards to mitigation measures.

should be indicated to the entity responsible for managing environmental and social issues:

- Assess the performance, and the progress during the implementation of the mitigation measures, and their environmental and social monitoring Program;
- Ensure the adaptability, and feasibility of the mitigation measures in time and space, obtaining thereof financial and human resources, where deemed necessary, from the direction of the Office;
- Disclose information on the enterprise, and its environmental and social impacts, recording and addressing any reports[28], or complaints lodged by members of the population from the surroundings, and by the government´s administrative authorities;
- Ensure proper implementation of the different plans developed for this project;
- Oversee and facilitate potential (internal or external) environmental audits that may be performed during the implementation of the project; [29]
- Prepare progress reports as requested by the environmental installation license.

In carrying out the actions contained within this Combined Environmental and Social Impact Study, the project promoter and its contractors will implement a number of additional programs that are framed by the Environmental and Social Management System of the Project. These plans, some of which are summarised within objectives hereafter, include:

- Stakeholder Engagement Plan which includes the Grievance Mechanism
- Communication Plan
- Environmental Education and Awareness Plan
- Biodiversity Management Plan

[28] These activities should be aligned with the Stakeholder Engagement Plan.

[29] As established by the Environmental and Social Management System.

- Livelihoods Restoration Plan
- Waste Management Plan
- Health, Safety and Environment Training Plan
- Traffic Management Plan
- Emergency Response Plan
- Construction Works Support Plan

In addition to the above plans, the contractor responsible for dredging activities is to develop a series of management plans and control procedures in order to manage environmental and social issues. These documents are considered integral elements of this ESMP and include the following:

- Health, Safety and Environment Manual;
- Environmental Policy;
- Dredging Specifications Document;
- Dredging Method Document.

The recommendations and measures presented in this Combined ESIS are the result of the evaluation of potential environmental and social impacts of the project in question and are covered in Chapter 5. These measures are intended to provide guidance to the project proponent and its contractors, providing appropriate measures in order to facilitate the mitigation of identified impacts, minimising negative and maximising positive impacts.

Minimising identified environmental and social impacts should always be a priority of the parties involved in the construction process and for that there must be strict compliance with the proposed measures, the assumptions of national legislation and alignment with international best practices including the recommendations of the Equator Principles and Performance Standards of the International Finance Corporation.

The tables below present details of the proposed mitigation measures and the below list summarises in general terms the main measures:

1. A dredging plan should be implemented according to methods to be implemented and schedule plan. This plan must comply with the recommendations of the Combined ESIS;
2. A water quality monitoring plan should be implemented as set out by Presidential Decree No. 261/11 and other applicable laws;
3. A sediment and benthic fauna monitoring plan should be implemented where applicable;
4. Accidental discharges of oil and other chemicals should be avoided. In the case of spillage of a polluting material, the affected area should be immediately cleaned;
5. Measures of best practice should be followed during the operation of the construction site. The site should be located away from densely populated areas and large movements of people and vessels;
6. Places that may offer danger to people, vehicles and vessels must be signed and signalled in compliance with current regulations;
7. Cargo boxes transported by trucks containing materials to be utilised during the Project should be adequately secured in order to prevent detachment during trips. The movement of vehicles shall be in accordance with the Traffic Management Plan in order to reduce the risk of congestion, accidents and road infrastructure overload;
8. An information centre will be installed which will serve as a liaison point with the population (including stakeholders). This centre will be governed by the Communication Plan and Stakeholder Engagement Plan;
9. Fuel carrying vessels will comply with security routines established by the Port Authority (specific procedures, containment equipment and emergency posts). This service will be provided for by third parties upon prior approval by the Port Authority.

Table 6.1: Environmental and Social Management Program.

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
Climate				
1. **Restrict intervention within the project area to a minimum, i.e. do not perform actions that are not planned for the Project.** 2. **Limit the amount of trips with regards to the transportation and dredging of material required for land reclamation and coastal protection, in compliance with the Traffic Management Plan.** 3. **Maintain in good working condition the equipment and generators assigned to work.**	• Absence of unplanned actions. • Number of trips as planned by the Traffic Management Plan. • Equipment and vehicles to have low failure rates.	• Develop carefully studied plans and detailed schedules regarding land reclamation operations. • Conduct direct, daily observations of the amount of scattered dust.	• Daily	• Contractors • Project Promoter
Geology and Geomorphology				
4. **Prevent unnecessary land reclamation in areas outside of the work zone.**	• Strictly follow the project plan.	• Punctual observations using the work plant resources.	• Daily	• Contractors • Project Promoter
5. **The exploration volume should be correctly accounted for, thus avoiding extraction and or**	• Volume of extracted land is to be equivalent to the volume of land necessary for the works.	• Volume Planning needed for each planned structure or grounded area including calculations related to the type and size of each	• Planning prior to the start of the construction phase.	• Contractors • Project Promoter

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
unnecessary utilisation of loan sand.	• Absence of excess loan material after the construction phase. • Prevention of soil dispersion regarding land mainly outside of the work zone.	project, as well as taking into account areas to be compacted (mainly road construction).		
6. **Selection of dredging methods based on the "Best Available Technique Not Entailing Excessive Costs" (BATNEEC), in other words, use, when available, an approach based on the adoption of more effective techniques regarding the scale of an operation, where the benefits outweigh the costs of obtaining them.**	• Use the best available dredging technique.	• Planning before the execution of works. • The entity monitoring the work must be aware of the methodology used.	• Planning before the works. Regular monitoring during project implementation.	• Contractor • Project Promoter
7. **Monitor of possible critical erosion points and the application appropriate control measures.**	• Prevent the occurrence of landslides or the collapse of embankments.	• Visual observations and photographic monitoring of the area.	• Monthly (with increased frequency during the rainy season).	• Contractor • Project Promoter
		Soils		
8. **With regards to areas characterised by steep slopes, must be taken appropriate measures in order to avoid landslides during the earthworks,**	• Prevent the occurrence of landslides. • Utilise support structures and soil retention in the areas of greatest concern.	• Analysis of potential landslide sites in areas of greatest slope. • Earthworks to be supervised near or in areas where the occurrence of landslides is highly probable.	• Before the start of the ground preparation process • Throughout the construction phase, whenever there is need for earthworks in high risk areas.	• Contractors

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
and implant support structures and soil retention if necessary, until the land reclamation site in question has been stabilised.				
9. **The maintenance of machinery used during the works (heavy machinery and vessels) shall be carried out in locations previously defined by the Waste Management Plan (preferably utilising a dry dock in the case of a vessel requiring major repairs).**	• Existence of facilities properly waterproofed to maintain machinery. • Waste resulting from this process to be properly stored and disposed in appropriate areas. • Absence of waste of this nature outside of intended storage areas.	• Plan the size and location of workshops taking into account the project's needs. Determine the best locations for the storage of waste. Implement waste separation and plan the methods of waste collection and final disposal.	• Planning of the workshops' orientation and determination of the best storage locations prior to the beginning of the design phase. • The continuation of waste separation must be throughout the construction phase of the project.	• Contractors
10. **Waste resulting from machinery maintenance should be stored and disposed of in appropriate places in order to avoid soil contamination.** 11. **Waste resulting from construction (or work associated with it) must be stored and disposed of in appropriate pre-designated places, as detailed in the project's Waste Management Plan.**	• Absence of solid waste outside of intended storage areas. • The defined waste storage location must be appropriately located and equipped. • Vehicles for collecting and / or transporting solid waste must be properly equipped in order to ensure proper waste containment. • Prevention of accidental waste spillage during	• Inspection of vehicles used for the transportation of waste, ensuring safe operational conditions. • Identify the best locations for storing solid waste, taking into account the typology of the waste. • Identify the best locations for solid waste disposal / treatment. • Develop check sheets detailing the volume and date of each waste deposit. • Direct surface observation of natural drainage lines in the area in order to detect accidental waste	• Continuous monitoring, whenever the collection / transportation of solid waste is implemented. • Locations must be identified before the construction stage and used thereafter. • Continuous monitoring during the construction phase, especially during the hours following waste collection.	• Project Promoter

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
	transport. • Absence of solid waste in the region's waterways.	spillage. In the event, take necessary measures in order to reverse the situation.		
12. **If solid / liquid waste transportation is required it must be implemented with the utmost caution, following specific safety rules regarding packaging and transportation in order to prevent accidental spillages.**	• Absence of accidents and spillages.	• Implementation and verification of control records and waste transportation manifesto.	• Continuous monitoring, whenever solid waste is collected / transported.	• Contractor • Project Promoter
Sedimentology				
13. **The following must be taken into account when opening the channel of Chicala Lagoon:** **a. Predominant orientation of general circulation (currents and tides, circulation promotion and water restoration);** **b. The predominant orientation of sediment transport (minimise erosion zones / accretion);** 14. **Enough width in order to avoid constraints of circulation (circulation promotion, water renewal**	• Do not constrain the movement of water and know the new direction / movement of water and sediment transport.	• Conducting sedimentological and current studies in the project area.	• Both before and after works implementation.	• Project Promoter

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
and avoid "cul de sacs").				
15. **Annalise the containment or dispersion characteristics of land reclamation area.**	• Fully understand the system dynamics.	• Conduct sedimentological and current studies in the Project area.	• During project implementation and for 5 years following the formation of grounded areas.	• Contractors • Project Promoter
16. **Monitor the appearance of new sandbanks or erosion zones along the coastline (including potential areas outside of the project area including Ilha de Luanda) paying attention to mainland drainage lines that may be influencing the formed zone (land reclamation area).**	• Provide maximum fluidity and functionality of the system.	• Formulate topographical and bathymetric records in potential accretion or erosion risk areas.	• Biannually	• Project Promoter
Hydrography				
17. **Implement current and hydrodynamic processes monitoring within the Project area and Mussulo-Corimba-Chicala system.**	• Know the newly formed system and the directions of the currents.	• Prepare reports containing, among others, photographic records.	• Yearly for a period of 5 years which may be extended to include future construction phases of the project.	• Contractors • Project Promoter
Water Quality				
18. **The maintenance of machinery should be implemented in an appropriate,**	• Residents and workers in the area with civic and respectful basis of watercourses in the region.	• Advanced planning of topics to be addressed as well as the implementation range of each civic education program.	• The overall planning of the number and frequency of each program should be carried out prior to the start	• Project Promoter

