REPORT

New International Airport of Cabinda (NAIC Project) - Angola

Environmental and Social Impact Assessment - Chapter 02 - Project Description

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2.0 PROJECT DESCRIPTION

2.1 The existing Cabinda Airport

Cabinda Province is separated from the rest of the Angola by a narrow strip of territory belonging to the Democratic Republic of Congo (DRC). It borders the DRC to the north and the Atlantic Ocean to the west (Figure 1). Due to the absence of a deep-water port in Cabinda for berthing large ships, air transport is currently the main means of transport connecting Cabinda province to the Angolan mainland.

Figure 1: Map of Angola, highlighting the Province of Cabinda.

The remoteness of its location has placed a severe constraint on its development. However, the city of Cabinda has one small airport, with domestic flights only, and is still the second busiest airport in Angola. The existing airport is located in the southern part of the province of Cabinda (Figure 2), on the south side of the city of Cabinda, and serves as the main gateway into the city. It has a handling capacity of 180 passengers/hour and an annual throughput capacity of 147,000 passengers. The airport is served with the highest weekly flight frequencies from Luanda and is currently operating at or above capacity due to an increasing flight demand.

Figure 2: Location of the existing airport in the south of the Cabinda Province.

The current airport is located in a very dense urban area (Figure 3). Formal and informal settlements/developments from all four sides exist directly at the airport boundaries. In addition, dense residential areas are less than 200 m from the runway threshold. These areas are classified as very high-risk, encompassing 30% to 50% of near-airport aircraft accident sites. Therefore, there exists a life-threatening and safety hazard case considering the current airport location and surrounding land uses. Figure 4 shows some photographs of the airport.

Figure 3: Existing Cabinda airport location in a highly urbanized setting. (Source: Google Earth.)

Figure 4: Photographs of the existing Cabinda airport.

Bearing in mind the foreseen growth in air traffic demand at the airport, there is an immediate need to increase its passenger and aircraft movement handling capacity to expand, upgrade, or add new infrastructure. However, due to the highly urbanized area around the airport, there is no available space for an expansion of the airfield (including runway extension and widening of its strips, addition of taxiways, expansion of the apron, and addition of aircraft stands to cater for larger aircraft types). Moreover, there is a lack of space to expand the terminal building and support facilities. Thus, due to the constrained space, the upgrade of the airfield in terms of air navigation aids, whether visual or non-visual, is challenging and probably not feasible.

Furthermore, an access restriction also exists for the airport. Road access is via an elliptical roundabout that joins three roads, namely EN200, EN100, and Rua das Redes. Any increase in passenger and freight operations will certainly increase traffic on the road network and surrounding intersections, which could lead to a deterioration in its level of service. Expansion of the surrounding road network is challenging due to the land use nature of the area and existing developments and settlements.

Given all the restrictions mentioned above and that an expansion of the existing airport cannot be achieved without the need for land expropriation and resettlement of the affected population, the solution was to find an alternative area in the province to build a brand-new airport, which will allow the establishment of airport infrastructure capable of handling the foreseen demand in both the short-medium terms and longer terms with space to accommodate future expansion .

2.2 The New International Airport of Cabinda (NAIC)

The Ministry of Transport (MoT), responsible for airport infrastructure, has identified a new greenfield area 36 km north of the city of Cabinda to relocate the existing airport. The space is unoccupied by developments or settlements and accessed from an existing road that branches off from the coastal road EN 100.

The proposed NAIC site boundary is 853 hectares in extent, in a polygonal format, as shown in Figure 5. The location of NAIC in relation to the existing Cabinda airport (about 30 km driving distance) is depicted in Figure 6.

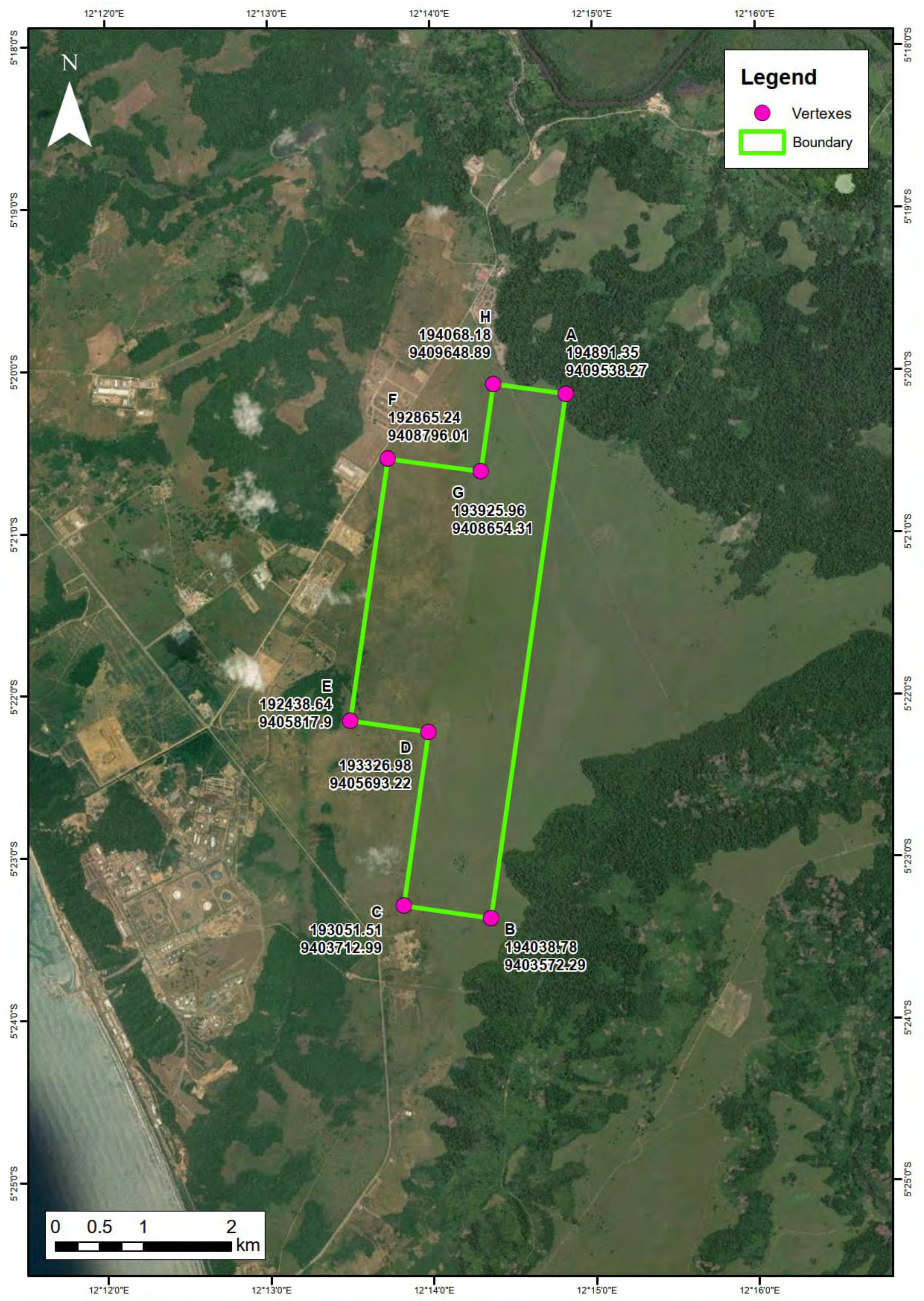


Figure 5: NAIC boundary.

Figure 6: NAIC location in relation to the existing Cabinda Airport.

The area around the Project is characterized by the presence of various economic activities. Relevant industrial settlements adjacent to the Project site are the Futila Industrial Development Complex, an area of 2,345 hectares containing several industries (still in the installation phase), including: detergent factories, wheat flour mills, factories of support materials for the oil and construction industry, ceramics, wood, asphalt, concrete, as well as an animal feed factory; the Malongo settlement, an industrial area with plenty of oil processing facilities, which also hosts a crude oil and LPG terminal, operated by Chevron Cabinda Gulf Oil Company (CABGOC); and the Cabinda refinery, situated around 1 km distant from NAIC. The location of these settlements, along with other infrastructure (such as telecommunication antennas and buildings) present in the surroundings of NAIC are shown in Figure 7 below.

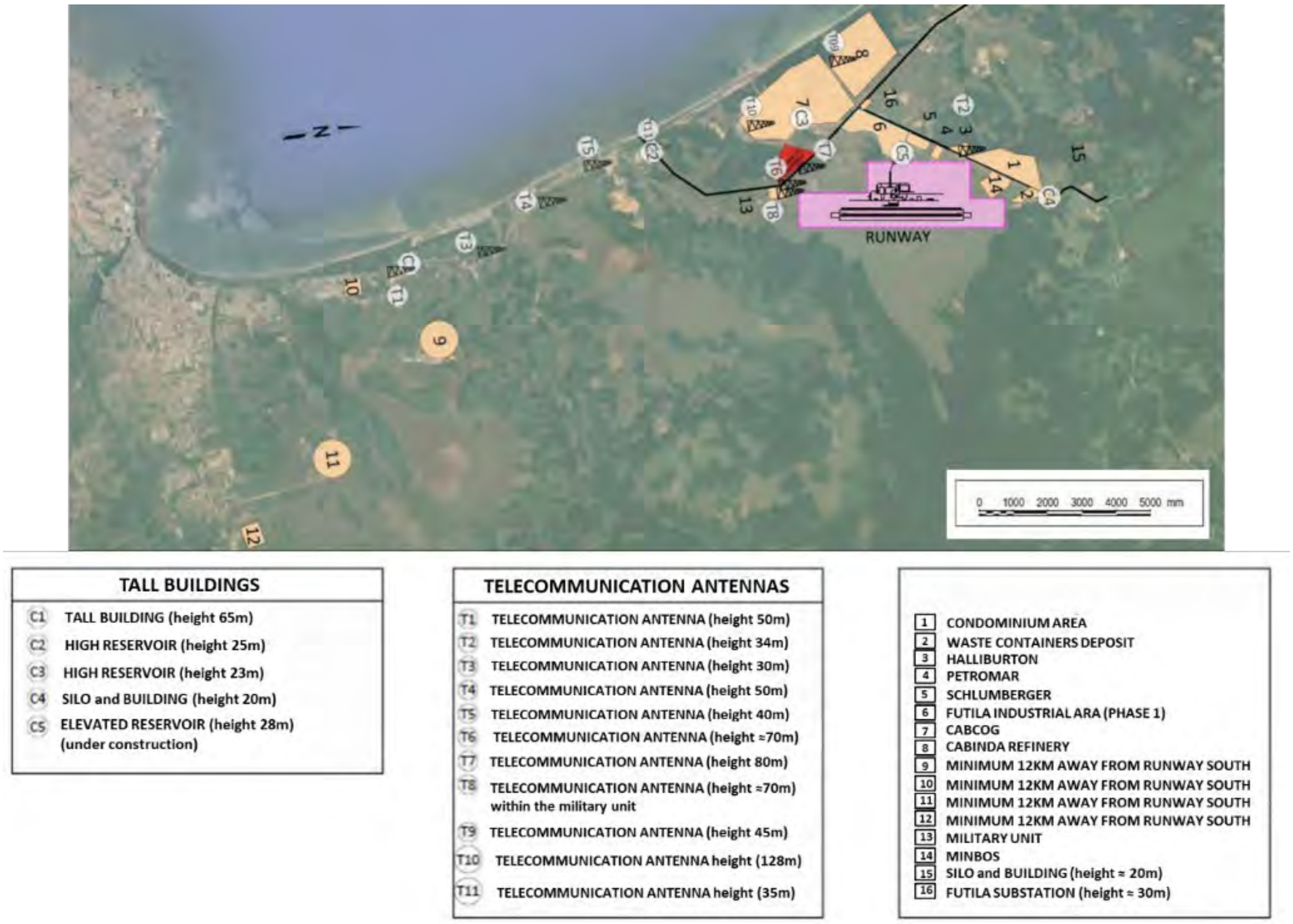


Figure 7: Surroundings of the site of the New International Airport of Cabinda.

A few meters away from the Project, southwest of the NAIC footprint, there is an unexplored area and suspected of containing land mines, as remnants of the recent civil war that took place in the country from 1975-2002. The land demining work in the Project footprint has already been completed as requested for all the lands in Angola prior to start any activities.

2.3 Airport infrastructure

The location of the main airport structures is shown in Figure 8 and described in the next sections.

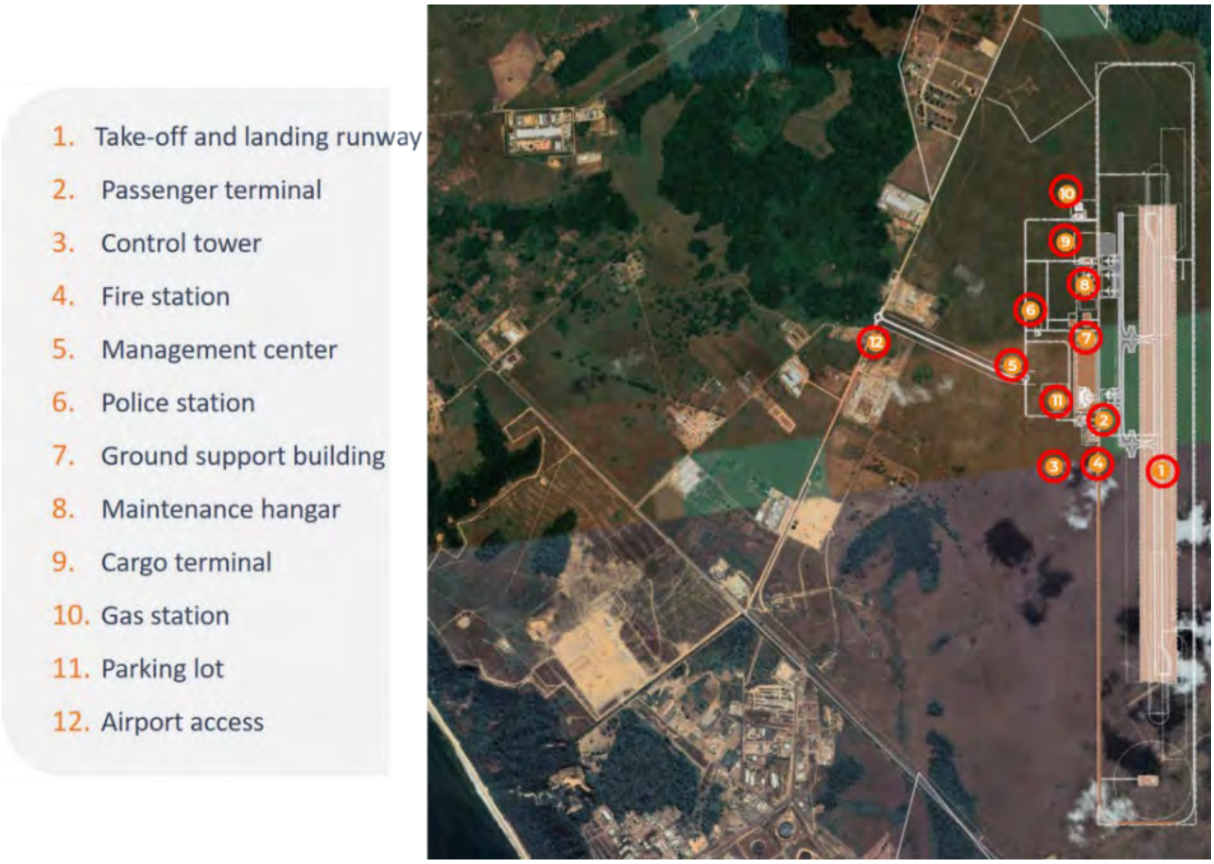


Figure 8: NAIC main structures.

Figure 9 below shows the general plan of the airport, with the location of these infrastructures in more detail within the footprint of the Project, along with some support structures that will be further described in the section 2.3.12.

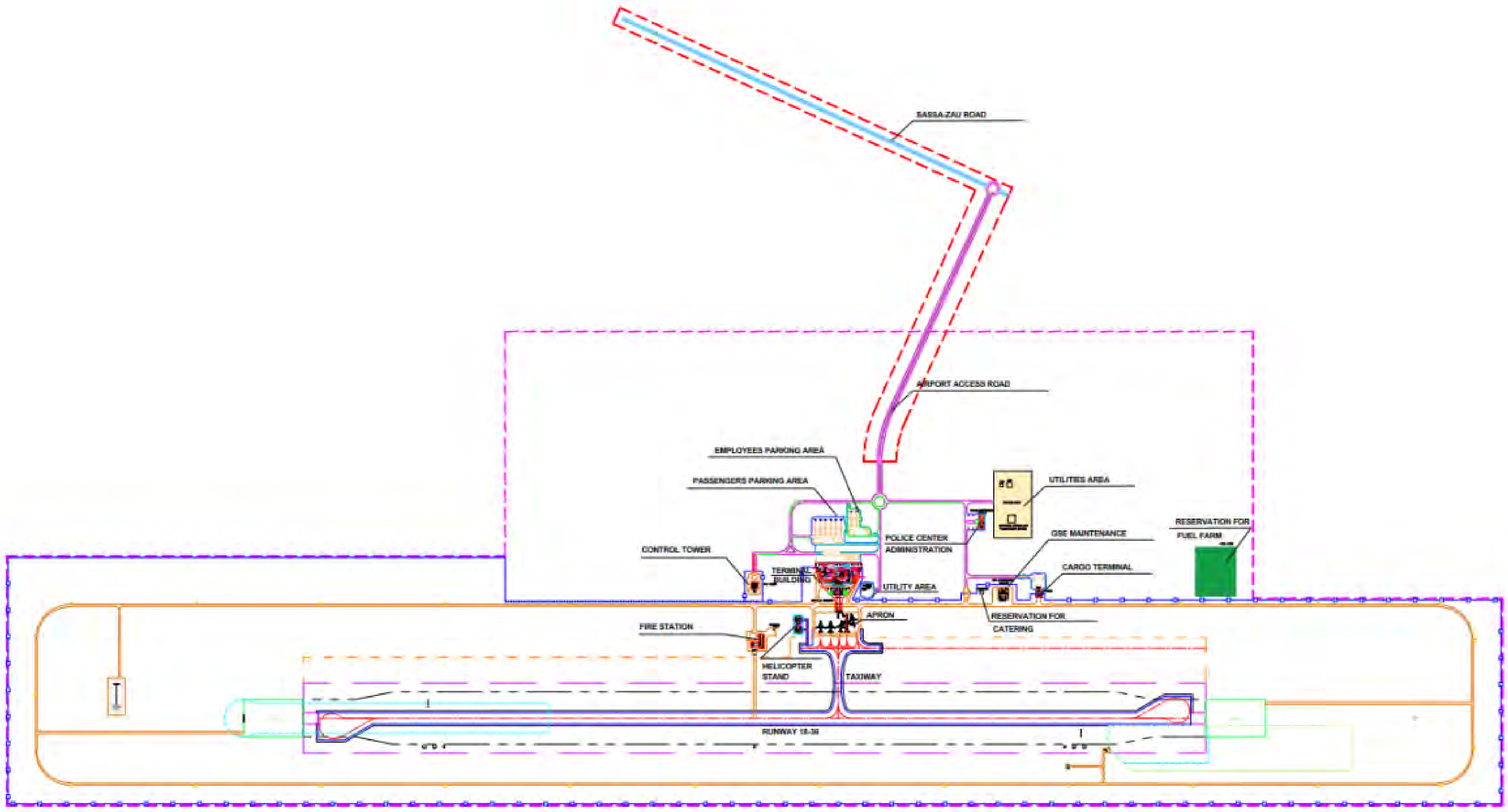
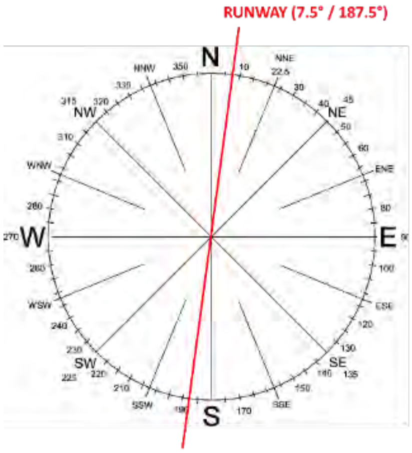


Figure 9: NAIC general plan.

2.3.1 Take-off and landing Runway

From the geographic North, the runway will be oriented at 7.5 degrees.



The runway orientation was determined based on a wind study that used historical wind data (wind speed and direction) from the last five years, obtained by the weather station at Cabinda Airport.

The runway length is estimated at 3,500 m.

Critical Aircraft

The NAIC critical aircraft is the Boeing 777, whose physical and operational characteristics (especially size and maximum take-off weight) are the most demanding for the use of the airport infrastructure.

NAIC will comply with ICAO Code 4E (runway over 1,800m; wingspan from 52 – 65m; wheel span from 8 – 14m). ICAO Aerodrome Reference Codes are available in ESIA Chapter 4 (Legal Requirements).

Airport Public Safety Zones (PSZs)

A preliminary study of land use compatibility performed in September 2022 made available the design of the NAIC's Public Safety Zones (PSZs)[1]. Runway lengths, aircraft types, and airport surroundings, such as topography and geographic features, affect the shape and dimensions of the safety zones.

The *California Airport Land Use Planning Handbook* was used to define the PSZs of NAIC. Of the six zones defined in the handbook, five (5) of them have been identified for NAIC (Figure 10). Their locations, shapes, sizes, compatibility qualities, and land use densities are largely based on incident data collected and analyzed in the handbook.

- **Zone 1 – Runway Protection Zone (RPZ)**: the most critical zone, characterized by a very high accident risk. It is located directly off each runway end. The most restrictive set of recommendations applies to this area.
- **Zone 2 – Inner Approach and Departure Zone**: a rectangular area that extends beyond the RPZ and encompasses areas overflown at low altitudes. This is a substantial risk area.
- **Zone 3 – Inner Turning Zone**: extends out at a wider angle from the RPZ. A triangular area over which aircraft are turning from the base to final approach legs of the standard traffic pattern. It also includes the

[1] Public safety zones (PSZs) are end of runway areas. Development within PSZs is restricted so as to control the number of people on the ground at risk of death or injury should an aircraft accident occur during take-off or landing. The implementation of PSZ policy at civil airports is based on the level of risk to people on the ground around airports. The extent of zone contours is based upon aircraft accident data. The areas of the PSZs essentially correspond to the concentration of accident location, based on relevant data (Control of development in airport public safety zones - GOV.UK (www.gov.uk)).

area where departing aircraft normally complete the transition from takeoff to climb mode and begin to turn on their en-route headings. Lower accident risk.

- **Zone 4 – Outer Approach and Departure Zone**: extends out from the runway centerline beyond the Inner Approach and Departure Zone. The risk in this area result from approaching aircraft flying at less than traffic pattern altitude. Lower accident risk.
- **Zone 5 – Sideline Zone**: encompasses a close-in area adjacent and parallel to the runway. These areas are generally not overflown. The primary risk in this area is with aircraft losing directional control on takeoff.

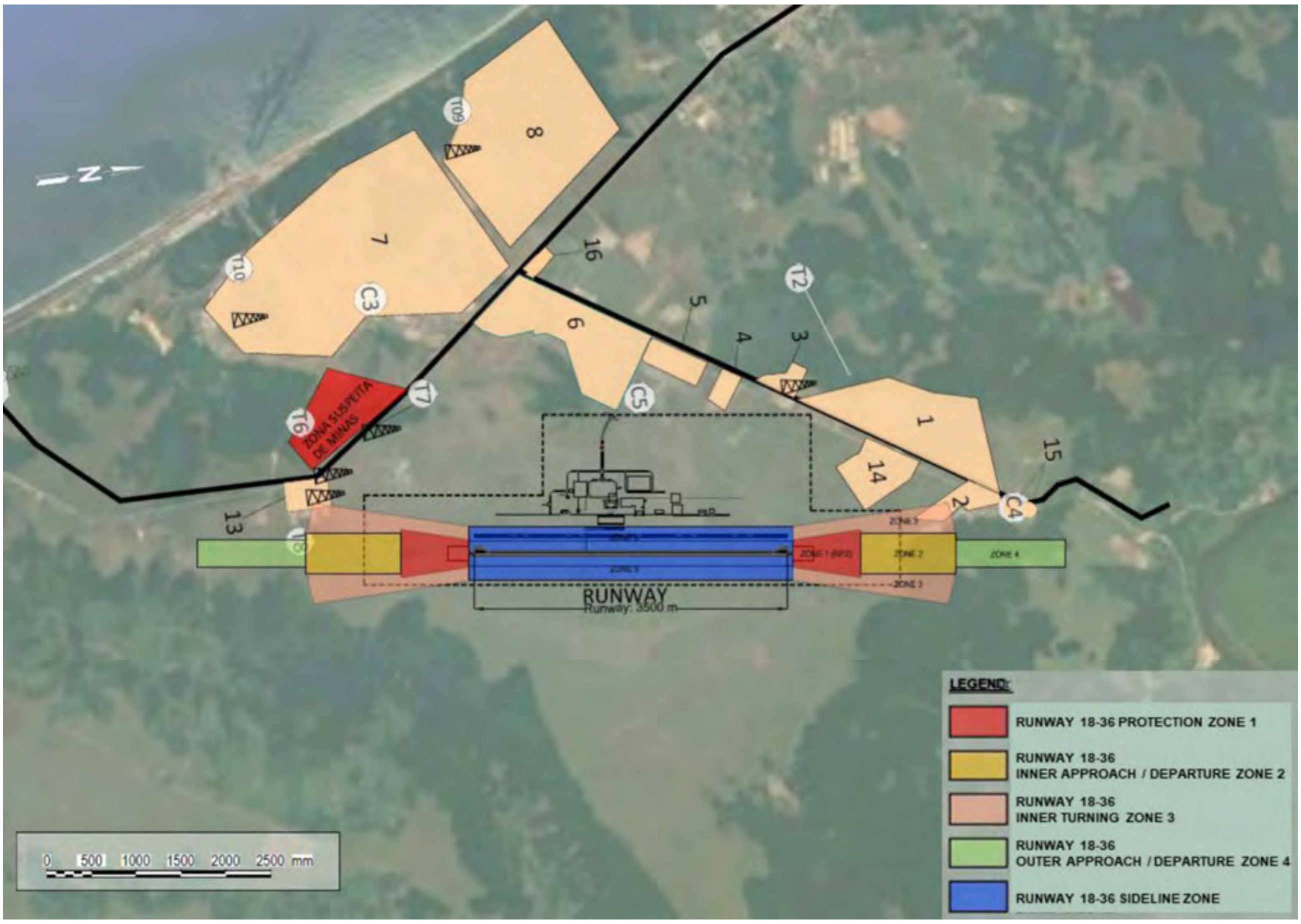


**Figure 10: NAIC's Public Safety Zones (PSZs). ***For the number's legend, please refer to Figure 7 above.

Radio-Navigation Guidance Equipment

- **VOR/DME System**

NAIC's radio-navigation system will be of type VOR/DME, which includes a combination of very high frequency (VHF) omnidirectional range (VOR) with a distance-measuring equipment (DME).

- **Instrument Landing System (ILS)**

The runway is planned to have a precision instrument approach equipped with an Instrument Landing System (ILS) CAT I.

ILS is a precision runway approach aid employing two radio beams to provide pilots with vertical and horizontal guidance during the landing approach. It has three categories: CAT I, CAT II and CAT III. The lower the need for visibility, the higher the ILS category. Each category previously defines its parameters so that the pilot receives assistance from the system during landing under restricted ceiling and visibility conditions (Table 1).

The ICAO document 8168, Vol. II (Aircraft Operations. Volume II (spilve.lv)) has all the requirements for an ILS operation.

Two parameters are essential for defining the ILS category:

- Decision Height (DH): defines the minimum altitude for the pilot to determine whether the runway environment is visible enough to continue with the final approach course and engage in normal landing;
- Runway Visual Range (RVR): the distance at which a pilot of an aircraft on the runway's centre line would see the runway surface markings or lights that delineate the runway or identify its centre line.

Table 1: Parameters of ILS categories.

Categories	Decision Height	RVR/Visibility
Category I	not lower than 60m (200 ft)	not less than 550m (visibility) and 800m (RVR)
Category II	lower than 60m (200 ft) but not lower than 30m (100 ft)	RVR not less than 300m
Category III – A	lower than 30m (100 ft) or no decision height	RVR not less than 175m
Category III – B	lower than 15m (50 ft) or no decision height	RVR less than 175 m but not less than 50m
Category III – C	no decision height limitations	no RVR limitations

Since NAIC has ILS CAT I (the most basic category, often used in normal operations), this means pilots can take the aircraft to 60 m without any outside visual reference beyond the 550 m of distance. The higher the category, the lower any aircraft can go since the runway provides more accurate guidance.

ILS CAT I operations rely on altimeter indications, vertical & lateral guidance, and waypoints to assist pilots in conducting an approach to land without visual reference to the ground.

Approach Lighting System (ALS)

An Approach Lighting System (ALS) must be implemented to provide visual guidance for circling, offset, and straight-line approaches. It consists of white lights, which may be one or more lighted bars, located at the end of the runway and extending out of it.

The ALS purpose is to make the runway as noticeable as possible, even in the lowest visibility situations, helping the pilot to identify and align the aircraft correctly with the runway centerline in a final approach. The ALS can have different configurations depending on the operational and environmental needs of the individual site and regional airport guidelines (Avlite, 2021).

The ALS in the NAIC will be located at one end of the runway only.

2.3.2 Domestic and International Passenger Terminal Building

The passenger terminal building will have a built-up area (BUA) of 13,140 m^2 and will be designed to accommodate domestic and international passengers. Domestic and international peaks are assumed to not occur at the same time (peak domestic: 268 passengers; peak international: 190 passengers).

The requested Level of Service (LoS) for this terminal is ´´Level C´´. According to IATA, ´´Level C´´ corresponds to a good level of service with conditions of stable flow, acceptable delays and good levels of comfort.

The terminal is planned to accommodate one aircraft stand ICAO letter code E (Boeing 777), two aircraft stands ICAO letter code C (Boeing 737) and two aircraft stands for Super Puma helicopter.

Two jet bridges (fingers) for passenger boarding (one for arrival and one for departure) will serve all types of aircraft in the Project first phase (Projects phases are more detailed in section 2.4 – Project Development).

A perspective view of the passenger terminal's exterior design is shown in Figure 11.

Figure 11: Perspective view of the passenger terminal's building.

The layout of the Terminal building has been primarily based on IATA recommendations. The interior areas have been developed keeping in mind the best functional and ergonomic standards. The terminal features a curved roof to provide a dynamic architectural form to the rectangular functional mass.

The Terminal building will accommodate domestic and international flights for Phase 1 of the Project. It is assumed that for Phase 2, the Passenger Terminal building will need to be constructed in a separate building to cater for the ultimate passenger capacity.

The Terminal building is distributed on 3 floors:

- Ground floor, which will accommodate on one side all the main processing areas for Departure flow (including check-in hall, security areas, passport control and remote lounge, as well as a transfer facility) and on another side the Arrival processing areas (including a remote arrival drop-off point with related passport control, passengers' amenities, baggage claim and customs check area). This is in addition to back of house (BOH) offices, baggage handling processing areas and technical MEP (mechanical, electrical and plumbing) rooms serving the Project. A dedicated protocol Area has been also incorporated for the processing of VVIPs for both departure and Arrival processes. The main technical areas are located at Apron level and Arrival levels and will be further developed in the Phase 2 of the Project;
- First floor, which will accommodate a link from the contact stand towards the baggage claim area at Ground floor, passing through the passport control area, as well as offices and breakroom for the staff;

- Second floor, which will accommodate boarding lounges for the contact gates with their related amenities as well as a First and Business class lounges.

2.3.3 Air Traffic Control (ATC) Tower

The Control Tower will have a BUA of 1,417 m^2.