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
waterproofed location. The waste from this process must be properly stored and subsequently forwarded to the appropriate location of final disposal taking appropriate due care and attention as described in the Waste Management Plan.	• Absence of unallocated waste and untreated effluents.		of project operation. • The interval between monitoring programs should be no more than 6 months.	
19. **Particular attention must be given to vessel maintenance and refuelling.**	• Prevention of visible oil slicks on the water's surface.	• Perform maintenance of marine engines.	• According to the manufacturer's guidelines.	• Users / owners of vessels
		Air Quality		
20. **Conduct periodic motor and generator maintenance, ensuring that it is implemented correctly in order to control greenhouse gas emissions from combustion engines used at the construction site.**	• All support vehicles and equipment are to have up to date maintenance checks and function correctly, without increasing the production of harmful gases: minimum emissions of CO_2 and CO / km / h from machinery, taking into account the model and specifications (CO at 1 metre from the emitting source not exceeding 0 ppm and CO_2 500 ppm).	• Pre-Planning of main access routes to different parts of the site, with the preference of shorter distances between more frequently used points. • Respect the planned routes. • Develop maintenance monitoring reports of each vehicle / machine together with checklists that indicate main maintenance review points. • Periodically monitor the concentration of the mentioned gases using specifically designed	• Planning before site preparation. • Continuously prepare reports. • Maintenance should be performed periodically, taking into account specifications and operating times or the mileage of vehicles / machinery. • Biannual measurements.	• Contractors

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
		equipment.		
21. **The transportation of inert materials, including rocks and construction materials, to be by covered vehicles.**	• Reduce emission of particulate matter into the atmosphere.	• Inspection of vehicles to be used during the transportation of the mentioned materials.	• Daily Inspection	• Contractors
22. **Humidify the soil during windy and dry periods and promote water sprinkling on roads and in work areas in order to avoid excessive dust levels.**	• Low dust dispersion levels in work areas, especially following the passing of vehicles / machinery. • Avoid respiratory problems of site users / workers resulting from excessive dust levels / dust clouds in the area.	• Determine soil humidifying range, taking into account its decline during windy and dry spells.	• Soil humidifying will be performed at least twice a day (preferably between 9.00-10.00 am, 2.00-3.00 pm and 3.00-4.00 pm) with the exception of during rainy periods (when there is no need to moisten) and very dry and / or windy days (when moistening will occur more frequently).	• Contractors
23. **Limit vehicle speeds within the works area, taking into consideration that potential dust emissions increase with vehicle speed.**	• Low dust dispersion rates in work areas.	• Implement speed limit signs along roads within the vicinity; heavy vehicles should have a speed limit not exceeding 40km / h. • Determine the best method of periodically assessing driver ability and professionalism throughout the duration of the contract or during the event of policy Infringements.	• Signals must be placed before routes are opened for use.	• Contractor
24. **Optimise vehicle / vessel trip routes used during the transportation of dredged / rock materials.**	• Decrease the amount of pollutants emitted into the atmosphere and the number of necessary trips.	• Plan routes to be implemented. • Monitor the movement of vessels in order to ensure the optimisation of routes.	• Before the start of the dredging and land reclamation phase.	• Contractor

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
		Noise		
25. **All equipment and machinery used during the works, whether on land or at sea, should be kept in good working order.**	• Maintain minimum noise and vibration levels of equipment / machinery taking into account technical specifications. • The noise emitting source must never exceed a level higher than 85 decibels at 3 m (except in areas where machinery specifications exceed this limit, where all workers must implement appropriate PPE).	• Develop equipment maintenance and monitoring reports together with checklists that indicate the main review points. • Implement periodic noise level measurements taken at different distances and at different measuring points, utilising specifically designed equipment for this purpose.	• Continuous • Biannually measurements during the construction period.	• Contractors
26. **Select construction techniques and processes that generate less noise.**	• Selected improved techniques in use.	• Prior analysis and implementation of construction techniques that are feasible and will create less noise.	• Analysis prior to the construction stage and implementation throughout.	• Contractors
27. **Evaluate and optimise the number of trips needed with regards to work vehicles and ships.**	• Minimise travel / journeys made by each work vehicle. • Utilisation of specific vehicles for specific tasks, thus keeping to pre-defined routes.	• Plan routes to be implemented during the construction phase, restricting the circulation of certain vehicles. • Monitor the movement of vehicles in order to ensure route optimisation.	• Prior Planning • Continuous monitoring	• Contractors
28. **Inform the neighbouring population, via the Communication Plan, of techniques to be used and**	• The local population aware of the possibility that high noise generating construction processes may	• Schedule meetings with local authorities in order to make known to the population that high noise generating construction	• If a meeting is necessary, it should be implemented at least one month before the start of any applicable	• Contractors • Project Promoter

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
high noise generating construction processes, preferably performing these processes during daylight hours.	occur.	processes may have to be utilised, after all other alternatives have been analysed. • Ensure that the population is notified of these procedures and of any potentially associated negative effects.	activities.	
		Marine and Coastal Biodiversity		
29. **Manage and control any waste produced.**	• Prevention of the presence of any waste at sea and on work area floors.	• Waste should be properly detailed in an appropriate Management Plan. This Management Plan should also include response measures with regards to waste coming into contact with the marine environment.	• A Management Plan of this type of waste must be prepared prior to the start of the construction phase.	• Contractors • Project Promoter
30. **Observe good vessel navigation and maintenance practices within the vicinity, respecting the fragility of the ecosystem and implement techniques that avoid turtle deaths.**	• Prevention of accidents and spills.	• Utilise good boating practices.	• Daily	• Contractors • Project Promoter
31. **Proper control of potential pollution causing effluent, so as to avoid contamination of the coastal zone.**	• Prevention of coastal zone contamination caused by effluent spillage. • The implementation of a control system (including treatment and final disposal) that is functional	• Implement an Emergency Response Plan. • Treatment of effluent to be implemented according to port legislation.	• Planning, identification and construction prior to the start of the constructive phase. • Quarterly monitoring and periodic maintenance, taking into account the	• Contractors • Project Promoter

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
	and appropriate to the nature of the project.		technical specifications of equipment to be used.	
32. **Provide educational information regarding the environment to employees, contractors and stakeholders regarding the current biodiversity of the region of Corimba with a view to its protection.**	• Environmental education information related to local biodiversity to be available to the general population. • The local population understands and respects the basic principles of wildlife protection and preservation.	• Create awareness programs focusing on environmental education, including the distribution / availability of relevant available material covering the protection of local biodiversity (Ex. Leafleting, placing posters, etc.).	• The programs should be created prior the start of project construction and maintained throughout the construction and operation phases.	• Project Promoter
33. **Prohibition of dumping leftover materials, debris, oils and lubricants into drainage lines or the sea.**	• Absence of solid waste outside of intended storage areas. • Properly defined, located and equipped solid waste storage units. • Solid waste collection and / or transportation vehicles properly equipped in order to ensure adequate solid waste containment. • Prevention of accidental waste spillages on roads during transportation. • Compliance with the Waste Management Plan.	• Inspection of waste transport vehicles, ensuring that safety standards are met. • Identify the best solid waste storage locations, taking typology into account. • Identify the best solid waste final disposal / treatment locations. • Develop detailed check sheets detailing the volume and date of each deposit.	• Continuous monitoring, whenever the collection / transportation of solid waste occurs. • Locations should be identified prior to the construction stage and utilised thereafter.	• Project Promoter

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
34. **Check noise levels of dredging machines, vessels and vehicles.**	• Minimise noise and vibration levels produced by the mentioned entities, taking into account their technical specifications. • The noise emitting source must never reach a level higher than 85 decibels at 3 m (except in areas where machinery specifications exceed this limit, in which case all workers must implement appropriate PPE).	• Develop maintenance monitoring reports of each vehicle / machinery together with checklists that indicate the main maintenance review points. • Implement periodic noise level measurements taken at different distances and at different measuring points with the aid of specifically designed equipment.	• Continuous • Bimanual measurements during the construction phase.	• Contractors
		Habitat		
35. **Consider and realise (where feasible) habitat recovery plans.** 36. **Keep dredging to areas exclusively defined by the project;** 37. **Avoid accidental oil and fuel spillages into the marine environment.**	• Preserve aquatic and terrestrial habitats; especially those that offer reproduction, landing and nesting sites,	• Conduct field visits to coastal and lagoon areas in order to observe variations in behaviour of species for a period of five years.	• Biannually	• Project Promoter
38. **Monitor repopulation rates of the benthic community.**	• Understand the new dynamics of the newly formed system.	• Realisation of field visits, studies and species observation of the area.	• Yearly for a period of 5 years which may be extended to after future construction phases of the project.	• Project Promoter
		Population, Landscape and Socioeconomic Framework		

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
39. **Limit intervention to the shortest possible duration, meeting deadlines and avoiding working at night executing the works as planned.**	• Comply with the work schedule.	• Monitor activities in accordance with the work schedule	• Weekly	• Contractors • Project Promoter
40. **Manage activities in order to avoid cross interference with the normal operation of other nearby activities.**	• Comply with all proposed mitigation measures relating to waste management, effluents and noise, and movement control of vehicles and work machinery as to not adversely affect the environment.	• In addition to the above mentioned measures, an overall plan of activities should be created, specifying schedules of annual activities and the end of the term of each activity and utilised areas.	• The general plan shall be developed prior the start of the construction phase and updated annually, or as per necessary changes in terms of priority or deadlines.	• Contractors • Project Promoter
41. **Signal and properly seal off construction sites and work access locations.**	• Existence of visible and understandable signalling, covering all of the site's access roads as well as construction sites. Restriction of the amount of personnel present both at building site access points and in active work areas. • Prevention of accidents involving persons not related to the works.	• More potential signalling sites with regards to restriction and the display of useful information should be identified. • Areas of greatest danger should be properly sealed.	• Identification of appropriate locations and the sealing of areas to be performed after the establishment of the shipyards and whenever a verified need is established	• Contractors
42. **Evaluate and optimise the number, timing and circulation routes of heavy work vessels and vehicles**	• Minimum disruption to local traffic as a result of the works. • Implement the circulation	• Plan routes and schedules to be implemented during the construction phase, restricting the circulation of certain vehicles.	• Prior planning and continuous monitoring	• Contractors