The Control Tower is one of the main buildings in the Airport for supervision and management of all the aircraft movement. It consists of:

- A ground floor plan with the main administrative functions including ATC equipment rooms, approach control room, offices, break room, pantry, toilets, workshop, and MEP services;
- A mezzanine level plan, open to sky, which includes a mechanical room;
- A typical core area including the stairs and lift to access the control area;
- The Control Cabin at the top. This requires a clear and unobstructed view of all movement areas of the airport including the Aprons, Taxiways & Runways.

Acoustic materials with high sound absorbent coefficients are used as necessary in the construction of walls, floors and ceiling to reduce the noise level in the cabin and other operational areas.

The cabin glazing has been designed to provide a 360°unobstructed view and all the windows are glazed with anti-reflective frames.

A perspective view of the Control Tower exterior design and a section are shown in Figure 12.

Figure 12: Perspective view of the Control Tower building and section.

2.3.4 Fire Station

The Aircraft Rescue and Fire Fighting (ARFF) Building will have a BUA of 1,430 m^2. It comprises a watch tower with a total height of 23 m. A drill tower (14 m height) for fire fighters training will be provided at the training yard.

Due to the small size of the airport, and considering that the sole function of the Fire Station will be to protect the airport property only, the design of the fire station is based on the below:

- The airport category for rescue and firefighting is CAT 8[2], based on the NAIC critical aircraft (Boeing 777);
- Three vehicle bays with 3 firefighters for each vehicle;
- The Fire Station will only be staffed when the Airport is in operation. In order to optimize the building BUA, the staff will be limited to the Fire Chief and the staff who need to perform Fire Fighting services. A few dormitories have been accommodated to allow some of staff to rest while other will be in the day room or other staff amenities;
- 1 Ambulance operator.

The Fire station will include:

- A ground floor with ARFF Apparatus Bays, Fire station administration, Firefighters amenities including day room, dormitories, pantry and toilets facilities as well as all technical MEP areas and technical areas needed for the Fire station operation including medical room & storage, gear wash/drying room, hose drying facilities, hose store, work area, fire extinguisher room, complementary agent storage, foam storage & related pump room;
- An upper floor for the watch room;
- The firefighting tank will have a water volume of 500 m^3.

A perspective view of the Fire Station building exterior design is shown in Figure 13.

Figure 13: Perspective view of the Fire Station building.

[2] The level of protection to be provided at an airport should be based on the dimensions of the aeroplanes normally using the airport as adjusted for their frequency of operations. Aerodrome Rescue & Firefighting Services (ARFFS) – ICAO.

2.3.5 Police Station / Administration / Server Room Building

A building of 905 m^2 is provided for the Police Station, Administration and server Room Building. This building has been designed to accommodate 9 police agents, 2 admin officers and 14 admin employees. Also, the building includes MEP service rooms such as server room, uninterruptible power supply (UPS) room, electrical room, and other service rooms.

A perspective view of the Police Station building and the Administration building exterior design is shown in Figure 14.

Figure 14: Perspective view of the Police Station / Administration building.

2.3.6 Ground Support Equipment (GSE) Building

The GSE Building will have a BUA of 1,955 m^2. It comprises the maintenance works required for the GSE vehicles. This building includes mainly a maintenance bays area for the GSE Vehicles with related workshops (mechanical, electrical, tire repair) / storage / paint booth / battery charging area and a small support office area. Mechanical support areas are provided within this building.

The building is designed to accommodate 4 persons per shift (with a total 8 staff in total). A perspective view of the GSE building exterior design is shown in Figure 15.

Figure 15: Perspective view of the GSE building.

2.3.7 Aircraft Maintenance Hangar (future construction by third parties)

Major aircraft maintenance activities contained within hangars are usually carried out at major airports, often where airlines are based (Hub airports), and it is common for multiple alliance partner airlines to share maintenance facilities. A demand for major overhaul servicing activities (C & D checks) is not envisaged for NAIC. It is expected that maintenance activities will be limited to routine maintenance (A & B checks) where these types of checks can be done on the apron.

Nonetheless, space will be reserved for this facility in the airport layout plan. The facility can be outsourced to a third party where it may be designed and constructed by the prospective operator at the time when such demand is justified. A one-bay Code E maintenance hangar including the relevant workshops and offices would require an approximate BUA of around 9,183 m^2, whereas a Code C hangar would require an approximate BUA of around 4,500 m^2.

2.3.8 Cargo Terminal

The Cargo Terminal building will have a BUA of 513 m^2. This is a building where cargo is loaded and unloaded from Ground based transport to Air based transport & vice versa. The Cargo Terminal will be designed for domestic transport, where cargo can be consolidated and transferred to various locations.

The building will have the following functions:

- Cargo receipt / Loading Unloading docks;
- Cargo security screening areas;
- Unit Loading Device, weighing and handling;
- Staff amenities.

The cargo terminal is planned to accommodate 2 slots for Code E aircraft (1 slot in the initial phase and 1 additional slot in the final phase).

A perspective view of the Cargo Terminal building exterior design is shown in Figure 16

Figure 16: Perspective view of the Cargo Terminal building.

2.3.9 Gas Station (Fuel Farm)

The fuel farm may be executed at a later stage by a third party (not under the scope of work of the current contractor), however the site grading and preparation will be done as part of the NAIC first phase of development.

Therefore, a site with a safe location and sufficient in size with capabilities for future expansion will be reserved for the fuel storage tanks and support facilities (fuel farm).

The fuel farm will not be immediately operative because the provision of an underground fuel hydrant network at airports with low number of flights is not feasible due to their costly maintenance as compared to the perceived benefits.

However, in order to avoid abortive works such breakage of a number of concrete slabs on the apron to install the fuel line and hydrants and disruption of the aircraft stands in the future, the underground fuel network can be executed as part of the NAIC initial phase, but refuelling of aircraft would be by tankers until demand justifies operating the network.

The fuel farm will need, in addition to the storage tanks, loading/unloading facilities and administration building that contains offices, conference room, laboratory, etc. Based on the daily aircraft departures for a planning horizon of 10 years, and assuming a storage period of seven days, the required jet fuel storage volume is estimated to be equal to 1,000m^3. This translates into four storage tanks to cater for the anticipated demand.

2.3.10 Parking Lot

The parking lot will be divided in 2 areas: passenger parking area and employees parking area. Car parking area will be organised as per the following:

- Passenger parking: with a capacity of 250 cars, 7 buses, area approximatively of 15,035m^2;
- Employees parking: with a capacity of 85 cars, 9 buses, area approximatively of 6,980m^2.

2.3.11 Airport Access

Two road accesses and a roundabout will be built to reach the NAIC (Figure 17):

- Sassa Zau roundabout;

- Sassa Zau road;
- NAIC access road.

To reach the Airport, from the EN100 (EN220) road it will be necessary to enter the Sassa Zau access (to the right coming from Cabinda), go through the Sassa Zau roundabout and enter the access to the NAIC.

The Sassa Zau road is currently unpaved and it will be upgraded as part of the Project. It could reasonably be expected that increased volumes during the construction and operational period could impact the quality of the road surface. Furthermore, it has to be considered that the Project will lead to increased traffic both during construction (from trucks hauling filling materials) and operation phases.

Figure 17: Road access to the airport, starting from the main road EN100 (EN220).

2.3.12 Support Facilities and Components

In addition to the items listed below, a flight catering area of 570m^2 for onsite meal preparation will be also part of the Project.

2.3.12.1 Airport Apron

Table 2 presents a summary of the number of parking stands (gates) for each aircraft code over three planning horizons. ICAO Aerodrome Reference Codes are available in ESIA Chapter 4 (Legal Requirements). Based on the aviation codes, the apron design should consider minimizing the impact of the critical aircraft on the size of facilities.

Table 2: Number of parking stands in Airport Apron for each aircraft code over three planning horizons.

ICAO letter code	Number of parking stands		
	Horizon 1 (10 years)	Horizon 2 (20 years)	Horizon 3 (Ultimate)
Code C	2	2 + 1 spare	3 + 1 spare
Code E	1 Multi-Aircraft Ramp System (MARS)	1 + 1 spare	1 + 1 spare

Total	3	3 + 2 spare	4 + 2 spare

The aircraft stands will be configured considering taxi-in / pushback[3] operations assuming that ground handling at the Airport will have the capabilities. Otherwise, a taxi-in / taxi-out configuration maybe proposed for Horizon 1. In the case of taxi-in / pushback configuration, one MARS (1E/2C) contact stand is envisaged.

For Horizon 1, it is assumed that that annual cargo volume of 2,000 tons will be carried inside the belly of passenger planes. Therefore, no cargo apron will be envisaged for the first development phase.

A maintenance apron sized for Code E will be required in case an aircraft maintenance hangar is constructed.

2.3.12.2 Water Treatment Station

As part of the first phase development of the airport, a Water Treatment Plant will be provided. The plant will be sufficiently sized to cater for the anticipated demand for the Project first phase (130 m³/d). Ample space will be reserved in the airport layout plan to accommodate future expansion of this facility, for the flow of 300 m³/d at the ultimate phase. NAIC will be supplied of fresh water from two sources:

1) The Cabinda Water Supply Network, which is supplied by surface water intake pumping station from the Chiloango River.

2) A water well equipped with a motor pump which is already installed within NAIC site, in the Water technical area (the location of the well is shown in Figure 27, section 2.4.1.1.2.

The groundwater, prior using it onsite, depending on its turbidity and salinity levels, might require treatment. The treatment will be operated through the Water Treatment Plant above mentioned.

The *Centro de Analises de Poluicao e Controlo Ambiental (Departamentos de Analises Fisico-Quimicas e Biologicas)* conducted, in December 2023, the sampling and analysis of the groundwater. The analyses results have been reviewed for the local groundwater baseline characterization.

The data analysed include only Conductivity and Total Suspended Particles. No information is available on the groundwater Salinity/Total Dissolved Solids (TDS).

Should the well water be determined in the pre-construction activities to have low salinity (TDS<500 mg/l), and is considered fresh water, the following treatment process is proposed in the Project design:

- Raw water storage tank;
- Pre-chlorination dosing system with sodium hypochlorite (NaOCl) solution. Pre-chlorination is required in order to avoid bacteria growth on the filter media and for oxidation of any organic substances, iron or manganese present in the water. The NaOCl solution will be used at a concentration of 12-15% by weight and will be stored in vertical cylindrical plastic (HDPE or PP) tanks. Chlorine contact will take place inside the raw water storage tanks. Chlorine storage tank will have adequate capacity to allow for 14 days of storage. It must be noted that chlorine storage for more than 20 days should be avoided due to chlorine decay. Dosing will take place with adjustable flow diaphragm dosing pumps;
- Pressure sand/multimedia filters (MMF). Vertical cylindrical pressure multimedia filters will be used for removal of any suspended solids and turbidity from the raw water. The filters will be installed all complete with feeding pumps, backwash pumps and automatic valves and sensors for automated operation and

[3] A taxi-in runway incursion is one where an aircraft which has just landed subsequently enters any active runway en route to parking. Pushback is an airport procedure during which an aircraft is pushed backwards away from an airport gate by external power (specialised ground vehicle attached to or supporting the nose landing gear).

backwashing. Dirty backwash water will be collected in a dedicated water tank and disposed the nearest surface drainage channel or stormwater network manhole or channel;

- Filtered/backwash water collection tank. Filtered water will be collected inside a tank in order to store water for filter backwashing. The tank will have adequate capacity to store the water needed for one (1) backwash cycle;
- Post-chlorination dosing system with sodium hypochlorite (NaOCl) solution. Post-chlorination is required in order provide the residual chlorine required to preserve the bacteriological quality of water during storage and throughout the distribution network. The NaOCl solution will be used at a concentration of 12-15% by weight and will be stored in vertical cylindrical plastic (HDPE or PP) tanks. Chlorine contact will take place inside the treated water storage tank. Chlorine storage tank will have adequate capacity to allow for 14 days of storage. It must be noted that chlorine storage for more than 20 days should be avoided due to chlorine decay. Dosing will take place with diaphragm pumps;
- Treated water transfer tank providing 1 hours of storage;
- Treated water pumps.

It must be noted that in case the well water turbidity is high the following will be included in the process:

- If the turbidity of the raw water quality exceeds 10 NTU then coagulation with ferric chloride or aluminum sulphate shall be added to the process. The coagulant will be added directly upstream of the filters through an in-line mixer (direct in line coagulation);
- If the turbidity of the raw water exceeds 20 NTU then coagulation/flocculation/sedimentation will be added into the process upstream of the filters. In order to increase the efficiency of sedimentation and reduce the size of the sedimentation tank inclined tube settlers will be used;

In the case that the well water has high salinity (TDS>500 mg/l), and is considered brackish water, the following treatment process is proposed:

- Raw water storage tank;
- Pre-chlorination dosing system with sodium hypochlorite (NaOCl) solution. Pre-chlorination is required in order to avoid bacteria growth on the filter media and bio-fouling of membranes. The NaOCl solution will be used at a concentration of 12-15% by weight and will be stored in vertical cylindrical plastic (HDPE or PP) tanks. Chlorine contact will take place inside the raw water storage tanks. Chlorine storage tank will have adequate capacity to allow for 14 days of storage. It must be noted that chlorine storage for more than 20 days should be avoided due to chlorine decay. Dosing will take place with diaphragm pumps;
- Pressure sand/multimedia filters (MMF). Vertical cylindrical pressure multimedia filters will be used for removal of any suspended solids from the raw water. The filters will be installed all complete with feeding pumps, backwash pumps and automatic valves and sensors for automated operation and backwashing. Dirty backwash water will be collected in a dedicated water tank together with the brine from the Reverse Osmosis (RO) unit;
- Activated Carbon Filters. Vertical cylindrical filters will be used for de-chlorination and removal of any organic and colloidal mater from the raw water. The filters will be installed all complete with feeding pumps, backwash pumps and automatic valves and sensors for automated operation and backwashing;
- Carbon filters are required when high TOC and COD are detected in groundwater. Contractor shall do raw water sampling to confirm the use of carbon filters;

- Filtered/backwash water collection tank. Filtered water will be collected inside a tank in order to store water for filter backwashing. The tank will have adequate capacity to store the water needed for one (1) backwash cycle;
- Anti-scalant dosing system. This is required in order to control membrane fouling;
- RO skids. The skids will include high pressure (HP) pumps, cartridge filter (5 microns), two-stage brackish water membranes and membrane vessels. Two stage RO system is preferred in order to improve water recovery and reduce water loss. The RO skids will be complete with stainless steel (SS) frame and piping, automation and controls, et;
- Clean-in place (CIP) skid including acid/base solution tank, pumps and cartridge filter (5 microns);
- Post-chlorination dosing system with sodium hypochlorite (NaOCl) solution. Post-chlorination is required in order provide the residual chlorine required to preserve the bacteriological quality of water during storage and throughout the distribution network. The NaOCl solution will be used at a concentration of 12-15% by weight and will be stored in vertical cylindrical plastic (HDPE or PP) tanks. Chlorine contact will take place inside the treated water storage tank. Chlorine storage tank will have adequate capacity to allow for 14 days of storage. It must be noted that chlorine storage for more than 20 days should be avoided due to chlorine decay. Dosing will take place with diaphragm pumps;
- pH adjustment dosing with caustic soda (NaOH) solution. During the RO process the pH is expected to drop, so a base solution is added in order to adjust the pH;
- Re-mineralization filter or mineral solution dosing, if required. Alternatively, the option of blending can be considered;
- Treated water transfer tank providing 1 hour of storage;
- Backwash and brine collection tank and pumping station. The tank will be capable of providing storage for at least 1 backwash cycle and 10 minutes of brine discharge. Such water will be disposed of by pumping to the external Wastewater network if dilution allows so. Other possible ways of wastewater disposal is by evaporation ponds or by deep well injection into the aquifer;
- If the turbidity of the raw water quality exceeds 10 NTU then coagulation with ferric chloride or aluminum sulphate shall be added to the process;
- Following is a description of pre-treatment configurations that may be used for the treatment of the water turbidity (as per water quality tests):
  - When TDS is lower than 1,000 mg/l and water turbidity is low (<10NTU) water micro-filtration followed by chlorination are enough,
  - When TDS is lower than 1,000 mg/l and water turbidity is moderate (10 to 20 NTU) direct in-line coagulation/ Filtration / Chlorination process is used,
  - When TDS is lower than 1,000 mg/l and water has very high turbidity (>20NTU), then Rapid mixing coagulation/ flocculation / sedimentation / filtration / chlorination process is used,
  - In this case sludge treatment should take place,
  - The presence of some substances in raw water will require additional treatment such as the need for oxidation when high level of iron and manganese is detected,
  - Some circumstances require pH adjustment. This is to be decided case by case.

According to the baseline data collected, both the surface water sampled from the Chiolango River and the groundwater intake from the water well present contamination (for further detail see Chapter 6 – Baseline Conditions Physical Environment). The Water Treatment Plant dimensioning and operation will take into account the surface water and groundwater chemical-physical characteristics (i.e., the physical values and the pollutants measured).

2.3.12.3 Drainage System

The stormwater network will be constituted of a collection network in the form of slot drains, pipes and channels along with cross drainage structures like culverts. The system will be divided into two parts; drainage of air side and drainage of land side.

In the air side, the stormwater network will be mainly constituted of open channels in order to collect the rainwater from the apron and drain into the larger storm collector. In the land side part, a normal and conventional system with gullies, pipe and grated channels will be adopted.

Collection network from airside and landside shall convey the stormwater to main storm collectors which shall discharge the flows into at least four natural streams (as it can be observed in Figure 18 below) located around the Project area. Part of the stormwater is also planned to be discharged into natural flood attenuation ponds. These ponds will consist of natural depressions which will be provided with outlet pipes to drain the collected stormwater (i.e., aimed at emptying them) within 2 days after the storm.

The ponds will be provided with physical barriers such as bird balls, wire grids, floating covers, vegetation barriers (i.e., bottom liners) or netting to prevent access to animals and birds, in line with the guidelines of the FAA Advisory Circular No. 150/5200-33C on “Hazardous Wildlife Attractants on or near Airports”.

The system will ensure that no water accumulation will take place for more than 48 hours within the airport limits or the nearby vicinity. Therefore, any proposed flood attenuation ponds shall be drained off within 48 hours. This is in conformity to the FAA regulations of not allowing water ponding near the airport to prevent attracting birds to the airport which can create a hazard to incoming or outgoing flights. The storm water drainage design will be limited to site boundary. However, necessary offsite works for protections of natural streams shall be taken as preventive measures.

Contaminated stormwater will be collected through oil interceptors. The clean stormwater will be then discharged into external stormwater channels.

Proposed drainage system for airport is provided in Figure 18 and Figure 19.

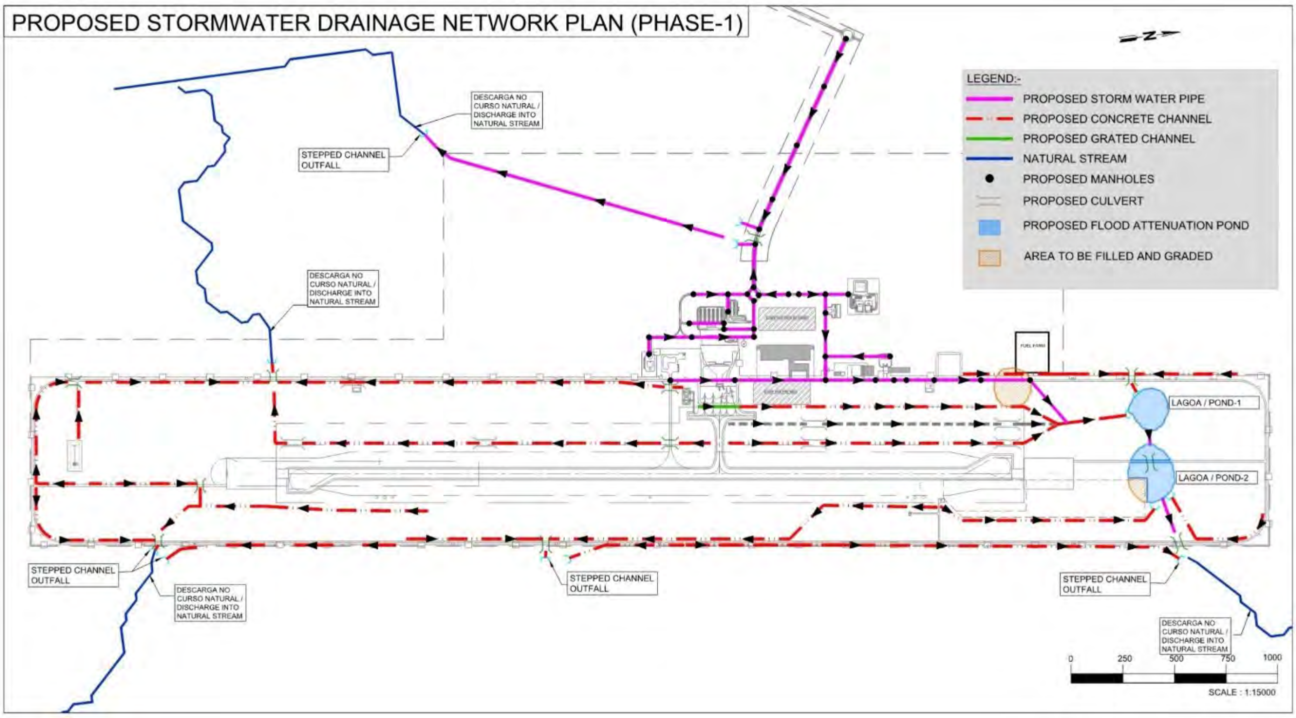


Figure 18: Proposed stormwater system (Phase-1) at NAIC

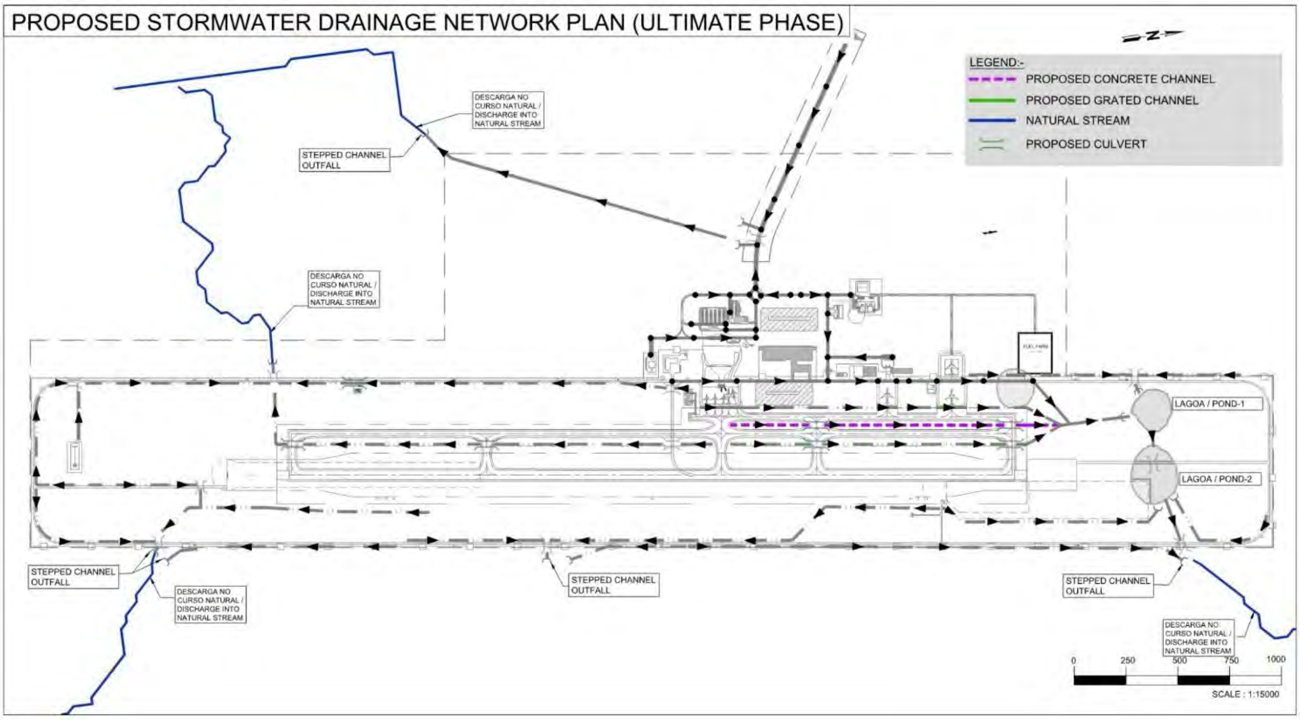


Figure 19: Proposed stormwater system (Ultimate Phase) at NAIC

2.3.12.4 Wastewater Treatment Plant (WWTP)

The design of wastewater system consists of treating wastewater to be used for irrigation. In order to avoid any nuisances from odors or attraction of birds the WWTP will be installed inside a closed building equipped with an odor control unit (OCU). The building will be of the industrial type with steel frame and external panels for easy and quick construction.

The plant will be designed for the ultimate phase (180 m^3/d) and civil works will be constructed for the ultimate phase and equipment will be installed to serve the first phase of the project with all necessary connection for future expansion.

The design of WWTP will consider municipal wastewater characteristics in nature. Any wastewater from airplane hangars or other maintenance facilities which may contain high amounts of oil or heavy metals should be pre-treated at source before discharging in the Wastewater network.

In absence of any wastewater characteristics samples and tests, the Consultant will consider typical municipal wastewater characteristics applicable for the project area.

The characteristic of the collected wastewater is a significant factor in the selection of the treatment technologies to be implemented in the treatment plant. The collected wastewater can be considered to be predominantly domestic in nature with a quality similar to the quality of medium to high strength wastewater (see Metcalf & Eddy: Wastewater Engineering, treatment and Reuse, 4th Edition, McGraw-Hill, Table 3-15 page 186), as given below:

- Total Suspended Solids, TSS :300 mg/l
- Biochemical Oxygen Demand, BOD_5 :300 mg/l
- pH :6-9
- Total Coliform Bacteria, TC :10^9 CFU/100ml
- Fecal Coliform Bacteria, FC :10^7 CFU/100ml
- Total Kheldah Nitrogen, TKN :50 mg/l
- Ammonia Nitrogen, NH_4-N :40 mg/l
- Total Phosphorous :15 mg/l

In the following paragraph, activated sludge treatment plant will be presented with the corresponding treatment phases and components.

According to the size of the plant it is preferable to use prefabricated packaged units in order to reduce construction time. As an alternative, concrete cast-in situ tanks or coated steel tanks welded on site can be used.

Wastewater will be conveyed by gravity from external network to inlet of the WWTP. The received flow will go through coarse screening upstream of the lifting pumps. Wastewater from the inlet pump station will be conveyed to the balancing tank (first compartment of the package unit) and then lifted by airlift pumps to the aeration tank. Clarified effluent from the secondary sedimentation tanks will be Tertiary treated by pressure multimedia filters (MMF) and disinfected by sodium hypochlorite (NaOCl) solution prior to reuse in irrigation. Sludge will be stored and aerated prior to disposal by tanker truck on a weekly basis to licenced and approved landfill.

The plant will be designed as two (2) treatment trains, each with a design capacity of 90 m^3/day on average, for the ultimate phase. One (1) train will be installed for Phase 1 and an additional train will be added for the Ultimate Phase.

2.3.12.5 Solid Waste Collection Area

Source-separated solid waste quantities from the terminal and cabin waste from aircrafts would primarily be staged at interim waste room(s) and close to stands at apron level, respectively before being dispatched to a central storage area and thereafter to offsite waste handling facilities. The central storage area is estimated to require:

- Phase 1:
  - Organics: 2 No. of 4-wheeled containers (each with a 2.5 m^3 capacity),
  - Mixed Dry Recyclables: 1 No. of hook-lift container (20 m^3 capacity),
  - Residuals: 2 No. of 4-wheeled containers (each with a 2.5 m^3 capacity);
- Phase 2:
  - Organics: 2 No. of 4-wheeled containers (each with a 4.5 m^3 capacity),
  - Mixed Dry Recyclables: 2 No. of hook-lift container (20 m^3 capacity),
  - Residuals: 3 No. of 4-wheeled containers (each with a 4.5 m^3 capacity).

The storage area is proposed to include the following provisions:

- Chemical resistant, non-slippery, washable walls and floor;
- Water supply for cleaning and bin-washing purposes (Hose reel/ hose bib for wash-down);
- Floor Drainage to adequate connections to wastewater network (Drain trench/ with water primer);
- Firefighting measures;
- Electrical supplies for necessary lighting;
- Proper ventilation (AC, exhaust, fresh air) and adequate weather conditions (maintain the room temperature between 18-24°C);
- Grease interceptor (as per client`s preference);
- Signage.

To facilitate collection process, the central storage area is proposed to be located at the boundary of landside and airside, with provision for entrance and exit from/to both sides in the ultimate phase. However, during Phase 1, the facility will be fully located in the airside in order to consolidate security screening of everything entering or leaving the airside including solid waste in one place. This facility is located near the maintenance area.

The majority of solid waste will comprise Municipal Solid Waste (MSW) materials from terminal and office-based locations, with lesser quantities of in-flight cabin waste from arriving aircrafts, and bulky waste similar in nature to industrial type from support facilities.

The used oil generated during the GSE maintenance and control activities will be collected in barrels inside the GSE maintenance bay, and then shipped to recycling facilities.

The broad solid waste management strategy covers operational waste. Main contractor will comply with his Construction Environmental Management Plan (CEMP), in accordance with applicable local standards and international GIIP.

2.3.12.6 Perimeter Patrol Path

The patrol path and the security fence will be aligned in order to reduce its length and, consequently, the total area of the airport, also reducing the amounts of earthworks, leaving only space and provisions for future needs for expansion of the runways.

2.3.12.7 Electrical Substation

As part of the first phase development of the airport, the electrical switch & transformer station will be provided. The station will be sufficiently sized to cater for the anticipated demand for the Project first phase. Ample space will be reserved in the airport layout plan to accommodate future expansion of this facility.

2.3.12.8 Heating, Ventilation and Air Conditioning systems

The gas which will be used as refrigerant for air handling units, direct expansion air conditioning units and variable refrigerant flow (systems will be the R-410A which is a type of Hydrochlorofluorocarbon having no ozone depleting potential).

The Heating, Ventilation and Air Conditioning (HVAC) equipment will be installed to meet the *American Society of Heating, Refrigerating and Air-Conditioning Engineers* standards and guidelines.

Noise and vibrations generated will be kept under control. Sound barriers and attenuators and vibration isolators will be provided when necessary.

2.3.12.9 Lighting

Airfield ground lighting system for the runways and taxiways areas are as follows;

<u>Runway centreline lights</u> shall be located along the full length of the runway and at a longitudinal spacing of not more than 15m runway central line lights are proposed for Cat 1 runways when the width of the runways is greater than 50m and for aeroplanes with high take-off speeds.

Bidirectional inset centreline lights shall be installed along the runway centreline, showing:

- White from threshold up to the 900m point from runway end, then;
- Alternate red and white from 900m point to 300m point before the runway end, afterwards;
- Only red up to the runway end.

<u>Runway edge lights</u> shall be placed along the full length of the runway and shall be in two parallel rows equidistant from the Centreline at longitudinal spacing of not more than 60m.

Bidirectional inset runway edge lights shall be installed in two parallel rows located on both shoulders along the full length of the runway, showing:

- White from threshold up to the 600m point from runway end, and then;
- Showing yellow up to the runway end.

<u>Threshold lighting & Runway end lights:</u>

- Uni-directional inset threshold lights shall be installed across the runway thresholds, showing green. The threshold lights shall either be combined with Runway End lights in a combined runway threshold/End fixture or housed solely in a runway threshold fixture.
- The threshold lights shall be equally spaced between the rows of runway edge lights with a uniform spacing not exceeding 3m for Category 1 as per ICAO Annex 14 Vol I clause 5.3.10.4.b and six lights evenly spaced for non-instrumental runways as per ICAO Annex 14 Vol I clause 5.3.10.4.a.
- Uni-directional elevated threshold wing bar lights shall be installed in-line with the threshold lights, showing green in the runway approach direction for Category 1.
- Threshold wing bar lights shall be installed in two groups of 5 lights at each threshold side, forming two wing bars for the threshold for category 1.