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
due to the intensity of local traffic, according to the Traffic Management Plan.	of heavy goods vehicles in times of lower traffic intensity.	• Monitor the movement of vehicles in order to ensure route optimisation.		
43. **Provide alternatives to the affected population (fishermen, fishmongers and industry) in view of the changes made within the intervention area, utilising a claims plan to be implemented where necessary.**	• Comply with the Restoration of Livelihoods Plan.	• In the case of the need to restrict access to areas of cultural, social or religious significance (schools, churches, sports areas, etc.) temporary or permanent (where considered necessary) alternatives should be designed / built.	• The implementation of areas and / or alternative infrastructure (also applicable in the case of damages) must be analysed and made effective prior to occupation.	• Contractors • Project Promoter
44. **Adequately signal intervention areas.**	• Appropriate signalling to be utilised throughout the intervention area. • Prevention of accidents involving persons not involved in the works.	• More potential signalling sites should be identified with regards to restriction and the display of useful information.	• Signalisation to be implemented prior to land preparation. • As the intervention area increases in size or changes, so to should the signalisation of the area.	• Contractors
45. **Undertake regular inquires and inforce rules of conduct with regards to workers involved in the transportation of materials.**	• All workers involved in the transportation of materials must understand the established rules of good conduct. • Avoid the occurrence of material diversion and subsequent losses, delays and / or substandard infrastructure durability.	• All contractors must be informed of the established rules of good conduct, for filling the requirement to sign a liability waiver as proof of acknowledgement.	• Each worker must sign the terms of liability before they commence.	• Contractors
46. **Implementation of the**	• Provide the same conditions	• Create a record of fishermen	• During the deactivation	• Contractors

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
Livelihoods Restoration Plan; 47. **Implementation of the Grievance Mechanism.**	to workers affected by the relocation of the fishing port. • Provide channels of communication with affected parties.	currently using the fishing port and correlate this document with the list of registered workers in the new fishing port. • Verify complaints and feedback.	phase of the old fishing port and prior to the opening of the new fishing port. • Monthly with regards to the mechanism.	• Project Promoter
48. **Develop and implement the Landscape Development Plan according to local needs and subsequent conditions of the next phases of the project.**	• Compliance with and development of the Landscape Plan • Take into consideration mitigation measures contained in the ESMP.	• The Plan shall be prepared in accordance with previously mentioned terms.	• Preparation prior to the start of the construction phase.	• Project Promoter
49. **Utilise screens in the work vicinity in order to ensure the safety of people and a balance of the visual quality of the landscape.**	• Comply with prior provisions of mitigation measure. • Prevention of accidents and damage to health of workers as a result of falls, dispersed particles and accidents involving building materials.	• Direct observation of infrastructure being erected.	• Continuous observation	• Contractors
50. **Limit intervention activities to the shortest possible duration, meeting deadlines and avoiding working at night, executing the works as planned.**	• Comply with the work schedule.	• Monitor activities in accordance with the work schedule	• Weekly	• Contractors • Project Promoter
51. **Signal and safeguard dredging activities in order**	• Prevention of boating accidents.	• Clearly signal the dredging area	• During the dredging period	• Contractor

Mitigation Measures	Goal	Implementation / Monitoring	Frequency	Responsibility
to prevent boating accidents				• Project Promoter
		Legal Framework		
52. **Comply with planning legislation with regards to land use.**	• Prevention of the occurrence of illegal activity.	• Continuous monitoring and oversight of activities	• Continuous monitoring and oversight.	• Project Promoter
53. **Comply with environmental legislation preventing the disturbance of species (birds) and sensitive habitats (mangroves), with extension to the Mussulo Bay lagoon system where the Integral Reserve of Ilhéu dos Pássaros is situated.**	• Protection of habitats and species; • Avoid penalties.	• Monitoring and continuous oversight of activities implemented within the Corimba Project area that are inherent or not to the project; • Monitoring of National Legislation.	• Continuous	• Project Promoter

In addition to the Environmental and Social Management Program herein proposed, it is suggested, due to the dimension of Marginal da Corimba Project, the development and implementation of Environmental and Social Plans, and Programs, by the Management Office of the Tourism Development Hub of Futungo de Belas and Mussulo (GGFBM) and its contractors, to complement the ESMP. These Plans and Programs are detailed below and are aligned with the Environmental and Social Management System.

6.1. COMMUNICATION PLAN

The Communication Plan is an important tool to support the relationship between those accountable for the implementation of the construction work of the Marginal da Corimba Project, and the various social segments affected and/or interested by enterprise. This exchange of information is essential in order to answer questions and receive comments and suggestions. This plan must be formalised on the basis of detailed procedures within the Stakeholder Engagement Plan including the Grievance Mechanism.

This Plan should guide the business procedures that should be put into practice during the discussions that are part of the planning of the construction work, and continue throughout the construction period. This implies the creation of effective communication channels of information, and disclosure on environmental actions and programs, of social interest foreseen in the project. One of these channels of communication will be the establishment as an information centre that will provide detailed information about the project and manage the Stakeholder Engagement Plan.

The Communication Plan will focus on the communities of the ADA and ADI, representatives of the municipalities of Belas and Luanda, and other stakeholders identified during the social surveys accomplished in the area; contributing to the decrease of uncertainties, and doubts related to the implementation of the enterprise.

The specific objectives of the Communication Plan include:

- Keep the population correctly informed of the enterprise, the characteristics of the actions, its impacts, and the programs proposed to mitigate them, avoiding conflicting information from some of the agents;
- Promote a mechanism (letter, telephone, internet, or other) that allows the population to expose their complaints;
- Minimize the distrust, and insecurity of the population, and users of the project area, with regard to the modifications proposed by the Project;
- Avoid misleading information, by providing more transparent and accessible information to the stakeholders;
- Promote the participation of the local population in specific programs, to improve the effectiveness of their implementation, monitoring, and continuity of the necessary actions;
- Build a closer relationship between the entrepreneur, and the various social sectors affected/interested in the enterprise; and
- Ensure institutional liaison between the entrepreneur, contractors, local institutions, churches, and NGOs.

6.2. Environmental Awareness and Education Plan

The environmental awareness and education program is here considered as part of a cross-cutting, participative, and comprehensive process, in which the environmental issues that affect the individuals, and the communities are emphasized, aiming at the promotion of a balanced environment and, more importantly, a healthy environment, which may result in an improvement of the living standards of the population of the Marginal da Corimba Project insertion area.

The main objective of the Environmental Awareness and Education Plan will be to provide training to the populations, and future users of Marginal da Corimba and associated infrastructure, and the project workers and contractors; and important relevant information for the improvement of the quality of life, and the preservation of the environment in the site, and surroundings.

The actions of the plan aim to mitigate impacts, such as the risks of accidents (outside and inside the work site), risks to the health, such as the transmission of sexually transmissible diseases (AIDS, and others), transmission of other diseases of importance to the public health, such as malaria; encouraging community relations and sociability.

The specific objectives of this plan applicable to project workers, which are also aligned with the Health, Safety and Environment Management Plan, are as follows:

- Raise workers' awareness of environmentally sound procedures related to the construction work, health, safety, and the relationship with the neighbouring communities;
- Raise workers' awareness of the gravity of prostitution, particularly child prostitution;
- Alert, and raise workers' awareness of potential means of transmission of diseases, with a focus on the risks of STDs, and their forms of prevention;
- Provide workers with the adequate knowledge on the likelihood of accidents involving the environment, and their own safety;
- Alert to the possibility of fire risks, indicating their most common causes, and guidelines on the measures to be adopted;
- Raise workers' awareness of environmentally sound procedures related to the construction work, health, safety, the relationship with the neighbouring communities, and the preservation of the environment.

6.3. CONSTRUCTION WORK SUPPORT PLAN

This Plan aims to provide environmental guidelines and technical components, to ensure a construction work at the lowest possible environmental and financial costs; and provide the contractors and subcontractors with all the environmental criteria to be complied, during the various stages of preparation, demolition, and construction of the infrastructures foreseen by the project. It will also provide the workers with policies for an environmentally sound behaviour. The specific objectives of this plan, which are aligned with the Environmental Policy of GGFBM (see Appendix B) include the following:

- Promote the development, and integration of the environmental subprograms;
- Reduce, mitigate, or avoid the interferences generated by the construction work in the site, and surroundings;
- Establish environmental guidelines and criteria, for the execution of construction work;
- Develop a Code of Conduct for the workers;
- Review the technical specifications for the construction work aspects that represent risks for the environment, and the health and safety of the workers;
- Develop environmental guidelines to be included in contracts signed with subcontractors, and service providers; and
- Promote the integration between the proposed programs, and the environmental policies of the enterprise owner.

6.4. BIOPHYSICAL MONITORING PLAN

The Biophysical Monitoring Plan should establish efficient mechanisms, to ensure the monitoring of the environmental quality, during the execution of the construction work, and soon after completion of the construction work. It is intrinsically associated with the mitigation measures proposed in the previous Chapter, and as such should be deemed a priority by the enterprise promoter.

The program should define an appropriate management structure, to ensure that the environmental protection measures established in the Environmental Impact Study report are correctly implemented, and that it will enable the monitoring of the implementation of the environmental Subprograms not directly linked with the construction work, providing a better integration between the different agents, companies, consultants, and public and private institutions involved in the process. The specific objectives of this program include the following bullet points:

- Promote the development of environmental programs associated with the monitoring of various indicators of marine biodiversity (detailed in the Biodiversity Management Plan) and water quality, during and after the construction work;
- Reduce, mitigate, or avoid the interferences in the man-made, and natural environment generated by the construction work;
- Promote the integration between the proposed plans, avoiding duplication, and maximizing the results.

6.5. LIVELIHOODS RESTORATION PLAN

The definition of the areas of influence of Marginal da Corimba Project comprised one of the initial stages of the Environmental and Social Impact Study (ESIS) of the project, for the purpose of establishing the geographic limits of the areas that may undergo positive or negative, direct or indirect changes, enabling the establishment of guidelines for the impact assessment and mitigation. Accordingly, the Livelihoods Restoration Plan should take into consideration these areas.

Moreover, the development of the Livelihoods Restoration Plan should take into account the social survey described in Section 4.8 of this document. Thus, this Plan should be developed with the following objectives:

- Identify the affected parties that will be impacted, dislocated and/or compensated due to the project scope;
- Determine who will be eligible for restoration and eventual compensation;
- Mitigate the negative impacts caused by the temporary limitation of sea access during the work;

- Compensate the sources of income, or livelihood of the Stakeholders;
- Provide conditions so that the interested and/or affected parties can have development opportunities;
- Ensure the disclosure and communication mechanisms required for the active participation of the Stakeholders in the planning and decision-making process;
- Establish grievance mechanisms, and resolution of disputes that are consistent;
- Monitor the success of the measures implemented, and define corrective actions, where required; and
- Execute a program of social rehabilitation, and community development, to oversee the post-resettlement/compensation.