- Runway end lights shall be installed in at the runway end with inner spacing not exceeding 6m;
- Unidirectional inset runway end lights shall be installed across the end of the runway showing red;
- Runway end lights shall be combined with the runway threshold lights.

Taxiway, Apron & Turnpad edge lights:

- Omnidirectional Elevated taxiway/apron/turn pad edge lights, showing blue, shall be installed outside the edge of the taxiways, turn pad edges etc. intended for used at night on a taxiway not provided with Taxiway centre line lights.
- Taxiway edge lights shall be installed at the curved sections of the taxiway edges as well as on a straight section of the taxiway an on a runway forming part of the standard taxi route shall be spaced at a uniform interval of not more than 60m.

Street lighting is provided for the roads ensuring access to the airport premises: NAIC access road, Sassa Zau road and roundabout. LED street lighting luminaires have been selected for their low energy consumptions, long life and high efficacy compared to conventional street lighting fixtures. Power supply is ensured from the airport facilities.

2.3.12.10 Obstacle Limitation Surfaces (OLS)

In September 2022, a **preliminary study of land use compatibility** was performed by Dar Angola, in which an OLS assessment for the Project area was made from theoretical data collection through Google Earth imagery and SRTM digital terrain model. In addition, a reconnaissance visit was made to the site to visually detect existing facilities in the vicinity of the NAIC. The purpose of the OLS assessment is to protect NAIC airspace from potential penetrations that may result from existing and proposed/planned/future developments in close proximity to the Airport. This assessment determined the site boundaries and their corresponding land elevations and geographical coordinates, in addition to obtaining the positions and heights of the existing facilities adjacent to the site that fit within OLSs.

The OLS consists of approach and take-off surfaces, transition and conical surfaces, and internal and external horizontal surfaces that protect the airspace for circulating aircraft (Figure 20).

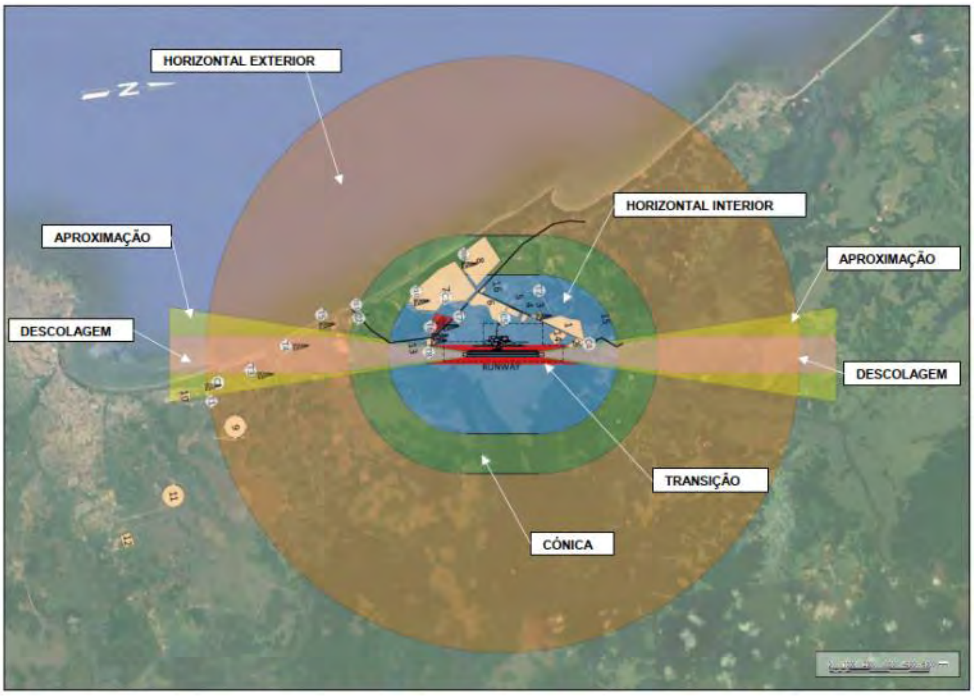


Figure 20: NAIC Obstacle Limitation Surfaces.

The assessment indicated several objects, including two installations, namely CABCOG (Cabinda Gulf Oil Company Limited) and the Military Unit, and four telecommunications antennas (T6, T7, T8, and T10) considered as obstacles because they intersect the OLS surfaces (see Figure 7 in section 2.2 for their locations).

2.4 Project Development

2.4.1 Construction Phase

The Contractor (OEC) shall carry out the construction, supply, installation of equipment and equipping of the New International Airport of Cabinda.

Construction activities are planned to take place within 48 months, divided into 5 main stages (Figure 21):

- A – Activities performed on the runway side;
- B – Activities performed on the ground side;
- C – Building activities;
- D – Systems and equipment implementation; and
- E – NAIC access works.

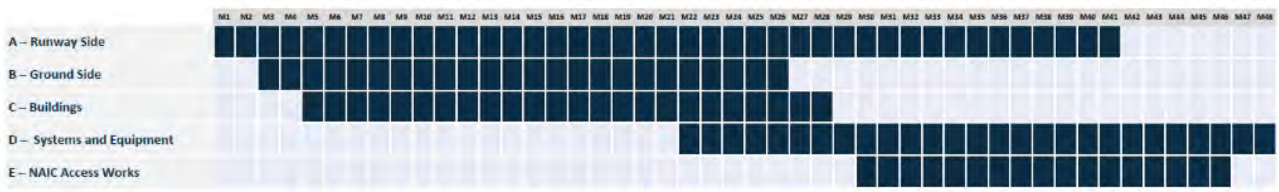


Figure 21: Construction Work Schedule.

The construction activities to be carried out in the 5 stages are described in the next section.

2.4.1.1 Construction Activities

A list with the construction activities is provided in Table 3.

Table 3: Summary of Key Project Activities during Construction Phase.

Construction Activity	Brief Description
A – Runway Side	
Earthworks	• Vegetation clearing and felling of shrubs/trees • Stripping of land • Excavation with mechanical means • Landfill
Installation of aeronautical pavements	• Strip (1st section) • Clearway • Bituminous pavements of the runway, circulation paths, berms and slabs: - Sub-base layer with local soils - Base layer - Bituminous macadam smoothing layer - Bituminous macadam binder layer - Bituminous concrete surface layer

Construction Activity	Brief Description
	- Concrete slab floors and stopping areas - Base of stabilized soils with cement
Drainage activities	• Concrete hydraulic passages/collectors • Hydraulic passage Simple Box of 4.0m x 2.0m • Channels, ditches and gutters • Ditches for rectification or diversion of water lines
Signalling implementation	• Horizontal signalling: painting with acrylic paint for airports • Night signalling • Navigation aids (NAVAIDs) • Lighting control and monitoring systems
Production and supply of electrical energy	• Building equipment • Wiring • Piping • Manholes
B – Ground Side	
Construction of access roads	• Earthmoving • Paving • Signalling and security • Rainwater drainage • Fences, round paths and access control • Public lighting, CCTV and park system
Installation of electrical infrastructure	• Medium voltage (MV) and Low voltage (LV) distribution systems • Communication network
Installation of hydraulic infrastructure	• Water supply system • Domestic wastewater network
Landscaping	• Floors • Walls • Plantations
Installation of urban furniture	
C – Buildings	
Buildings' construction (Earthworks + Architectural and structural activities)	• Terminal building • Control Tower building • Administration building • Police installations • Fire Station building
Technical buildings construction (Earthworks + Architectural and structural activities)	• Cargo Terminal Building • Hangar Maintenance Building • Farm Fuel • GSE support building • Building for the Solid Waste Treatment Area • Switching and transformer stations buildings
D – Systems and equipment	

Construction Activity	Brief Description
Systems and equipment implementation	• Terminal systems • Infrastructure systems • Security systems • CCTV systems • Access and control systems • Communication systems • Navigation systems • Control tower systems
E – NAIC access works	
Access Works	• Pipeline for water supply • Public lighting network • Sassa Zau roundabout - NAIC access • Sassa Zau road • NAIC access road • Signaling and security • Drainage system
Others	
Road and parking lot construction activities	
Logistical support for demining the area destined for the construction of the NAIC.	Mine clearance has already been performed.

The management of water supply, solid waste, wastewater, stormwater, electricity, materials, workforce, and traffic are also understood as Project construction activities and are described below:

2.4.1.1.1 OEC Construction Camp

At the time of this ESIA submission, the Contractor is already developing its own construction camp within the Project footprint. The location of the camp is shown in Figure 22.

The construction camp will have the following characteristics:

- Total number of rooms – 94;
- Total number of bathrooms – 80;
- Total number of kitchens – 1x general kitchen;
- Accommodation Capacity – the accommodation is designed to accommodate 154 people;
- Septic Tanks – Septic tanks are planned to be installed on the industrial site (areas far from the planned WWTP). These Septic Tanks will be regularly maintained and managed by a local company, licensed by the Ministry of the Environment to collect, treat and dispose of liquid sewage waste;
- Underground Conduits – Various Electrical Ducts, Water Supply Pipes, Sewer Pipes, and Stormwater Drainage Pipes;
- Storage Deposits – 1x Covered Warehouse, 1x Uncovered Warehouse, Aggregate Silos.

The layout of the construction camp is shown in Figure 23.

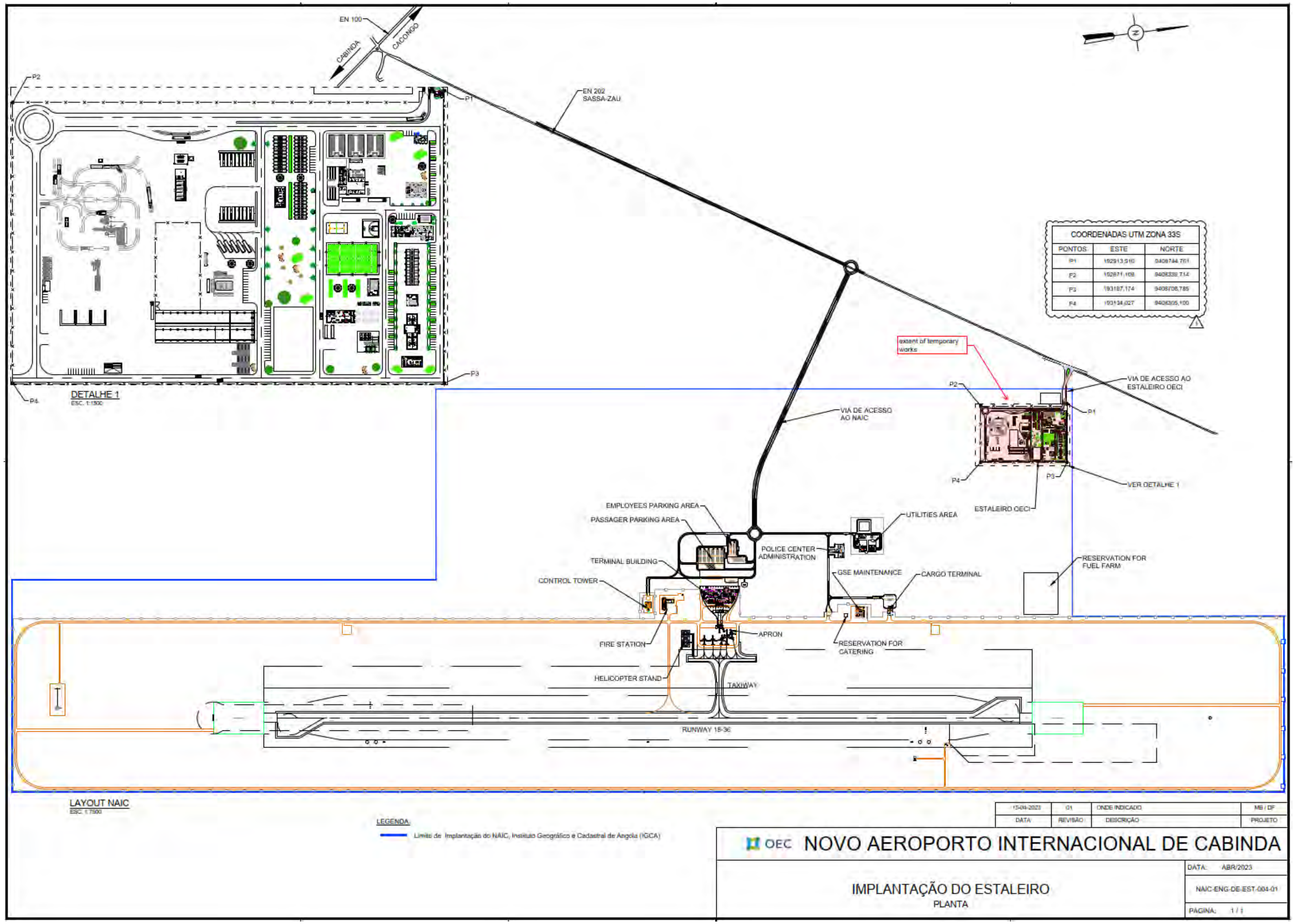


Figure 22: Construction Camp location within the NAIC footprint.

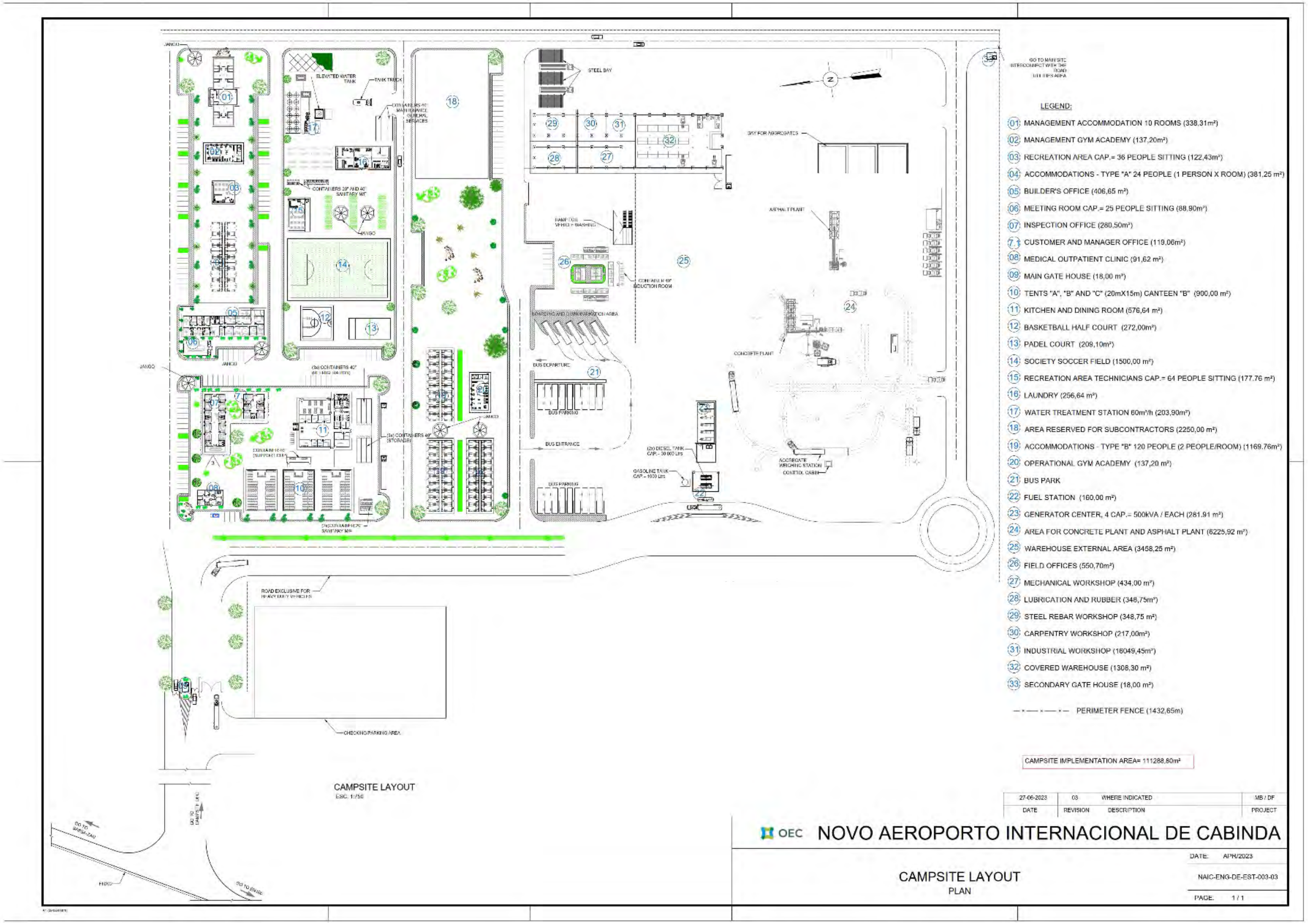


Figure 23: Construction Camp Layout.

Currently, a total of 155 workers are employed for the construction camp activities. 80% of them come from Cabinda Province, 14% from other parts of Angola, and 6% are expatriates.

Since the accommodation camp is still being set up (as per mid-September 2023), the workers that come from other parts of Angola and expatriates are currently accommodated in a commercial hostel situated near the construction camp, named ESS Village Hostel.

As mentioned, the accommodation camp will have the capacity to accommodate 154 workers. In punctual cases, when necessary, the Contractor will use the services of the ESS Village Hostel or other commercial hotels in the City of Cabinda.

The following pictures show aerial photos of the current mobilization area of the construction camp (September 2023).

Figure 24: Aerial Photo of the Construction Camp - mobilization area. (OEC photo)

Figure 25: Aerial Photo of the Construction Camp. Mobilization area - raft slab. Water Supply Management (OEC photo)

2.4.1.1.2 Water Supply Management

The total amount of water used during the 48 months of construction phase is estimated to be 129,334 m^3 of which about 2,208 m^3 per month will be sourced for the construction works and about 23,350 m^3 for specific earthworks and for the concrete preparation.

Airports are facilities having large water consumption. Two sources for obtaining water are foreseen:

1) Through a water well (equipped with submersible pump to extract the water from the underground reservoir) located inside the administrative yard, in the Water technical area. A map with the location of the well within the construction site layout shown in Figure 27;

2) Through the Cabinda Water Supply Network, whose pipes pass through the Sassa-Zau road (Figure 28).

The surface water abstractions may put water systems under pressure through flow regime modification and morphological alterations. Impacts of this nature are currently considered to be low, since the Province of Cabinda is considered to have very low water scarcity risk at the present scenario. However, in the long term, the risk of water scarcity may increase so a backup is needed. The well will serve as backup. According to the hydrogeological study conducted on site while drilling the well's borehole, the maximum water flow limit advisable - in order to avoid the aquifer damage - is of 14 m3/h.

The water from these sources will be sent to a raw water tank. This tank will later send the water to a Water Treatment Station, which will guarantee its treatment within the limits specified by Angolan law.

The treated water will be stored in Surface Tanks, and then it will be pumped through a pressurization system and a buried network of HDPE pipes, to their destinations.

A total of 12 surface PVC tanks are planned, interconnected with one elevated tank with a total capacity of 195,000 liters (15,000 liters each) (Figure 26). These tanks will be used to store Raw Water, Treated Water and Reuse Water.

Figure 26: Type of 15 000 L tank to be installed.

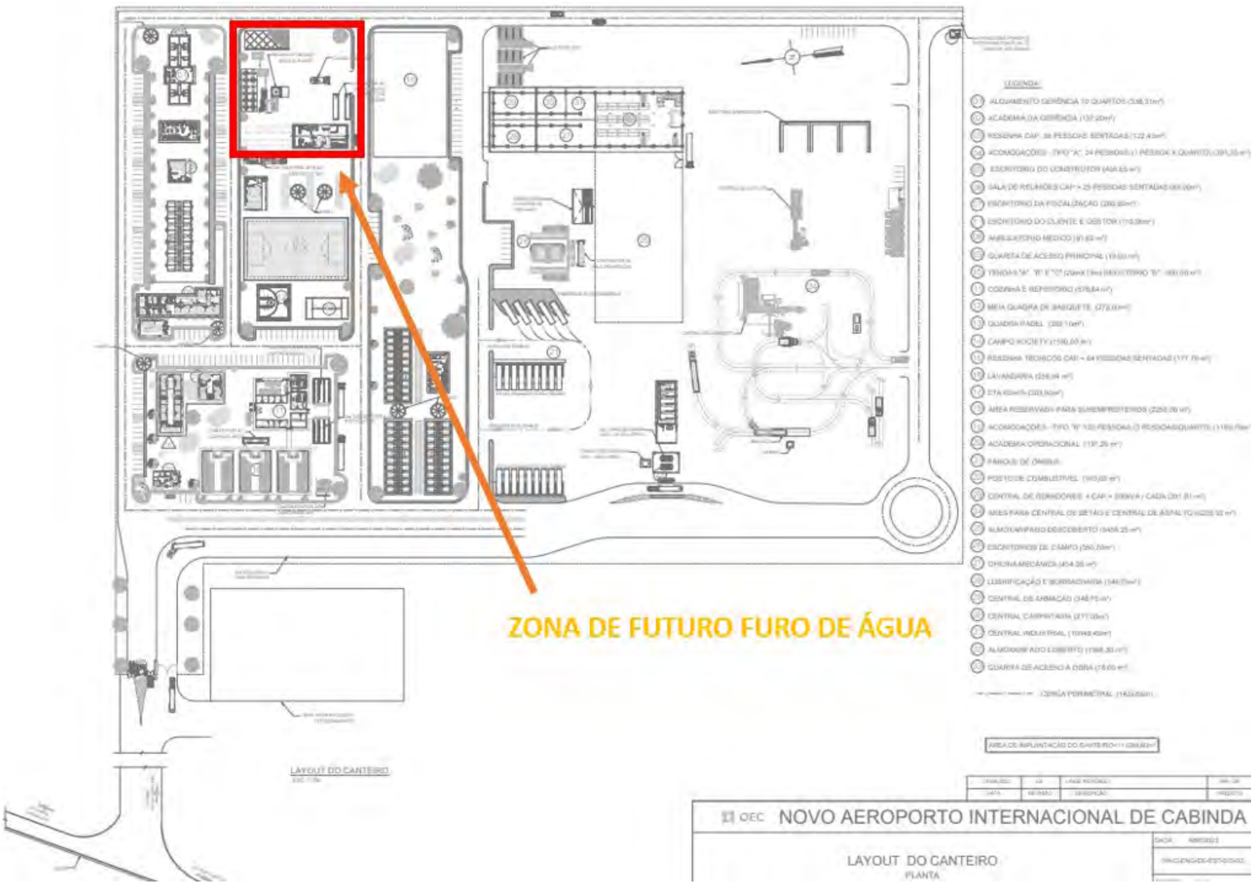


Figure 27: Location of the water well within the NAIC construction site layout.

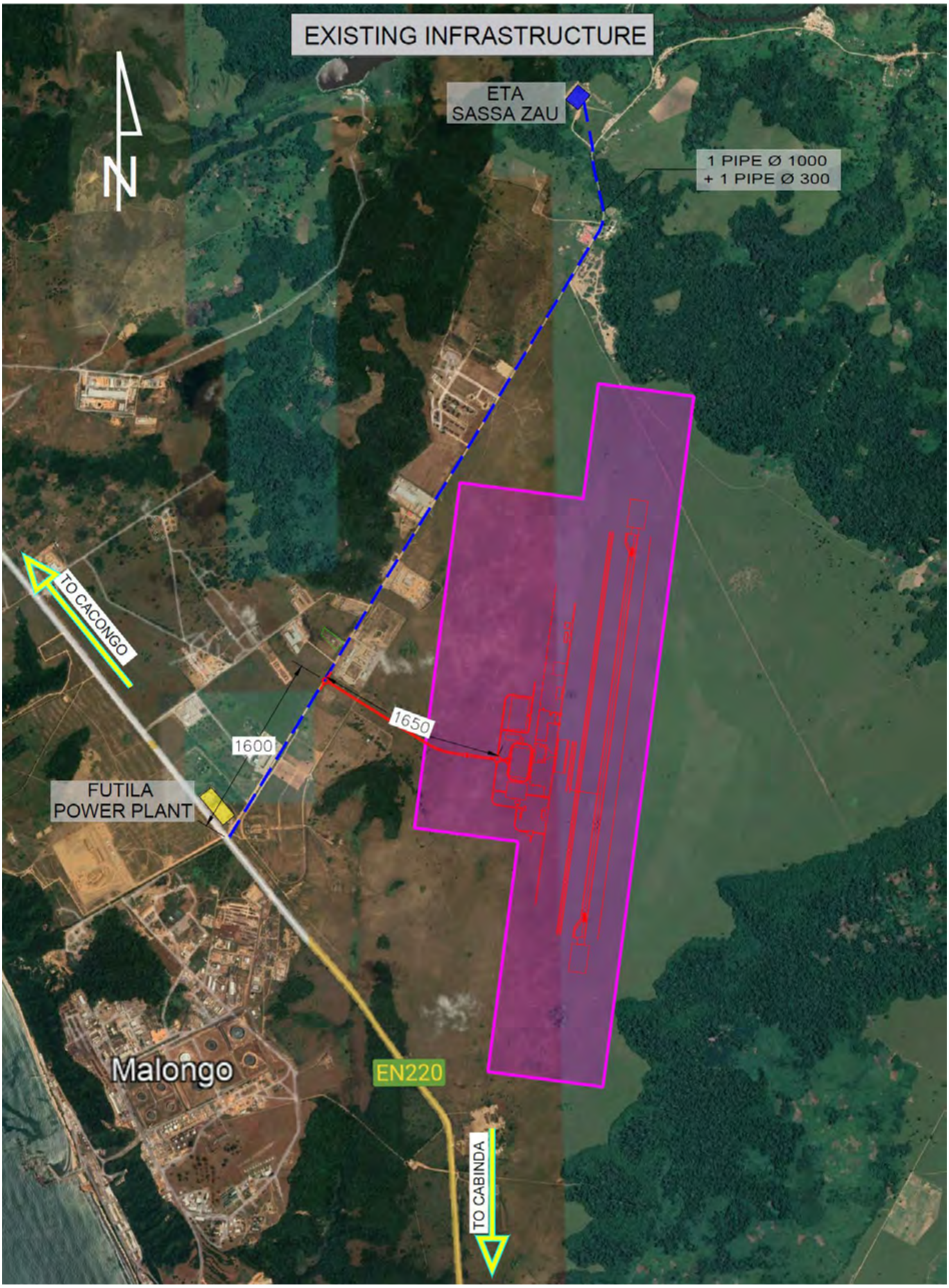


Figure 28: Water supply designed network.

It is anticipated that the following activities will require the use of larger volumes of water:

1) Earthworks – landfill and compaction of local soil layers to achieve the desired degree of compaction;

3) Production of Concrete and Asphalt;

4) Preparation of food for all Workers;

5) Dust Control through Water Truck Passages, on access roads and during construction.

Measures to reduce water consumption during construction activities are planned as following:

- Reuse of effluent from the Water Treatment Plant;
- Reuse of the effluent from the backwashing of the Water Treatment Plant filters;
- Reuse of effluents from the Water Treatment Plant from washing concrete mixers and concrete mixer trucks;
- Reuse of water and oil separator effluent.

Reuse water will be destined to degraded areas in the process of recovery, to the soil wetting process and other non-noble purposes in accordance with current legislation in Angola, with a view to closing cycles of use. Reuse water will be destined for activities such as for earthmoving activities, wetting aggregates, washing vehicles and concrete mixers, washing industrial plants, workshops and loading areas, wetting to control atmospheric emissions, irrigating vegetation, among others.

2.4.1.1.3 Solid Waste Management

A maximum area of 2 250 m^2 is foreseen in the construction camp to serve as a Waste Management Centre (WMC). Figure 29 below illustrates its location.

Figure 29: Foreseen area to serve as a Waste Management Centre within the construction site.

Table 4 presents the average monthly estimate of solid waste production expected to be produced during the construction of the Project:

Table 4: Average monthly estimate of solid waste production during construction.

Residue type	Unit	Average amount
General waste	kg/month	11,707.51
Organic	kg/month	9,839.50
Sawdust	kg/month	654.73
Crushed wood	kg/month	775.43
Cardboard	kg/month	56.64
Metal	kg/month	9,923.53
Glass	kg/month	144.00
Plastic	kg/month	2,222.93
Tires	kg/month	842.04
Automotive batteries	kg/month	0.56

All solid waste produced on the different work fronts and site will be sorted at source and will be collected by the Cleaning and Environment teams of the constructor consortium and sent to the WMC. Here, the waste will be temporarily stored and, depending on the type of waste, it will be treated in the WMC and sent to its final destination (recycling – organic becomes organic compost, plastic bottles will be used in the seedling nursery, etc.).

Waste recycling is planned for the construction phase:

- Organic waste will be composted, and the final composted product might be used to recover areas degraded by construction;

  The Contractor (OEC) has a sustainability plan in partnership with Instituto Médio João Paulo II, located in the City of Cabinda, to use part of the residual cooking oil, that will not be collected for incineration, to produce vegetable soap for human consumption. This soap will be used in OEC's supporting activities (dish washing, clothes washing, etc.). OEC also has a plan, to create additional income for the neighboring communities, to train them in this Soap Production Process, so that they can sell the products within the communities. OEC's HSE Department will be responsible for these activities;
- The plastic bottles might be reused in a seedling nursery and in decorative adornments. OEC's HSE Department will be responsible for these activities;
- Metal scrap might be collected by local steel mills;
- Toners and ink cartridges might be reused;
- Industrial oils are planned to be sent to be used in an outsourced brick manufacturing unit in the region. The considered unit is called Sassa Zau Ceramic Tiles Manufacturing Company. They are located in Sassa Zau and have a License to Produce Ceramic Tiles. To date, they do not have a License to treat or reuse Waste. If they obtain a license to reuse the Waste, OEC will make a proposal to send the industrial oils to them. Alternatively, OEC can also hire a Third Party, such as Delacerda Prestação de Serviços SU. LDA, who are Licensed to Collect and Treat this kind of waste to deliver the treated industrial oils to the Ceramic Tiles manufacturing Company.

The Constructor Consortium will subcontract a specialized and duly licensed local/national company, which will collect all the waste that will not be recycled/reused in the construction site and transport it for the area designated by the Municipal Administration of Cabinda. Based on the information received, it is understood that the original plan for waste disposal is to send it to the Yema dumpsite, situated close to the city of Cabinda, about 60 km from the NAIC. The Yema dumpsite is managed by a private company. Its approximate location is shown in Figure 30. Photographs of the dumpsite conditions are show below in Figure 31 to Figure 36.

Currently, the province of Cabinda is served only by municipal dumpsites, and do not have sanitary landfills. However, the government of Cabinda has selected an area to implement a new sanitary landfill and waste collection and treatment centre, for waste separation and preparation for recycling and recovery, including an incinerator for hospital waste. This structure will be built in the Subantando Village (see Figure 30), at a distance of approximately 47 km from NAIC, connected by the EN100/EN220 and EN201 roads, a journey of approximately 1 hour. It will serve most of the province, including the Malembo area. At the time of this study the Government reportedly said that the Contractor for starting the construction has been selected. No scheduled date for the start of work has been yet defined, however in the field visit carried out in November 2023, the MoT confirmed that the structure will be ready in the next 3 years. In this way, it is expected the structure to be functional during the last year of NAIC construction and during NAIC operations.