6.6. WASTE MANAGEMENT PLAN

The entrepreneur and the contractor should develop a Waste Management Plan, in compliance with the Legislation in force, namely Presidential Decree No. 190/12. This Plan aims to provide methods that minimize the production of wastes (whether liquid, solid, or gaseous) generated by the enterprise; best practices for the transportation, and treatment of wastes; to ensure the protection of workers, the preservation of public health, natural resources, and the environment.

CHAPTER 7

FINAL REMARKS

7. FINAL REMARKS

It is currently observed that the implementation area next to the Marginal da Corimba Project is modified by the human impact on the environment, with high environmental and social costs, particularly within the coastal zone where a large number of activities related to fisheries and trade take place. Moreover, the majority of the population that inhabit the surroundings of the project area lives in precarious basic sanitation conditions and in high risk areas. The surrounding area is also characterised by sharp degradation rates with respect to the drainage component, sanitation infrastructure and road infrastructure.

It is also important to note, that in recent years, other projects have been implemented in the area that have had an impact on local populations and fishing activities, including the construction of certain infrastructure of Marginal Southwest (construction of bridges nearby to drainage ditches and hydraulic fill in certain areas of the Project). The Marginal da Corimba Project, which is framed by the Luanda General Metropolitan Master Plan (PDGML), comprises of a set of activities that will serve as the foundation for the large-scale development of the areas of Corimba and Futungo de Belas, that in environmental and socioeconomic terms, it may widely benefit from the implementation of the project.

However, the development of the proposed project area will result in some changes, of varying degrees of significance, leading to potential environmental and social impacts to the various project components summarised below. Mitigation measures have been proposed for all of these potential impacts, which are defined in Chapters 5 and 6 of this Combined ESIS.

Potential impacts on **physical and chemical components** include the following:

- Change to the coastal geomorphology of the area resulting from the establishment of a new continental shelf / land reclamation area. This area will be constructed along approximately 8.5 kilometres of coastline with a drop of 110 metres to the bay below.

- Changing the bathymetry of sand loan areas as a result of dredging activities (particularly near the coastal area) with future consequences for local coastal dynamics (currents, waves and sediment transport).
- Effect on water quality with an increase in turbidity as a result of dredging activity and consequent creation of land reclamation areas as well as potential contamination due to spillage.
- Change in air quality associated with the emission of gases and dust due to the movement of vessels during the dredging process and of trucks assigned to work during the consolidation of the land reclamation phase and also in order to transport rocks, facilitating trench extension and coastal protection.
- Increased noise levels caused by vehicles, boats, generators and other work related, noise generating equipment.

Potential impacts on **ecological and biological components** include the following:

- Disruption and temporary removal of marine and coastal species existing in the area, especially sea turtles, birdlife and fish populations that use the Project insertion area for nesting, resting, feeding and reproduction.
- Disruption of Mussulo lagoon aquatic and coastal habitats including the benthic fauna either caused by the dredging activity itself or by the creation of the land reclamation area; and in the future resulting from changing coastal dynamics.
- Improvement of the coastal area's current condition potentially resulting in healthier coastal habitats.

Potential impacts on **social and cultural components** include the following:

- Temporary limitations regarding sea access on land reclamation areas during dredging and consolidation of land reclamation activities.

- Potential disturbances to fishing activities, including the reception, processing and marketing of fish as well as to other activities that take place along the coast.
- Allocation of fishing infrastructure and associated services resulting in the reduction of direct and indirect jobs, reduced fish supply, possible price increases and decreased yields.
- The changing of the landscape due to the emergence of new elements, namely the land reclamation area.

Potential impacts on **economic and legal components** include the following:

- Medium to long term Impacts on the local economy due to the revitalisation of the Corimba coastline.
- Overloading of road and sanitation infrastructures during the land reclamation platform creation and extension of drainage ditch infrastructure phases.
- Compliance with strategies and policies highlighted by the Luanda General Metropolitan Master Plan (PDGML).

An important aspect to be highlighted is the use of the area known as the Mabunda Port, and its beach as a source of income for the local population, ship-owners and fish processing structures. The potential impacts on these are expected to be significant due to the temporary limitation of certain services related to fishing activities. A Restoration of Livelihoods Plan will be developed in order to alleviate potential conflicts and safeguard the affected parties.

Overall and taking into account the importance of the impacts identified in the Environmental Assessment performed; a major part of them are inevitable, and result from the activities developed during the dredging, consolidation of land reclamation, and extension of the drainage ditches. Nevertheless, if the good practices and safety policies are followed, in addition to the implementation of the Environmental and Social Monitoring

Programme (ESMP) and other plans and programs proposed in this report, as they can be minimized/mitigated in a satisfactory and sustainable manner.

As part of the recommendations of this Combined Environmental and Social Impact Study, the project proponent and contractors will develop a series of plans, programs and procedures in order to protect the environment together with the living conditions of any interested and/or affected parties. The plans, which are an integral part of the Project's Environmental and Social Management System, include the following:

- Stakeholder Engagement Plan which includes the Grievance Mechanism
- Communication Plan
- Biodiversity Management Plan
- Livelihood Restoration Plan
- Waste Management Plan
- Health, Safety and Environment Training Plan
- Traffic Management Plan
- Emergency Response Plan

In addition to these documents, the implementation of this project will comply with requirements set out by the International Finance Corporation (IFC) Performance Standards and the Equator Principles, insuring that the best dredging practices, including those presented in IFC guidelines for port and terminal projects, are followed.

CHAPTER 8

BIBLIOGRAPHY

8. BIBLIOGRAPHY

AMARAL, A.C.Z. (2002). Condições ambientais e estrutura das comunidades da praia. In CETESB. Derrames de óleo no mar e os ecossistemas costeiros. Companhia de Tecnologia e Saneamento Ambiental – CETESB – Apóstila do curso Derrames de óleo no mar e os ecossistemas costeiros. São Paulo: Cap. 10, p 153-166.

ABECASSIS, F. (2001). **As restingas de Angola: onde a Terra encontra o Mar**.

ANZECC. (2000). **Australian and New Zealand guidelines for fresh and marine water quality. Volume 1**, The guidelines. Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.

AZEVEDO, A.L., REFEGA, A.A.G., SOUSA, E.C., PORTAS, C.A.N., VILHENA, M.A.L., MARQUES, M.N., LOURO de SÁ, V.H. (1972). **Caracterização Sumária das Condições Ambientais de Angola**. Universidade de Luanda. Nova Lisboa. 106p.

BARBOSA, L.A.G. (1970). **Carta Fitogeográfica de Angola. Instituto de Investigação Científica de Angola.** Luanda. 323p.

BIRD. E.C. e Schwartz. M.L. (1985). **The World's Coastline**. New York. Van Nostrand Reinhold Co., pp. 1071.

BRANCH, B. (1998). **Field Guide to Snakes and Other Reptiles of Southern Africa**. Third edition. Struik Publishers (Pty) Ltd. Cape Town. 399p.

BRANCH, G.M., GRIFITHS, C.L., BRANCH, M.L. & BECKLEY, L.E. 2007. **Two oceans. A guide to the marine life of southern Africa.** Struik Publishers. Cape Town.

BOLTOVSKOY, D. (1981). **Atlas del zooplankton en el Atlantico sudoccidental y metodos de trabajos con el zooplankton marino**. Mar del Plata, INIDEP

BOLTOVSKOY, D. (1999). **South Atlantic zooplankton**. Vol.1 e 2. Backhuys Publishers, Leiden, The Netherlands 1706 pp.

BRIGANTE, J. & ESPÍNDOLA, E. L. G. (2003). (org.) **Comunidade de macroinvertebrados bentônicos no rio Mogi – Guaçu. In:), Limnologia Fluvial.** São Carlos – SP, Editora Rima p 181 – 187.

CHANNING, A. (2001). Amphibians of Central and Southern Africa. Protea Bookhouse. Pretoria, 470pp.

CETESB - **Ficha de informação toxicológica - Cádmio e seus compostos**. Disponível em: www.cetesb.sp.gov.br. Acesso em: Janeiro/2015.

COELHO, A. (2001). **Lei de Bases do Ambiente Anotada**. Faculdade de Direito da Universidade Agostinho Neto. Luanda. 450p.

COMISSÃO DE IMPLEMENTAÇÃO DO GABINETE DE GESTÃO DE DESENVOLVIMENTO TURÍSTICO DO FUTUNGO DE BELAS & MF/PV. (2008a). Plano Director Normativo de Ocupação do Perímetro Desanexado do Futungo de Belas. Luanda, Angola.

COMISSÃO DE IMPLEMENTAÇÃO DO GABINETE DE GESTÃO DE DESENVOLVIMENTO TURÍSTICO DO FUTUNGO DE BELAS & MF/PV. (2008b). Plano Director de Desenvolvimento do Perímetro Desanexado do Futungo de Belas. Luanda, Angola.

COMISSÃO DE IMPLEMENTAÇÃO DO GABINETE DE GESTÃO DE DESENVOLVIMENTO TURÍSTICO DO FUTUNGO DE BELAS & BROADWAY MALYAN & MOBILITY IN CHAIN. (2013).

Plano Director de Desenvolvimento do Perímetro Desanexado do Futungo de Belas. Luanda, Angola.

CONSELHO NACIONAL DO MEIO AMBIENTE – CONAMA (2005). **Resolução sobre a classificação e directrizes ambientais para as águas superficiais** (Resolução nº. 357 de 17 de Março). Ministério do Meio Ambiente. Brasil.

CONSULMAR (1983). Obras de protecção costeira da Ilha de Luanda. Projecto – Vol 1: Memória descritiva e justificativa. Direcção Nacional de Obras de Engenharia. Angola. 40 p

CONSULMAR (1994-96?). **Baía de Luanda - Mussulo, Modelo Matemático.** Direcção Nacional de Infraestruturas, Ministério das Obras Públicas e Urbanismo, Luanda, Angola.

CONSULMAR (1994). Complexo Lagunar Baía de Luanda – Mussulo. Estudo da Baía de Luanda e Zona Marítima Adjacente. Ministério das Obras Públicas e Urbanismo / Direcção Nacional de Infra-Estruturas. 1º Relatório. Angola. 23 p

COSTA, M.J., Marques, A.L.G. e Lopes M.T. (1994). **Um ecossistema frágil – Baía do Mussulo, Angola**. Estudo preliminar e identificação dos impactos sobre os recursos naturais. Actas da 4ª Conferência nacional sobre a qualidade do ambiente, 1: G-43-G-52.