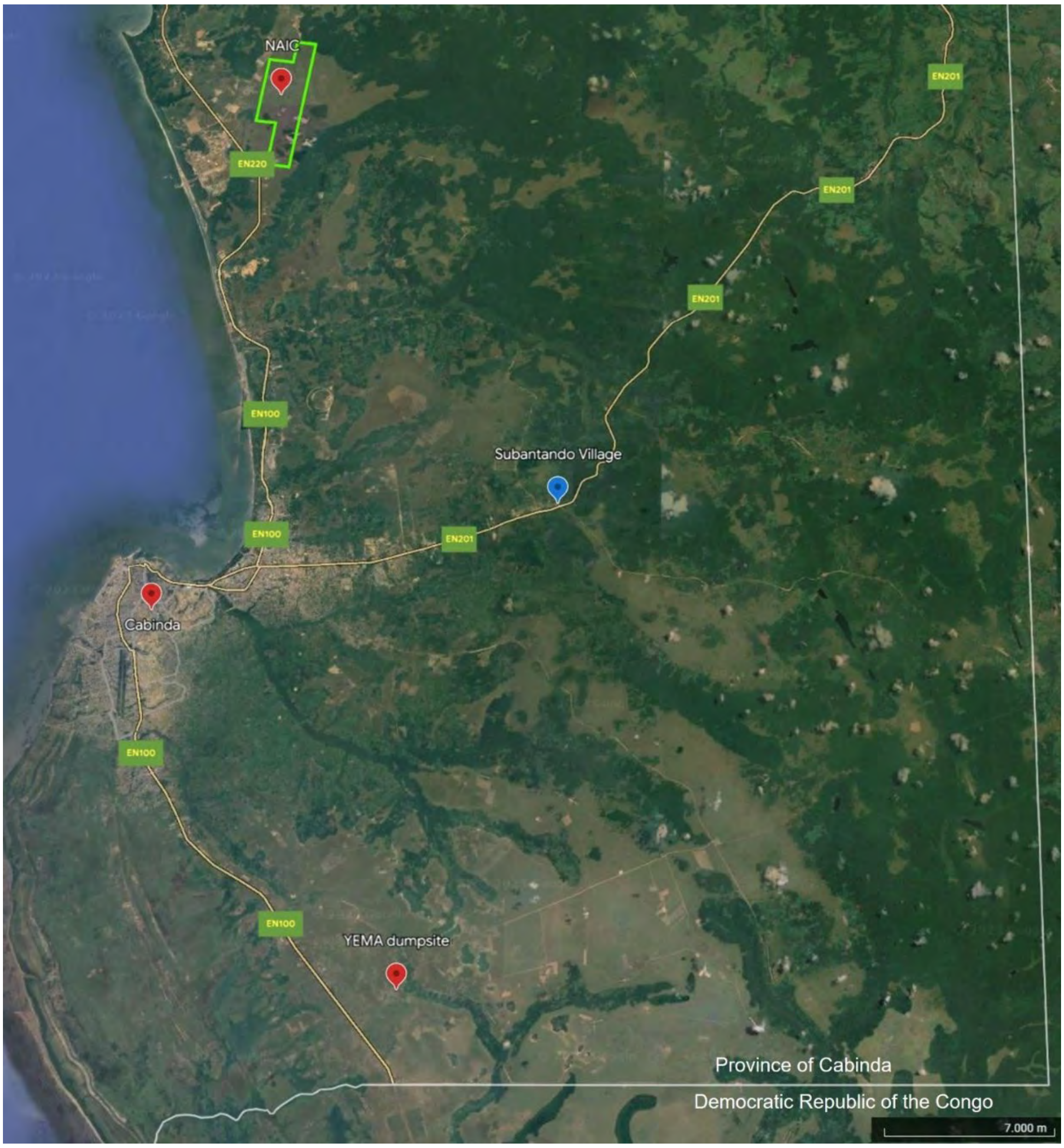


Figure 30: Approximate location of the Yema dumpsite in relation to the NAIC. The location of the Subantando Village is also shown.

Figure 31: Yema dumpsite - front.

Figure 32: Yema dumpsite - Pit to bury and burn healthcare waste.

Figure 33: Area reserved for disposal of domestic effluents (including sewerage).

Figure 34: Area for industrial waste disposal.

Figure 35: Area reserved for common waste.

Figure 36: Area reserved for waste segregation according to its typology.

2.4.1.1.4 Hazardous waste management

Regarding the production of hazardous waste, Table 5 shows the average monthly production estimate of hazardous waste expected to be produced during the construction of the Project:

Table 5: Average monthly estimate of hazardous waste production during construction

Description		Unit	Average amount
Oil residues	Waste contaminated by oils and greases	kg/month	109.70
	Oil filters material	kg/month	21.23
Incinerated waste	Oil residues	kg/month	130.93
	From outpatient area	kg/month	16.56
	Ashes generated	kg/month	4.03

The hazardous waste (waste from the Health Service) will also be collected by the Cleaning and Environment teams of the constructor consortium and sent to the WMC to temporary storage. The hazardous waste will be later collected and incinerated by a specialized local/national company duly licensed for this purpose, in

Cabinda. The company is called Angola Environmental Serviços[4]. They are licensed and have an incineration facility in the Province of Soyo, Angola.

2.4.1.1.5 Wastewater Management

An underground Wastewater Treatment Station (WTS) is planned for the construction phase, which will receive the Domestic Sewage from the Accommodations, Bathrooms, Offices, Gyms and Canteen. Figure 37 shows the layout of a typical WWTP, like the one that will be installed.

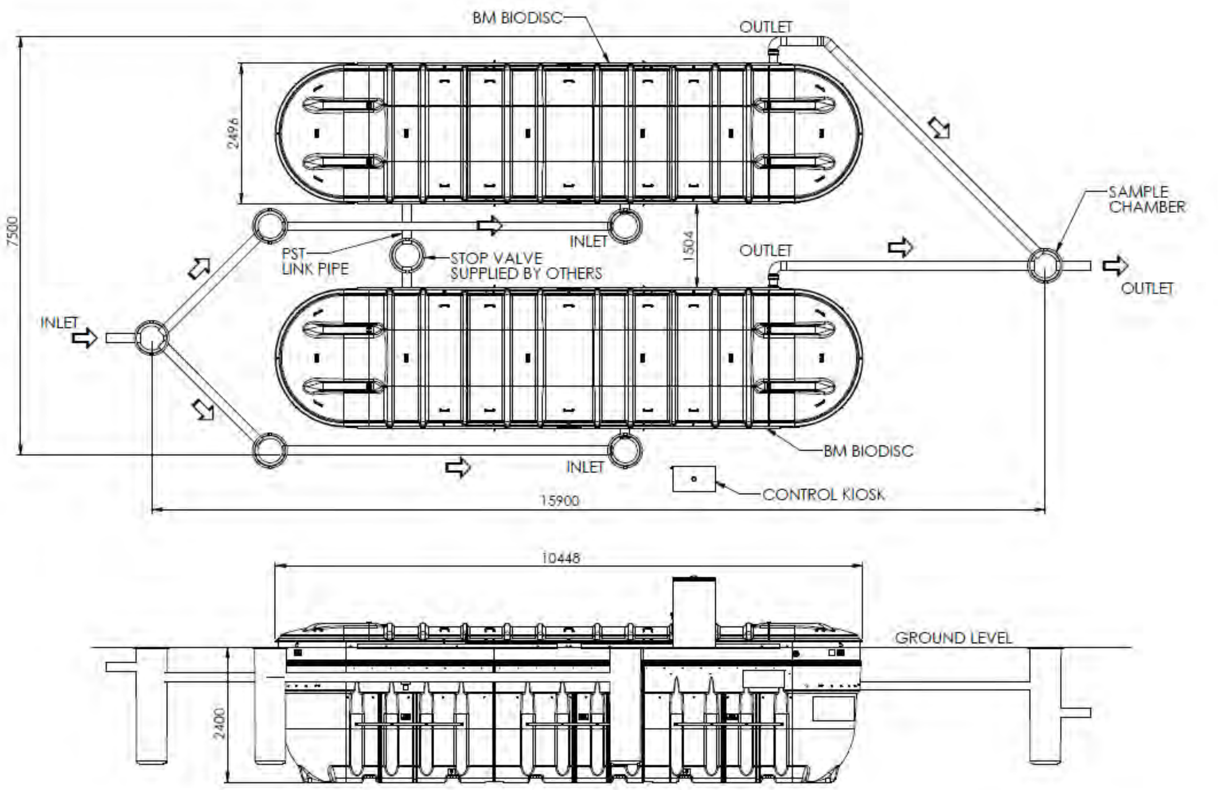


Figure 37: Wastewater Treatment Station design for the construction phase.

A maximum monthly production of 60,000 liters per day of wastewater is estimated. This water will be collected through the construction yard's sewage system and sent to:

1) Wastewater Treatment Station (WTS);

2) Septic Tanks and Sanitary Drains.

The WTS and the septic tank will treat the wastewater, within the limits stipulated by Angolan law, and subsequently the treated water will be sent to the nearest water lines or drains.

Both the WTS and the Septic Tanks will store the sewage sludge resulting from the wastewater treatment. The treated sewage effluent issued from the WTS will be used for irrigation and the resulting sludge will be sent to licensed disposal facilities by using trucks.

Qualitative (bimonthly) and quantitative (weekly) monitoring will be carried out by the Environment teams of the Consortium Constructor, on the effluents from the WTS and installed septic tanks.

[4] AES – Angola Environmental Serviços.

The kitchen, mechanical shop, generator area, pump station and other areas within the Construction Camp that are in constant contact with oil and grease will have an oil/grease trap attached, which will separate these substances from the sewer. Oils and Fats will be collected weekly by the Cleaning and Environment teams of the constructor consortium, who will then forward them to the Waste Management Centre.

The Constructor Consortium will provide chemical toilets, with sewage storage tanks on the work fronts, for the use of the teams. The stored sewage will be collected by local companies specialized and certified for the activity, which will then forward it to the municipal sewage network or licensed sanitary landfills.

2.4.1.1.6 Stormwater Management

- Stormwater management in the construction area: The construction of Temporary Drainage Systems will be carried out to mitigate impacts on the soil, avoiding sweltering, erosion, ravines, etc., directing the water to natural flood attenuation ponds indicated in the Project design with the aim of reusing rainwater. These ponds are the same ones that will be later used for Airport Operations and are located near the runway (please check Figure 18 in section 2.3.12.3 for the ponds location and further description). The rainwater can be also discharged into natural courses, depending on the situation feasibility (technical / economic reasons). The location and photographs of the natural courses are shown in Figure 38. According to the photographs received and knowledge of the Project area, all the natural courses are most likely temporary.

  It has been informed that several Oil / Grease Interceptors will be located in the areas prone to be in contact with Oil / Grease utilization (Apron / Runway, Main Buildings, Mechanical Building, Fire Rescue Building etc.).

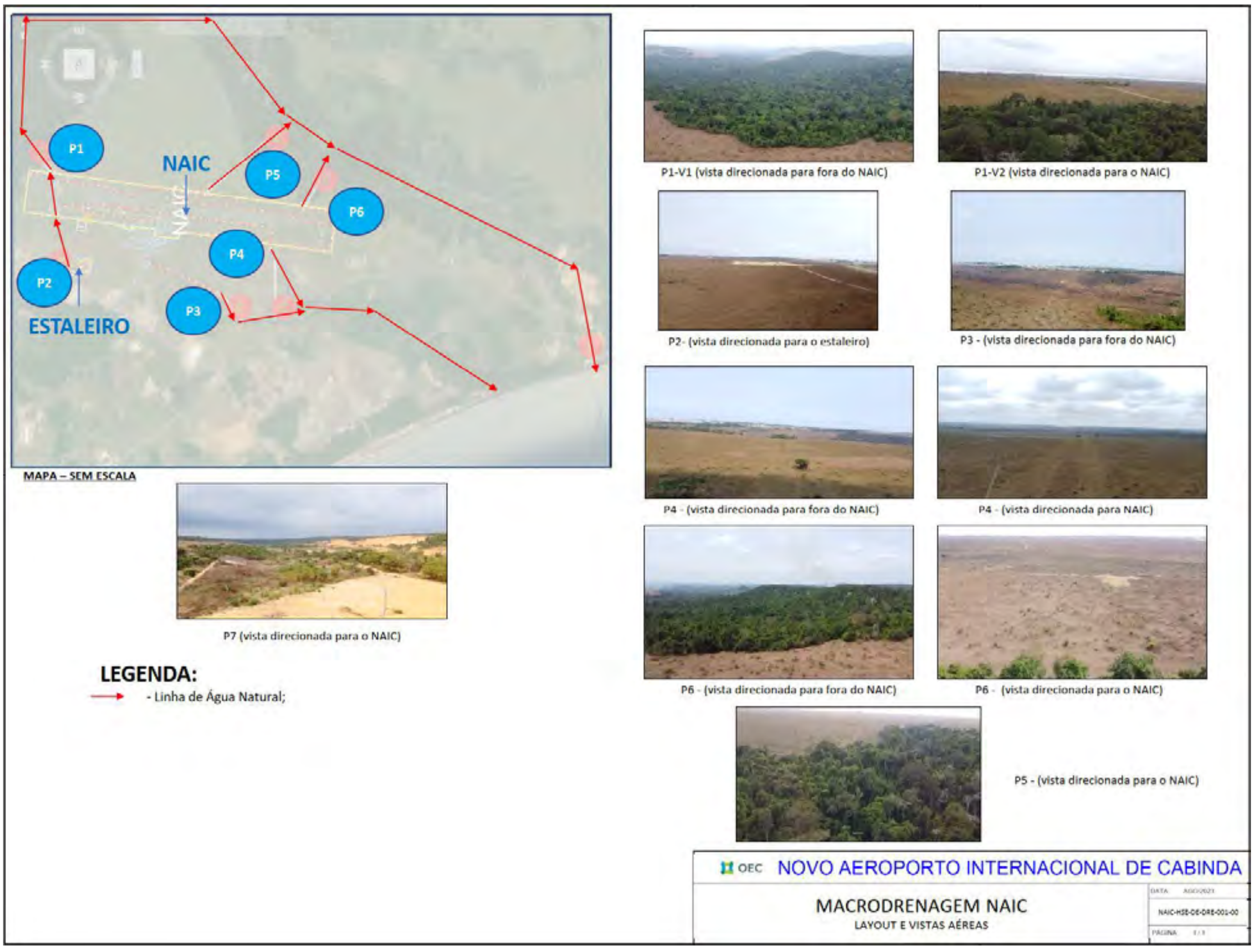


Figure 38: NAIC Drainage System for construction.

- Stormwater management in the Construction camp area: a Surface rainwater drainage system composed by ditches will be directing runoff to natural courses. The ditches will be built to prevent, mainly, the stormwater that will fall outside the Campsite Area to enter and infiltrate the Campsite Area. This stormwater will not be filtered. A map with the stormwater drainage system in the construction camp is shown below in Figure 39.

  The stormwater that will fall inside the Campsite Area, in the vicinities of the areas that are in constant contact with Oil / Greases, such as the kitchen, mechanical shop, pump Station, generator area, etc, will be filtered through an Oil / Grease separator, before being launched to the drainage ditch and natural courses.