COSTA, M.J., Santos C.I., e H. N. Cabral (2002). *Comparative analysis of a temperate and a tropical seagrass bed fish assemblages in two estuarine systems: the Mira estuary (Portugal) and the Mussulo lagoon (Angola)*. Cah. Biol. Mar., 43, 73-81.

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (2001). **Avaliação de impacto ambiental de actividades de perfuração para exploração a realizar por TEXACO EXPLORATION ANGOLA SUMBE INC.***, no Bloco 22, no talude continental de Angola*. (ENV-S-C 2001-091)

CRAWFORD-CABRAL, J. (2005). The Ungulate Fauna of Angola. Systematic List, Distribution Maps, Database Report. Instituto de Investigação Tropical. Estudos, Ensaios e Documentos 163. Lisboa, Portugal.

DAY, J.H. 1967. ***A monograph on the Polychaeta of Southern Africa***. Part I.Errantia.Trustees of the British Museum (Natural History), Londres. Reino Unido.

DEAN, WRJ. (2000). The Birds of Angola. BOU Checklist series: 18. British Ornithologists' Union, Tring, UK.

DEAN, WRJ. (2001). Angola. Pages 71-91 in: Fishpool LDC and Evans MI (Eds) Important Bird Areas in Africa and associated islands: Priority sites for Conservation. Pisces Publications and BirdLife International: Newbury and Cambridge, UK.

DESSIER, A. e J. R. Donguy (1994). ***The sea surface salinity in the tropical Atlantic between 10°S and 30°N – seasonal and interannual variations (1977-1989).*** Deep-Sea Res. I, 41, 81-100.

DINIZ, A.C. & AGUIAR, F.B. (1998). **Zonagem Agro-Ecológica de Angola.** [Estudo cobrindo 200.000 Km2 do Território], Europam, Lda., Portugal. 415pp.

DINIZ, A.C. (1973). **Características Mesológicas de Angola**. 2ª Edição. Missão de Inquéritos de Angola. Nova Lisboa. Angola. 482p.

ESTEVES, F.A. (Editor). (1998). Ecologia das Lagoas Costeiras do Parque Nacional da Restinga de Jurubatiba e do Município de Macaé (RJ). Computer & Publish Editoração Gráfica, Rio de Janeiro. 442 p.

FONSECA, H.D. (1971). **A calema na costa de Angola. Simpósio Sobre Agitação Marítima**. in Estudo e Documentos, Lisboa 1971.

GGFBM. 2015. **Primeiro Relatório de Monitorização Ambiental do Projecto de Requalificação Urbana do Perímetro Desanexado do Futungo de Belas**. Luanda. 29p.

GOFAS, S., AFONSO, J.P. & BRANDÃO, M. (Eds). (s/d). **Conchas e Moluscos de Angola - Coquillages et Mollusques d'Angola.** Universidade Agostinho / Elf Aquitaine Angola. Angola.

GOSSWEILER, J. & MENDONÇA, F.A. (1939). Carta Fitogeográfica de Angola. Governo Geral de Angola

GOVERNO DE ANGOLA. (1998). **Lei de Bases do Ambiente** (Lei n.º 5/98 de 19 de Junho). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2002). **Lei das Águas** (Lei n.º 6/02 de 21 de Junho). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2004a). **Decreto sobre a Avaliação de Impacte Ambiental** (Decreto n.º 51/04 de 23 de Julho). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2004b). **Lei do Ordenamento do Território e Urbanismo** (Lei n.º 3/04 de 9 de Novembro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2004c). **Lei de Terras** (Lei n.º 9/04 de 9 de Novembro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2004d). **Lei dos Recursos Biológicos Aquáticos** (Lei n.º 6-A/04 de 08 de Outubro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2005). **Lei do Património Cultural** (Lei nº 14/05 07 de Outubro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2006). **Lei das Associações de Defesa do Ambiente** (Lei nº 3/06 de 18 de Janeiro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2007a). **Decreto sobre o Licenciamento Ambiental** (Decreto n.º 59/07 de 13 de Julho). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2009c). **Decreto Executivo Conjunto que aprova as Taxas de Licenciamento Ambiental** (Decreto Executivo n.º 96/09 de 6 de Outubro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2010c). **Constituição da República de Angola** (Diário da República n.º 23 de 5 de Fevereiro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2011a). **Regulamento sobre Qualidade da Água** (Decreto Presidencial n.º 261/11 de 6 de Outubro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2011b) **Regulamento sobre a Responsabilidade por Danos Ambientais** (Decreto Presidencial n.º 194/11). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2011c) **Lei das Transgressões Administrativas** (Lei n.º 12/11 de 16 de Fevereiro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2011d). **Decreto Presidencial n.º 152/11 de 13 de Junho que aprova o Estatuto Orgânico do Gabinete de Gestão do Pólo de Desenvolvimento Turístico do Futungo de Belas.** Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2011e). **Decreto Presidencial n.º 194/11 de 7 de Julho que aprova o Regulamento da Responsabilidade por Danos Ambientais**. Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2012a). **Estatuto Orgânico do Ministério da Energia e Águas** (Decreto Presidencial n.º 246/12 de 11 de Dezembro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2012a). E**statuto Orgânico do Ministério do Urbanismo e Habitação** (Decreto Presidencial n.º 232/12 de 4 de Dezembro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2012b). **Regulamento sobre Gestão de Resíduos** (Decreto Presidencial n.º 190/12 de 24 de Agosto). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2012b). **Termos de Referência para Elaboração de Estudos de Impactes Ambientais** (Decreto Executivo n.º 92/12 de 1 de Março). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2013). **Decreto Executivo sobre a Gestão de Resíduos de Construção e Demolição.** (Decreto Executivo n.º 17/13 de 22 de Janeiro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2014a). **Estatuto Orgânico do Ministério do Ambiente** (Decreto Presidencial n.º 85/14 de 24 de Abril). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2014b). **Estatuto Orgânico do Ministério das Pescas** (Decreto Presidencial n.º 280/14 de 30 de Setembro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2014c). **Regulamento de Abastecimento Público de Água e de Saneamento de Águas Residuais** (Decreto Presidencial n.º 83/14 de 22 de Abril). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2014d). **Atribuição de Competências ao Ministro de Estado e Chefe da Casa Civil** (Despacho Presidencial n.º 240/14 de 22 de Dezembro). Governo de Angola. Luanda.

GOVERNO DE ANGOLA. (2016). **Aprovação do Projecto Marginal da Corimba e Minutas dos Contratos** (Despacho Presidencial n.º 9/16 de 25 de Janeiro). Governo de Angola. Luanda.

HOLÍSTICOS. (2010). Estudo de Impacte Ambiental do Projecto Ilha da Cazanga – Golf & Resort para a Imogestin. Luanda, Angola.

HOLÍSTICOS. (2011). Estudo de Impacte Ambiental do Projecto de Requalificação Urbana do Perímetro Desanexado do Futungo de Belas. GGFBM, Luanda. 432p.

HOLÍSTICOS. (2015a). Estudo de Impacte Ambiental do Projecto de Requalificação Urbana do Perímetro Desanexado do Futungo de Belas – Versão Actualizada. Luanda. 411p.

HOLÍSTICOS. (2015b). Estudo de Impacte Ambiental do Projecto de Requalificação Urbana da Marginal da Corimba. Luanda. 373p.

HOLÍSTICOS, **Caracterização Ambiental e Social para o Desenho da Sensibilidade Costeira entre Luanda e Namibe**, Agosto 2014.

INGLEBY, B., e M. Huddleston (2007). ***Quality control of ocean temperature and salinity profiles - historical and real-time data.*** *Journal of Marine Systems*, 65, 158-175.

INSTITUTO HIDROGRÁFICO (1974). **Carta para navegação e recreio n°1050**, Luanda-Corimba-Mussulo. Missão Hidrográfica de Angola e S. Tomé. Instituto Hidrográfico – Ministério da Marinha, Rua das Trinas, 49 –Lisboa.

INSTITUTO NACIONAL DE ESTATÍSTICA (2014). **Recenseamento Geral da População e Habitação**. Resultados Preliminares. Governo de Angola.

IUCN. (1992). **Angola. Avaliação do Estado Actual do Meio-Ambiente. Relatório Principal**. IUCN – Gabinete Regional para a África Austral. Harare. 264 p.

MARINE ECOLOGICAL SURVEYS LIMITED. 2008. ***Marine Macrofauna Genus Trait Handbook***. 184 pp.

MINISTÉRIO DO ULTRAMAR (1955), (Decreto nº 40:040 de 20 de Janeiro). Diário do Governo, 1ª Série, nº16, de 1955.

MOHRHOLZ, V., BARTHOLOMAE, C.H., van der Plas, A.K. e H.U. Lass (2008). ***The seasonal variability of the northern Benguela undercurrent and its relation to the oxygen budget on the shelf.*** Continental Shelf Research, 28, 424–441.

MOHRHOLZ, V., M. SCHMIDT and J.R.E. Lutjeharms (2001). ***The hydrography and dynamics of the Angola-Benguela Frontal Zone and environment in April 1999***. S. Afr. J. Sci., 97, 199-208.

MONTEIRO, P. M. S. and A. K. van der Plas (2006). *Low Oxygen Water (LOW) Variability in the Benguela System: Key Processes and Forcing Scales Relevant to Forecasting. In The Benguela: predicting a large marine ecosystem*, Shannon, V., G. Hempel, P. Malanotte-Rizzoli, C. Moloney and J. Woods, eds. Elsevier, Amsterdam, pp. 71-90.

MOORE, C.M., Mills, M.M., Achterberg, E.P., Geider, R.J., LaRoche, J., Lucas, M.I., McDonagh, E.L., Pan, X., Poulton, A.J., Rijkenberg, M.J.A., Suggett, D.J., Ussher, S.J. e E.M.S. Woodward (2009). ***Large-scale distribution of Atlantic nitrogen fixation controlled by iron availability.*** Nature Geoscience 2, 867-871.

MORAIS M., TORRES M. O. & MARTINS M. J. (2006). Biodiversidade Marinha e Costeira em Angola. Ministério do Urbanismo e Ambiente. Luanda, Angola.

MOREDJO, A (1990). **Avaliação dos efeitos de actividades humanas sobre o estado trófico dos açudes paraibanos com ênfase na utilização da comunidade zooplanctónica como bioindicadores**. Universidade Federal da Paraíba.

OLIVEIRA, J.F. (2005). **Gestão Ambiental**. Lidel. Lisboa.

PALMER, A.J.M. & ABBOTT, W.H. **Diatomáceas como Indicadores de Mudanças de Nível do Mar**. In: Sea-level Research: a manual for the collection and evolution of data. Geo Books, Norwich (England).

PARLAMENTO EUROPEU E CONSELHO DA UNIÃO EUROPEIA (2000). **Directiva 2000/60/CE de 23 de Outubro de 2000, que estabelece o WFD, um quadro de acção comunitária no domínio da política da água**. www.eur-lex.europa.eu.

PAULO, C., (2007). **Contribuição para a avaliação da dinâmica zooplantónica na zona sul da costa angolana**. Trabalho de fim de curso. Universidade Agostinho Neto. Faculdade de Ciências. 3 pp.

PINTO, A. (2005). **Sistemas de Gestão Ambiental. Guia para a sua implementação**. Edições Sílabo. Lisboa.

QUEIROZ, T. (2013). **Cabo Ledo & Baía do Suto: A study case for coastal erosion (Angola).** *Report submited to Partnership for Ocean Global Observation (POGO) under the scope of NANO-Nearshore Hydrodynamic Group project, pp. 33.*

RANGEL, I. & SILVA, S**.**, (2007). **Pseudo-nitzschia spp and Prorocentrum micans blooms in Luanda Bay**, Angola Harmfull Algae News, nº 33, 8-9.

RANGEL, I., MUAI, J. & SILVA, S. (2003). Taxinomia fitoplanctónica e marés vermelhas em Angola. Comunicação apresentada nas 10ª Jornadas Técnico Científicas do Instituto Nacional de Investigação Pesqueira. Luanda.

RÉ, P., AZENTEIRO, U & MORGADO, F. (2005). **Ecologia do plâncton marinho e estuarino**. Edições Afrontamento. Ciência e Natureza. 43-59 pp

REDECKER, E. S., VAN CAMPENHAUT, K., BERVOETS, L., REIJNDERS, H., BLUST, R., (2007). **Subcellular distribuition of Cd in the aquatic oligochaete Tubifes tugifex implication fortrophic availability and toxicity**. Environ. Pollut. 148, p 166-175.

RIVM. (1995). **A General Strategy for Integrated Environmental Assessment at the European Environment Agency**. RIVM, Bilthoven.

SÆTERSDAL, G., BIANCHI, G., STRØMME, T., VENEMA, S.C. (1999). ***The DR. FRIDTJOF NANSEN Programme 1975–1993. Investigations of fishery resources in developing countries. History of the programme and review of results.*** FAO Fisheries Technical Paper. No. T391. Rome, FAO. 434p. (disponível em http://books.google.com)

SALDANHA, L. 1997. **Fauna Submarina Atlântica**. 3ª ed. 361pp. Publicações Europa América. Lisboa

SALES, J.D. (1991). **Nova contribuição ao estudo das microfaunas dos sedimentos do interior e exterior da Baía do Mussulo.** Tese de Licenciatura, Departamento de Geologia, Universidade Agostinho Neto, Luanda, 58 p.

SANCHEZ, L.E. (2008). **Avaliação de Impacto Ambiental – Conceitos e Métodos**. Oficinas de Texto. São Paulo. 495p.

SANTOS, C.I. (2007). **Comunidades de macroinvertebrados e peixes associadas à pradaria marinha de Halodule wrightii (Ascherson, 1868) na Laguna do Mussulo, Angola**. Tese de doutoramento em Biologia (Biologia Marinha e Aquacultura), apresentada à Universidade de Lisboa através da Faculdade de Ciências, Lisboa, 195 p.

SEYVE, C., Brandao, M., Santos, C.I., Castro, R.FV., e A. Menard (2000). ***The Mussulo Bay, a modern example of lagunar siliciclastic sedimentation. Proceeding of Colloquium on Stratigraphy and the Paleogeography on the South Atlantic, Angola.***

SHANNON, L.V., J.J. ANGEBAG and M.E.L. BUYS (1987). ***Large and meso-scale features of the Angola-Benguela Front***. S. Afr. J. Mar. Sci., 5, 11-34.

SHILLINGTON, F.A., C.J.C. REASON, C.M. DUNCOMBE-Rae, P. FLORENCHIE and P. PENVEN (2006***). Large scale physical variability of the Benguela Current Large Marine Ecosystem (BCLME). In The Benguela: predicting a large marine ecosystem***, Shannon, V., G. Hempel, P. Malanotte-Rizzoli, C. Moloney and J. Woods, eds. Elsevier, Amsterdam, pp. 49-70.

SILVA, A., FERNANDES, B., RUBY, C. & MARTINS, A. (2005). Resultados preliminares da análise de monitorização das águas marinhas de Angola. Comunicação apresentada nas 10ª Jornadas Técnico Científicas do Instituto Nacional de Investigação Pesqueira.

SILVA, C.A.R. (2004). Análises Físico-Químicas de sistemas marginais marinhos. Interciência, Rio de Janeiro. 118 p.

SILVA, S. & RANGEL, I. (2006). **Resultados do fitoplâncton e microzooplâncton da Baía do Mussulo**. XIII Jornadas Técnico-Científicas do Instituto de Investigação Marinha–Luanda.

SINCLAIR, I. & RYAN, P. (2003). ***Comprehensive Illustrated Field Guide Birds of Africa South of the Sahara. Struik Publishers.*** Cape Town. 759p.

SMITH, L. D., (1977). **A Guide to marine coastal plankton and marine invertebrate larvae**. USA 147 pp.

STRAMMA. L., Fischer. J., BRANDT. P. e SCHOTT, F. (2003). ***Circulation. variability and near-equatorial meridional flow in the central tropical Atlantic***. *In Interhemispheric Water Exchange in the Atlantic Ocean. Goni. G. J.. Malanotte-Rizzoli. P.. eds. Elsevier. Amsterdam. pp. 1–22.*

STUART, C. & STUART, T. (2000). **A Field Guide to the Tracks & Signs of Southern and East African Wildlife.** Struik publishers. Cape Town.

TOMAS, C. R., (1997). **Identifying marine phytoplankton**. Academic Press, New York. 858 p.

TRAYLOR, M.A. (1963). Check-list of Angolan birds. Publicações Culturais da Companhia de Diamantes de Angola. 61: 1-250.

TREGOUBOFF, G., ROSE, M., (1957). **Manuel de planctonologie méditerranéenne**. Tome II Centre National de la Recherche Scientifique. Paris 207 pp.

USEPA. (1986). ***Quality Criteria for Water. Office of Water Regulation and Standards. Washington,*** EUA. www.water.epa.gov.

WALLACE, W. G., LOPEZ, G. R., LEVINTON, J. S., (1998). **Cadmium resistence in an oligochaete and its effect on cadmium trophic transfer to an omnivorous shrimp**. Mar. Ecol. Prog. Ser. 172, p 225- 237.

WARWICK, R.M. (1986). **A new method for detecting pollution effects macrobenthic communities**. Marine Biology. 92, p 557-562.

WASMUND, N., H.U. LASS & G. NAUSCH (2005). ***Distribution of nutrients, chlorophyll and phytoplankton primary production in relation to hydrographic structures bordering the Benguela-Angolan frontal region.*** Afr. J. of Mar. Sci., 27: 1, 177-190.

YONEDA, N.T (1999). Plâncton. Centro de Estudos do mar. Universidade Federal do Paraná.

YOO, J.-M. & J. A. Carton (1990). ***Annual and Interannual Variation of the Freshwater Budget in the Tropical Atlantic Ocean and the Caribbean Sea.*** J. Phys. Oceanogr., 20, 831-845.

APPENDIX A

Public Consultation Minutes

Urban Requalification Project of Marginal da Corimba	MINUTES OF THE PUBLIC CONSULTATION			
		Project: [redacted]		
VENUE: Former Presidential Complex Futungo de Belas		DATE: 7th April, 2016		# OF PAGES: 18
SUBJECT MATTER: Public Consultation	NOTES BY: [redacted]	TIME: 09h35		REVIEW: EF/VR

NAME	INSTITUTION	FUNCTION
See list of participants in Annex 2		
COPIES SENT TO: GGFBM, Holísticos, Urbinveste and the Ministry of Environment		

ITEM	DESCRIPTION	NOTES / ACTION
1	The opening ceremony of the public consultation meeting began at 09h35. The meeting was chaired by the following people: Engineer Rodrigo dos Santos (Director of the Management Office for Tourism Development of Futungo de Belas and Mussulo (GGFBM), Mrs. Sandra do Nascimento (Director of the National Directorate for Prevention and Environmental Impact Assessment – DNPAIA) and Mr. Rui da Silva (Vice-Governor of Luanda Province for Community Services).	
2	The Technical Director of Holísticos, [redacted] gave a brief introduction regarding the public consultation meeting before going on to present himself to the audience and the main elements of the meeting. [redacted] thanked the participants, gave a brief explanation of the meetings held under the scope of the involvement of interested and/or affected parties involved with the project emphasising that the public consultation needs to be a comprehensive and definitive meeting. Next [redacted] invited those present to make use of the opportunity to submit suggestions, concerns and expectations regarding the Urban Renewal Project of Marginal da Corimba [redacted] also stated that all participants had access to a copy of the non-technical summary and that a copy of the Environmental Impact Study is available in the meeting room for consultation by interested and/or affected.	
3	The Vice-Governor of Luanda province for Community Services, Mr. Rui Celso Fernandes da Silva, welcomed all those present and stressed that the project will be an asset to the Angolan government, explaining that it will facilitate the improvement of road traffic issues, urban mobility and offer the creation of leisure and recreation facilities at the level of the city of Luanda.	
4	The Director of DNPAIA, Mrs. Sandra Nascimento (SN) welcomed the audience and went on to	

ITEM	DESCRIPTION	NOTES / ACTION
	say that the Environmental Framework Law (Law No. 5/98 of 19 June) establishes the procedures of the Environmental Impact Study as an environmental management tool with regards to projects that by their nature, size or location have environmental and social harmony balance implications.	
5	Following on, SN stated that the Environmental Impact Study was prepared by an Angolan environmental consulting firm (Holísticos) registered by the Ministry of Environment, and that the study was submitted by the GGFBM to the Ministry of Environment. SN invited those present to submit suggestions, criticism, requests, expectations and contributions to the ongoing EIS and pointed out that the following environmental licensing process will take up to eight (8) days, starting from the date of the public consultation, giving the interested and/or affected parties an opportunity to submit their contributions to DNPAIA.	
6	SN gave the floor to the Director of GGFBM, Engineer Rodrigo dos Santos (RS) for a brief presentation of the project. RS thanked the participants before proceeding with the Corimba da Marginal Project presentation, justifying the motivations behind the project, namely the demand for leisure and recreation infrastructure, improvement of road traffic and urban mobility between the city centre and the South Zone, the urban regeneration of the region and the promotion of tourism. He said that the city of Luanda has a very high population and urban mobility demographic hence the need for such a project in order to address the numerous road congestion problems.	Power point presentation attached.
7	RS referred to the multidisciplinary team involved in the project (companies specialising in marine engineering), stressing that the project's vision and objectives is to create a land reclamation area approximately 8.5 km in length with a drop of 110 m to the Urban District of Samba bay below, facilitating the construction of a coastal road. RS also spoke of existing conditions in the region, the existing situation (with emphasis on the Marginal Southwest Project), environmental factors to keep in mind, the proposed new route, the main advantages of the project and concluded by emphasising the uses of the allotments provided by virtue of land reclamation.	
8	The representative of Holísticos. VR began the presentation of the EIS detailing the agenda of the meeting. He clarified the scope of the EIS and of the institutional and legal framework applicable to the project in question.	
9	[redacted] from Holísticos presented the applied methodology of the EIS field surveys, explaining the situation of reference of the project insertion region (with emphasis on the health of the environment, marine and coastal biodiversity and socioeconomic	Power point

ITEM	DESCRIPTION	NOTES / ACTION
	characterisation). Following on from this, VR summarised the methodology used to evaluate potential impacts, concluding by presenting the main environmental and socioeconomic impacts and the various programmes that the environmental and social monitoring plan will take into consideration.	presentation of the EIS attached.
10	The session of questions and contributions consisted of the following participants:	
11	• **Filomena Espírito Santo (FS) – Agostinho Neto University** FS enquired as to how land use issues were to be addressed, taking into account current activities relating to developing the region. She also questioned why the project managers had not invited universities to take part, referring to the fact that there are several architectural projects that have been realised by graduate students, and that they could analyse the coastal region of the project in question. She also wanted to know what measures would be taken in order to avoid conflict between swimmers and fishermen with regards to beach space at Ilha de Luanda. She also requested information regarding the sustainability of the fishermen whose activities will be affected, albeit temporarily, by the actions of the project. FS requested clarification regarding the relationship of this project to the Luanda General Metropolitan Master Plan (PDGML) with emphasis on the aspect of drainage of waste water. Finally, she asked if the project provided sheltered areas for water sports and recreational areas.	
12	• **Arménio Lopes (AL) – Owner of COAPescas** AL indicated that there is a pier and a fish processing factory present on the site which belongs to the COAPescas company and that will be affected by the creation of the platform. He said the plant has eleven (11) fishing trawlers and that it is the largest of its kind in Angola.	
13	• **Júlio Baptista (JB) – Representative of COAPescas** JB praised the fact that the project is an asset to the region. He then went on to question whether a passage (temporary or permanent) would be created during the course of dredging phase in order to provide access to the sea for businesses and fishermen alike who rely on fishing activities in the region since a lack of access could derail these economic activities. JB also questioned whether the fishing port will be built now or only after the execution of hydraulic fill and if waste effluents and domestic waste from drainage ditches will be treated. JB also wanted to know if educational and public awareness activities will be developed in relation to solid waste disposal.	
14	• **António Chaves (AC) – Representative of COAPescas** AC asked where the COAPescas' company quay will be situated as the land reclamation proposal, with a drop of 110 metres, will bury it and paralyse the company. He asked who the	

ITEM	DESCRIPTION	NOTES / ACTION
	responsible party for indemnity and compensation of potentially affected populations will be. AC also pointed out that institutions were not consulted in order to give their opinion and wondered how the grievance mechanism would work.	
15	• **Santos Pereira (SP) – Ambergol** SP questioned whether exhaust fumes or potential oil spills from motor vehicles travelling along the coastal road would affect the marine and coastal environment of the region. He requested that mitigation measures be identified for this scenario. SP indicated that from a technical view point, there is no need for careful analysis of the situation of drainage ditches as these currently end at sea and are loaded with solid waste.	
16	• **Arménio Lopes (AL) – Owner of COAPescas** AL reported that the works carried out along Camuxiba bay (with emphasis on the Marginal Southwest Project) have generally been poorly implemented or planned. He stressed that thorough studies should be conducted before implementing such projects, explaining also that the companies linked to the fisheries sector and local artisanal fishermen should be consulted in order to better know the region. AL said that because the land reclamation has a drop of 110 metres down to the Camuxiba bay, the landing of COAPescas boats at the current quay, built by the company, will be disrupted. AL concluded by stating that if the project impacts the activities developed by COAPescas, economic disorders will escalate as COAPescas is currently the largest company in the country linked to the industrial fishing sector and has approximately 1,000 employees.	
17	• **Inene Dias (ID) – Unitel** ID reported that Unitel has several telecommunications infrastructures within the Urban District of Samba at this time and questioned whether they will be affected by the project. During her explanation, ID mentioned that Unitel has an interest in participating in the project with regards to installing new telecommunications infrastructure as the population density of the area, following project implementation, will be sufficient in order to justify new installations.	
18	• **Rodrigo dos Santos (RS) – Director of GGFBM** Regarding occupation of the land under the dredging project, RS responded by saying that it will be the Administration of the Urban District of Samba's responsibility to define the terms of use. He reiterated that the project is an initiative of the Angolan government and falls within the scope of the Luanda General Metropolitan Master Plan (PDGML) and that the GGFBM has been chosen to oversee the implementation of certain phases of the project presented in the public consultation.	

ITEM	DESCRIPTION	NOTES / ACTION
	Regarding the management of residual and domestic waste drainage ditches, RS stated that he predicts that all of the storm water within the networks of the Urban District of Samba will be treated before its release to the sea. He stressed that the GGFBM in partnership with the Administration of Samba will implement environmental awareness programmes in order to lessen the amount of household waste being deposited into drainage networks by the population, as tourism activity will be compromised if no care is taken regarding domestic effluents. Regarding the involvement of universities in the project, RS said that the Association of Architects and Engineers were consulted and that universities may also be invited to engage in the future. He stressed that the directorate of the GGFBM are open to the collaboration of all interested parties. He then alluded that potential socioeconomic impacts were identified during the EIS and that lines of communication will be established with potentially affected parties. RS then pointed out that companies that develop activities related to the fisheries sector in the region will benefit from the construction of the fishing port as it will provide adequate infrastructure for the development of fishing activities in the region. He acknowledged that some economic activities in the region will clearly be affected by the actions of the project. However, RS also reported that synergies will be created between various companies involved in project in order to find viable solutions in order to minimise or avoid potential impacts. Regarding the allocation of the COAPescas company pier, RS responded by saying that the project will meet the interests of the state and citizens. He stated that the management of the future fishing port will be the responsibility of the Ministry of Fisheries and that viable solutions regarding the implementation of the project are to be sought in order to prevent disorders to activities developed by COAPescas. RS gave as an example the possible temporary displacement of the pier. He went on to say that the pier would be framed within the construction of the fishing port. RS stressed that the aim of the project is to adapt the various activities carried out at appropriate locations, and that the fishing port should concentrate all activities of fish processing, and the GGFBM is always available to receive complaints and claims and in partnership with several companies involved in the project will look for viable solutions. RS reiterated that currently the project limits itself to only dredging and the creation of land reclamation with a drop of 110 metres to the bay in order to facilitate the construction of the Marginal da Corimba road. He went on to say that everything that can be recovered from the housing developments will be considered in the future and that the citizens of Luanda province will be proud of the new seafront.	

ITEM	DESCRIPTION	NOTES / ACTION
	Regarding the concern and interest shown by Unitel, RS stated that the project will not cause any disruption to telecommunications equipment, since it will all be developed on the land reclaimed from the sea. He stressed that the launch of the ducts systems for the installation of telecommunications networks will be monitored by the Ministry of Telecommunications and Information Technologies. RS went on to stress that a possible a partnership with Unitel would be possible. Finalising his explanation, RS said that the GGFBM is working with international companies specialised in marine engineering that have implemented successful projects in other parts of the world. RS also reiterated that additional bathymetric studies are being conducted in order to avoid potential failures or conflicts with regards to the navigation of passenger and fishing vessels.	
19	• **Vladimir Russo (VR) – Technical Director of Holísticos** VR alluded that the landing and processing of fish land reclamation area should not be used in a disorderly way and as a result the fishing port will be built. With regards to the potential disruption to the COAPescas company, VR stated that this is a particular case and that there will be an ongoing dialogue with the representatives of the company in order to search for solutions. He said that the same situation will be observed in front of the civil nautical club (Sea Association), military nautical club (General Rui de Matos Marina) and at the Capossoka docking area where the creation of a platform which will extend for more than 60 metres into the sea is forecast. Solutions and alternatives will be developed in order to minimise or reduce potential disorders caused by the new land reclamation area. Regarding the involvement of universities, VR responded by saying that universities are always invited or involved in consultation meetings and during the public consultation of projects subject to environmental impact studies; Technical universities were involved during the preparation of this EIS. He reiterated that there will be no physical resettlement of the local population and that an information centre will be created to disseminate information about the project. A grievance and complaints mechanism is also being developed so interested and/or affected parties may submit suggestions, contributions, complaints and claims regarding the project's actions (e.g. a possible collision between the fishing boats and the dredger or road accidents involving project vehicles). VR said that all complaints and grievances should be submitted by all affected parties to the project information centre, the office or to the Administration of Samba. A registration of vessels and their fishermen will also be made so that they can later be framed by the fishing port which is to be built as soon as possible in order to safeguard the livelihoods of local	

ITEM	DESCRIPTION	NOTES / ACTION
	populations who rely on fishing for a living. Regarding the current situation of drainage ditches, VR alluded that the drainage ditches were built exclusively for storm water runoff and not for the disposal of domestic solid waste which must be deposited in containers. However, he stated that the PDGML contemplates the treatment of waste water from drainage ditches before its release to the sea. Regarding the concerns of the COAPescas, VR briefly presented the steps of the bay dredging activity and future installation area of the fishing port, whereby he exemplified that the first areas where the land reclamation will be created will be exactly where COAPescas is situated. He stressed that new housing developments or other significant projects will be subject to a process of independent environmental impact evaluation. Finalising his explanation, VR addressed the importance of the monitoring of potential impacts and conflicts arising from the Project's activities and advised the representatives of COAPescas to contact GGFBM in order to share information and create synergies with regards to the identification of viable solutions.	
20	• **Sandra do Nascimento (SN) – DNPAIA** SN stated that it is the responsibility of the Ministry of Environment to monitor the Environmental Impact Study and mitigation measures to be detailed in the environmental project installation environmental licence. She reiterated that the public consultation does not end on its implementation date and that the interested and/or affected parties have a period of eight (8) days, starting from the date of the public consultation, to send suggestions, criticisms, recommendations and expectations to DNPAIA.	
21	**Note:** After the public consultation a meeting was held between Holísticos and representatives of the COAPescas company in order to analyse aspects relating to the potential impacts of dredging and land reclamation. During the meeting, potential mitigation measures and mechanisms were discussed which could assist the continuation of operations of the COAPescas plant during the dredging and consolidation of the land reclamation phase. The recommendations of the COAPescas technicians were as follows: • A pipe used to transport fish from trawlers (in the sea) to the factory (land) could be extended to the new land reclamation limit. This would allow the plant to be functional during the works of this project until a final solution is identified. • Additional dredging activities could be undertaken in order to create a channel that	

ITEM	DESCRIPTION	NOTES / ACTION
	enables the navigation and docking of their vessels alongside a fish discharge point (suction pipe) as once there is a setback of 110 metres, the new shoreline will have a shallow bathymetric area (about 1.5 metres) preventing the safe navigation of vessels. • That a visit is made to the factory in order to better understand its operation and infrastructure. This visit was carried out by Holísticos on 11th April and the data collected during the visit will be integrated into the Combined Social and Environmental Impact Study. • That a meeting between the project proponent (GGFBM) and the directorate of COAPescas is held in the near future in order to assess the recommendations.	

OBSERVATION:	Photographic Record in Annex 1 and the Advertisement of the Public Consultation in Annex 3.

ANNEX 1: Photographic Record of the Public Consultation.

Photograph 1. Opening Moment of the Public Consultation.

Photograph 2: Intervention by Vice-Governor Mr. Rui da Silva.

Photograph 3: Intervention by Mrs. Sandra do Nascimento.

Photograph 4: Presentation of the project by Engineer Rodrigo dos Santos.

Photograph 5: Presentation of the EIS.

Photograph 6: Presentation of the Reference Situation.

Photograph 7: Questions by Filomena Espírito Santo.

Photograph 8: Questions by Arménio Lopes.

Photograph 9: Questions by the representative of the COAPescas.

Photograph 10: Interview with the Soba Grande of Samba.

Photograph 11: Audience detail.

Photograph 12: Interview with a representative of the project.

ANNEX 2: Attendance List for the Public Consultation

Republic of Angola

Ministry of Environment

National Directorate for Prevention and Evaluation of Environmental Impact

Attendance list for the Public Consultation

"URBAN REQUALIFICATION PROJECT OF MARGINAL DA CORIMBA, AT MUNICIPIO DE BELAS, PROVINCE OF LUANDA"

7th April, 2016

Nama	Institution	Contacts
[redacted]		

[redacted]

Appendix A – Public Consultation Minutes

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Appendix A – Public Consultation Minutes

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Appendix A – Public Consultation Minutes

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Republic of Angola

Ministry of Environment

National Directorate for Prevention and Evaluation of Environmental Impact

Attendance list for the Public Consultation

"URBAN REQUALIFICATION PROJECT OF MARGINAL DA CORIMBA, AT MUNICIPIO DE BELAS, PROVINCE OF LUANDA"

[redacted]

[redacted]

Appendix A – Public Consultation Minutes

ANNEX 3: Announcement of the Public Consultation published in the Jornal de Angola and in Jornal "O País".

REPÚBLICA DE ANGOLA
MINISTÉRIO DO AMBIENTE
Direcção Nacional de Prevenção e Avaliação de Impactes Ambientais
CONSULTA PÚBLICA DO PROJECTO "REQUALIFICAÇÃO URBANA DA MARGINAL DA CORIMBA" PROVÍNCIA DE LUANDA

O Ministério do Ambiente, em parceria com o Gabinete de Gestão do Pólo de Desenvolvimento do Futungo de Belas e Mussulo, realizará uma sessão de Consulta Pública do projecto **"REQUALIFICAÇÃO URBANA DA MARGINAL DA CORIMBA"**, no âmbito do Decreto Nº 51/04, de 23 de Julho - sobre Avaliação de Impacte Ambiental.

A Consulta Pública realizar-se-á no dia **7 de Abril de 2016, às 9h00, no Complexo A do ex-Complexo Protocolar do Futungo de Belas, no Município de Belas, Província de Luanda.**

Assim sendo, vimos por este meio convidar todos os interessados em dar o seu contributo ao Estudo de Impacte Ambiental (EIA) apresentado pelo proponente, devendo contactar os seguintes endereços:

- Ministério do Ambiente, Direcção Nacional de Prevenção e Avaliação de Impactes Ambientais, Rua dos Enganos, Edifício Zimbo Tower, 4° andar; Ingombota-Luanda; Tel: 923001907

- Gabinete do Pólo de Desenvolvimento do Futungo de Belas e Mussulo.

Aos interessados será disponibilizado o **Resumo Não Técnico do EIA.**

DIRECÇÃO NACIONAL DE PREVENÇÃO E AVALIAÇÃO DE IMPACTES AMBIENTAIS, em Luanda, aos 18 de Março de 2016.

A DIRECTORA
SANDRA NASCIMENTO

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República de Angola

Ministério do Ambiente
Direcção Nacional de Prevenção e Avaliação de Impactes Ambientais

**CONSULTA PÚBLICA
DO
PROJECTO "REQUALIFICAÇÃO URBANA DA MARGINAL DA CORIMBA" PROVÍNCIA DE LUANDA.**

O Ministério do Ambiente, em parceria com o Gabinete de Gestão do Pólo de Desenvolvimento do Futungo de Belas e Mussulo, realizará uma sessão de Consulta Pública, do projecto **"REQUALIFICAÇÃO URBANA DA MARGINAL DA CORIMBA"**, no âmbito do Decreto nº 51/04, de 23 de Julho sobre Avaliação de Impacte Ambiental.

A Consulta Pública realizar-se-á no dia **07 de Abril de 2016, às 09h00, no Complexo A do Ex - Complexo Protocolar do Futungo de Belas, no Município de Belas, Província de Luanda.**

Assim sendo, vimos por este meio, convidar a todos os interessados em dar o seu contributo ao Estudo de Impacte Ambiental (EIA) apresentado pelo proponente devendo contactar os seguintes endereços:

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- Gabinete do Pólo de Desenvolvimento do Futungo de Belas e Mussulo.

Aos interessados será disponibilizado o **Resumo Não Técnico do EIA.**

DIRECÇÃO NACIONAL DE PREVENÇÃO E AVALIAÇÃO DE IMPACTES AMBIENTAIS, em Luanda aos 18 de Março de 2016.

A DIRECTORA

SANDRA NASCIMENTO

APPENDIX B

GGFBM Environmental Policy

GABINETE DE GESTÃO DO PÓLO DE DESENVOLVIMENTO TURÍSTICO DO FUTUNGO DE BELAS E DO MUSSULO

POLITICA AMBIENTAL

O Gabinete de Gestão do Pólo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo (GGFBM) é o órgão responsável pela gestão de três (3) grandes projectos que estão a ser implementados na cidade capital de Angola (Luanda), designadamente: Projecto de Requalificação Urbana do Perímetro Desanexado do Futungo de Belas, Projecto da Marginal da Corimba e o Projecto de Requalificação Urbana da Península do Mussulo.

É nossa responsabilidade segundo o decreto executivo nº 152/11 exarado na criação deste gabinete, o acompanhamento dos trabalhos que estão e/ou serão desenvolvidos pelas diferentes empresas a contratar para atingir-se os objectivos preconizados nos referidos Planos Diretores. Temos a responsabilidade de fazer com que sejam salvaguardados todos os pressupostos definidos na Lei de Base do Ambiente e as demais legislação para a Protecção do Ambiente aplicáveis a nível nacional e internacional, bem como na definição de melhores metodologias e tecnologias ambientais disponíveis para garantir o uso racional dos recursos naturais sem comprometer a sustentabilidade para as futuras gerações.

Assim sendo consta da nossa Política Ambiental:

- Cumprimento da legislação ambiental e os demais decretos nacionais aplicáveis e os acordos internacionais para a protecção do ambiente que Angola ratificou;
- Definição de uma Politica de Responsabilidade Social sustentável, para salvaguardar a não violação dos direitos legalmente consagrados das pessoas afectadas directa ou indirectamente pelas acções resultantes do nosso projecto;
- Promover o respeito pelo ambiente entre os colaboradores do GGFBM, tanto dentro como fora do local de trabalho;
- Assegurar a eficiência na utilização dos recursos materiais, bem como a sua origem assente na sustentável;
- Contratação de empresas certificadas para a prestação de serviços e que cumprem com a Legislação Ambiental em vigor no país, bem como

os princípios para Protecção Ambiental internacionalmente estabelecidos segundo a especificação dos serviços a prestar;

- Apostar nas melhores práticas de gestão e utilização racional dos recursos naturais renováveis e não renováveis;
- Apostar na utilização das melhores tecnologias ambientais disponíveis no mercado para a minimização dos potenciais impactes ambientais e utilização de energias renováveis, reduzindo a dependência de combustíveis fósseis no nosso projecto;
- Construção de Estações de Tratamento de Águas Residuais (ETAR) para evitar a contaminação da zona costeira, reduzindo desta forma a degradação dos ecossistemas marinhos e garantir a sustentabilidade;
- Transformar os nossos principais resíduos num recurso valioso para a sociedade, apostando na reciclagem e reutilização;
- Proteger e conservar a biodiversidade das áreas onde se encontram os nossos projectos, e das áreas de proveniência da nossa principal matéria-prima;
- Colaborar e manter um diálogo aberto sobre questões ambientais com os nossos principais *stakeholders*, para uma melhoria contínua em termos de sustentabilidade.

O Gabinete de Gestão do Pólo de Desenvolvimento Turístico do Futungo de Belas e do Mussulo, reitera que vai continuar a envidar esforços para o cumprimento da Legislação Ambiental em vigor e as recomendações dispostas no Estudo de Impacte Ambiental (EIA), bem como na escolha e aplicação de boas praticas para a Protecção do Ambiente estabelecidos a nível internacional, para tornar os nossos projectos um modelo viável do ponto de vista económico e ambiental, assentes numa política de racionalização do uso sustentável dos recursos naturais sem comprometer as futuras gerações.

Luanda 13 de Abril de 2016

O DIRECTOR

RODRIGO DOS SANTOS