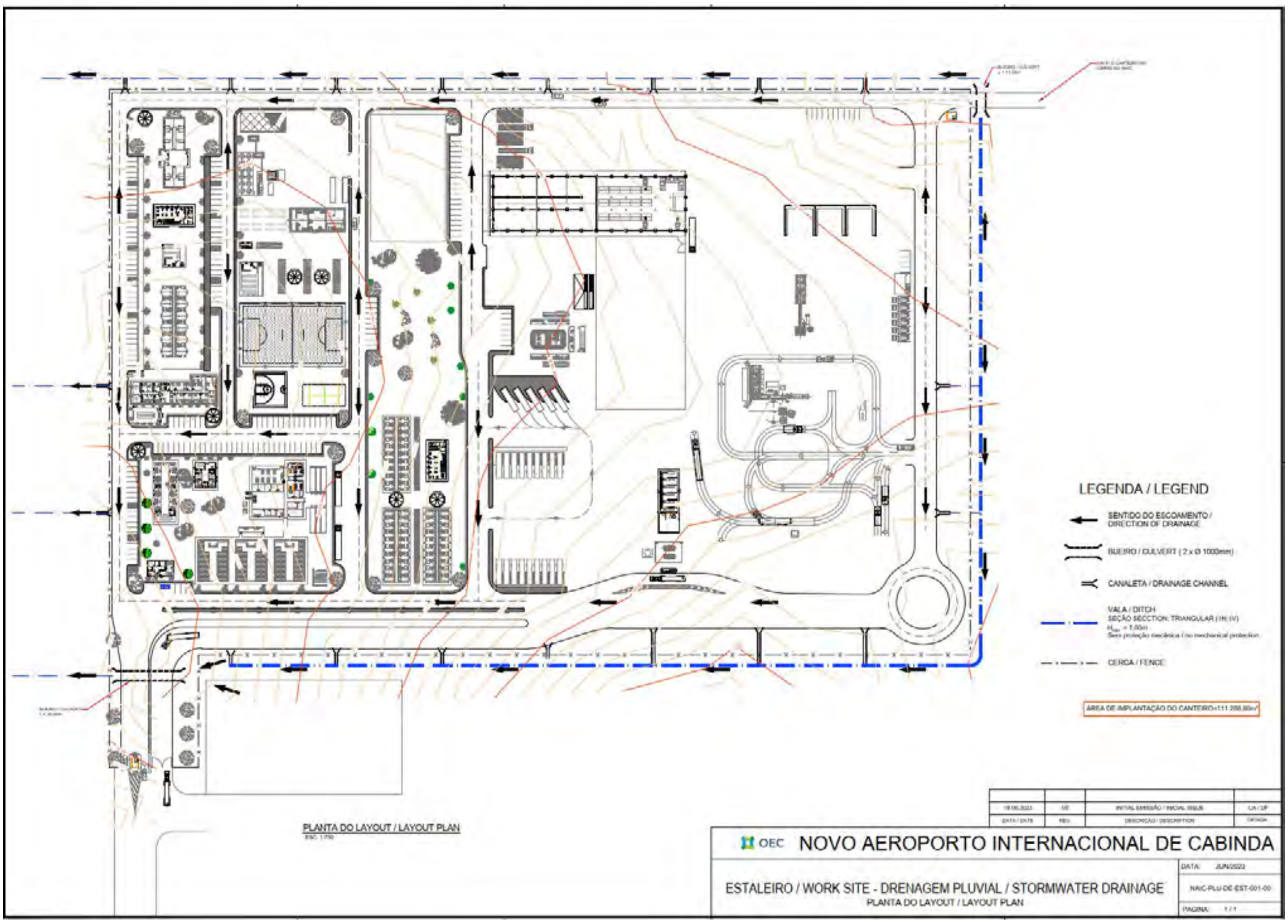


Figure 39: Stormwater Drainage System - OEC Construction Camp.

2.4.1.1.7 Electrical Installations and Power Supply

As shown in Figure 40, there is a forecast of 750 kVA to serve the administrative area and 1250 kVA to serve the industrial area.

Figure 40: Electrical needs for construction activities.

There is an ongoing authorization process for setting up the power transformer station for the construction site to the National Electricity Distribution Company in Angola (ENDE – EMPRESA NACIONAL DE DISTRIBUIÇÃO DE ELECTRICIDADE). According to the most up-to-date information received, the contractor sent a letter (along with the construction site layout project) identifying the interconnection from the public concessionaire network to the construction site, as shown in Figure 40 above, to the Department of Electrical Energy Network of the Province of Cabinda (ENDE). The Regional technical manager requested a descriptive memorial, complementing the forwarded information. The contractor is waiting for an update to the request to start the network execution process.

As backup, the use of generators is foreseen – 4 generators of 500 kVA each and 4 of 60 kVA distributed in the work fronts.

Currently, is being considered the option for the use of solar energy for lighting the internal circulation routes of the construction site and access roads to the construction site. Additionally, all lamps purchased for buildings (accommodation, offices, laundry, kitchen, etc.) will be LED.

All household appliances for use in the accommodation (air conditioners), kitchen (air conditioners, industrial kitchen equipment, refrigerators, etc) and offices (air conditioners, notebooks, monitors, printers, etc) will be new, in compliance with overall energy efficiency management.

2.4.1.1.8 Soil Management

The amounts of removed topsoil and subsoil are as follows:

- Topsoil volume: Approximately 270,000 m^3 of surface layer. This volume includes vegetation suppression to an average depth of 0.40 m for paved structures (accesses, internal streets, acceleration lanes and other roads) and buildings.
- Subsoil volume: 630,000 m^3 of subsoil layer. The subsoil volume is the complement of the topsoil volume until reaching the average depth indicated for changing soils that meet the respective resistances indicated in the design for paved structures (accessways, internal streets, acceleration lanes and other roads) and buildings.

The topsoil will be removed and stored for later use in the Degraded Areas Recovery Program.

For the Project earthwork activities, there is no forecast of excess subsoil to be removed. It will be necessary to explore a subsoil deposit, within the limits of the NAIC area. After completion of the earthwork activities, the deposit will be recovered and left in conditions similar to the original.

Soil management during the construction phase involves techniques to prevent soil degradation and erosion, such as:

- Mechanical practices: Mechanical practices are related to earthmoving or engineering works, adopted to provide stability to the surfaces of degraded land. Among these practices, the following can be mentioned: definition of slope geometry, construction of berms, drainage structures such as terraces, level grooves, benches, energy sinks, accumulation and infiltration basins.
- Vegetative practices: Vegetative practices are a set of erosion control techniques that do not involve earth movements or engineering works. Vegetative practices include level planting, retention strips and reforestation.
- Edaphic practices: Edaphic practices are related to improving the chemical, physical and biological conditions of the soil, in order to provide a more productive system, and, consequently, more resistant to erosion, by providing better conditions for the development and establishment of the vegetation cover. Examples include irrigation, liming, chemical and organic fertilization.

2.4.1.1.9 Materials Management – Supply Chain

Raw material will come from various sources:

1) Nearby quarries in Cabinda (their locations are shown in Figure 41). The Contractor will use existing private commercial and licensed quarries operated by third parties. They were selected by a private tender, prepared by the Contractor.

- Commercial granular material quarry: according to the information provided, there are several deposits of commercial granular material already in operation at the location observed in the map. The types of materials coming from the quarry are rolled pebbles, stone powder, washed sand, and Futila sand.

  The material from these deposits will be used to produce concrete, mortar, and asphalt mixtures. The Project is not expected to significantly affect the quarries since the existing granular material deposits serve the entire Cabinda region.

- Soil quarry (subsoil deposit). For the earth movements foreseen in the Project, there is no provision for excess subsoil to be removed, requiring the exploration of a subsoil deposit, within the limits of the land where the NAIC is located. After completion of the earthmoving activities, the deposit will be recovered and left in conditions similar to the original.

  The transport of the quarry materials will take place via National Roads, in bituminous concrete and existing earthed roads – it will not be necessary to create new accesses. A 15 to 18 m^3 tipper truck will be used, protected with plastic tarpaulin with equivalent material (Minimum – 0 trucks per day / Maximum (peak) – 20 trucks per day).

2) Materials / equipment purchased in Cabinda, other parts of Angola, other parts of Africa, Europe, South America and Asia.

These materials will arrive:

- By sea at the Ports of Luanda, Cabinda, Point Noire (Congo Brazaville);
- By air to Luanda / Cabinda Airports;
- By road, from ports and airports to the work site, using national roads (Angola, Congo Brazzaville, Congo Kinshasa);
- Materials / equipment purchased regionally will come from the acquisition site to the Project site using national roads (Angola, Congo Kinshasa).

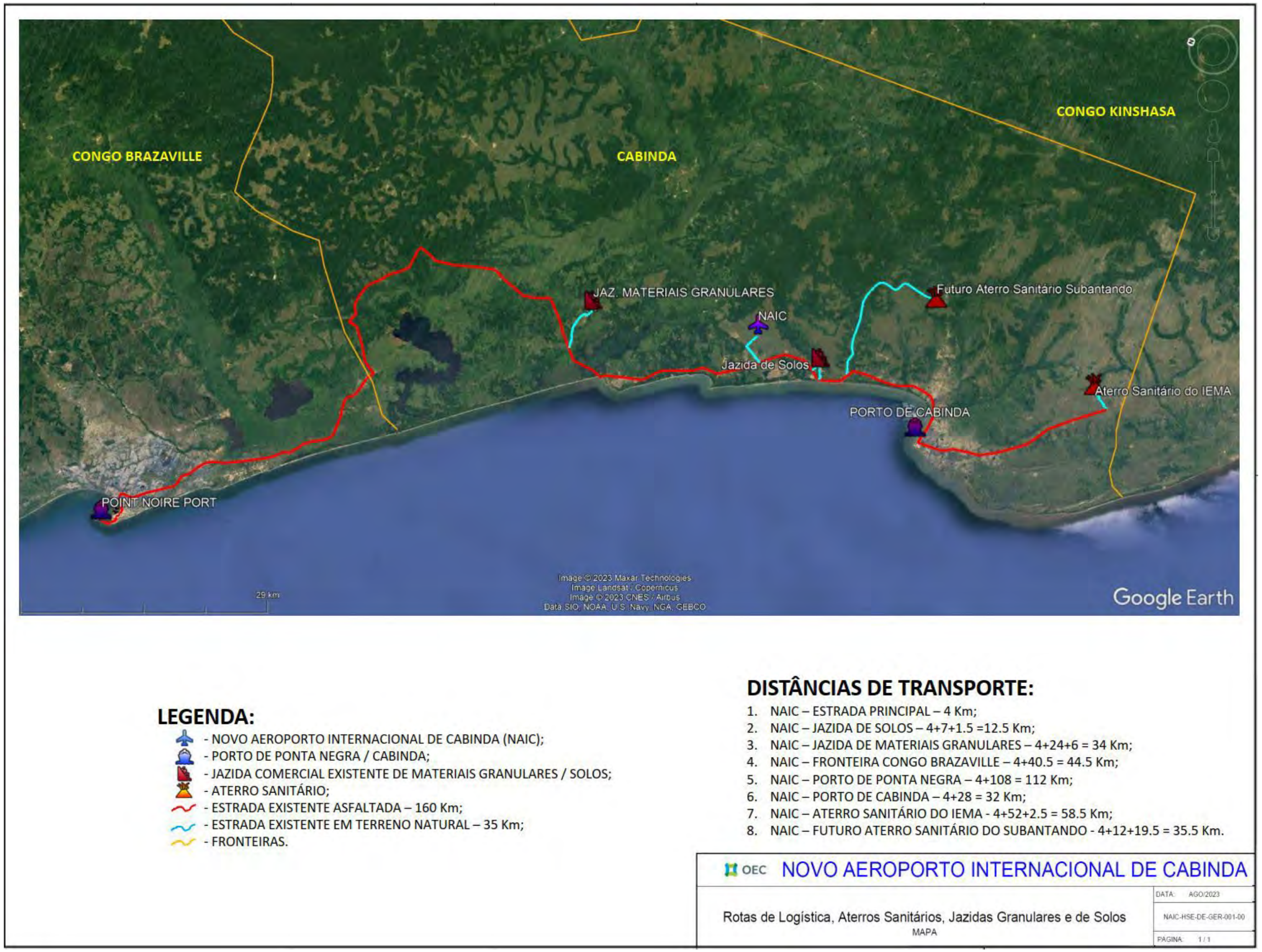


Figure 41: Location of the quarries in relation to the NAIC.

The main raw materials to be used are as follows (Table 6):

Table 6: Main materials and volumes required for NAIC construction phase.

Material	Volume required for construction
Common Excavation (on-Site soil)	1,800,000 m^3
Sand and gravel	206,100 m^3
Wood	659 m^3
Base (BGS and cement soil)	66,7000 m^3
Formwork	17,000 m^2
Compacted Landfile	1,900,000 m^3
Asphalt paving	933,000 m^2
Concrete	34,400 m^3
Sub-base	197,000 m^3
Steel Frame	962,000 kg
Masonry	12,000 m^2

The main types and volumes of hazardous materials to be used are as follows (Table 7):

Table 7: Main hazardous materials and volumes required for NAIC construction phase

Material	Volume required for construction
Diesel	6,700,000 L
Water Based Paints	15,000 L
Solvent	2,500 L
Water Treatment Station products / WWTP products	200 L per month (chlorine)
Bitumen	8,400 Ton
LPG gas	1,000 Kg (cylinders) per month
Welding Consumables (Acethylene and Oxygen)	50 m^3 / month and 200 m^3 / month

Deposit and Storage of construction materials:

- Covered and uncovered warehouse for small/medium construction materials and equipment (2 385 m^2 / 3 460 m^2, respectively);
- Granular materials stored in stalls, or in controlled and treated heaps (when necessary, protected with tarpaulins).

2.4.1.1.10 Workforce Management

The Contractor estimates an approximate number of 828 workers in the peak months (months 18, 19 and 20) during the construction period. It is reported that 95% of the workforce needed for the Project is Angolan, which will be guaranteed through the Local Content Plan (PCL), proposed by the OEC to encourage local labor. To facilitate the process, workers will be accommodated in the OEC camp that will be constructed for NAIC purposes.

The distribution of manpower use during the 48 months of construction is shown in the histogram below (Figure 42):

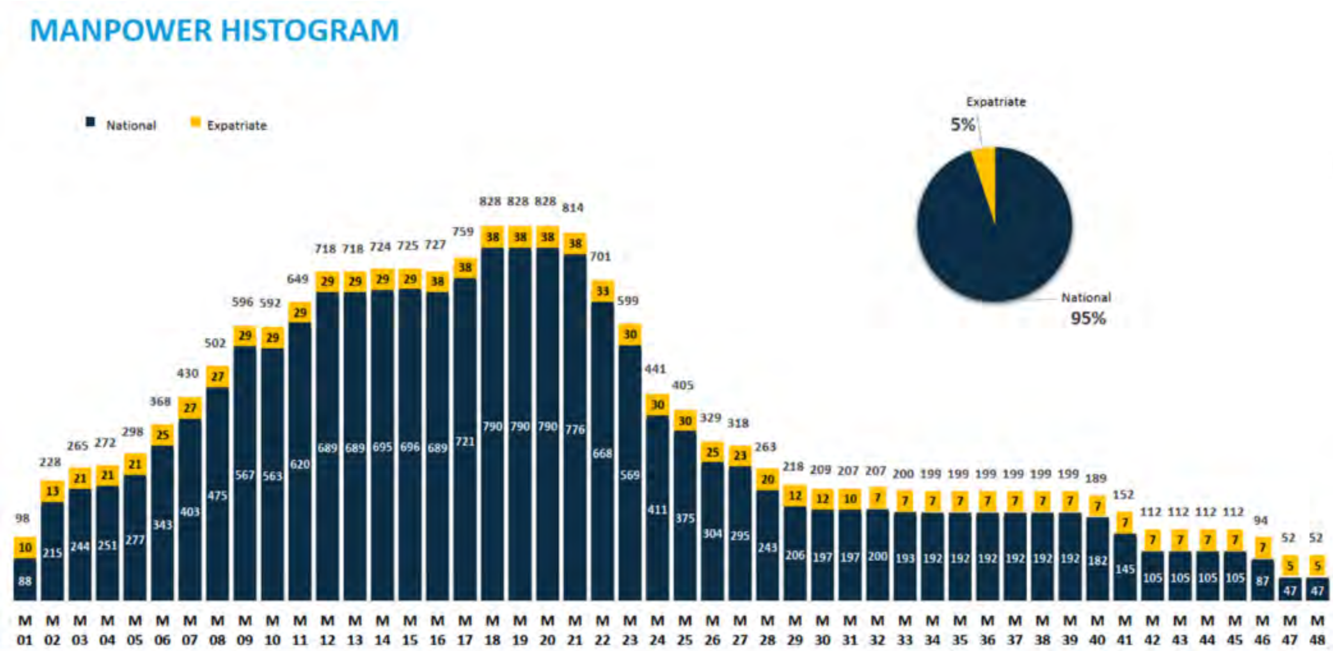


Figure 42: Manpower Histogram for construction phase.

2.4.1.1.11 Security Management

The Contractor has hired a specialized and licensed local security service provider, named Lince Segurança S.A. No firearms are expected to be used. The contractor has established a procedure for the Security Management (PI-PR-080-RISK MANAGEMENT ASSOCIATED WITH PROPRETY SECURITY_EN) which, specifically, refers to the assets security.

2.4.1.1.12 Project Road Traffic Management

The contractor has established procedures for Project Traffic Management, and they can be found in a dedicated document (*Anexo 7 - PI-PL 107 NAIC – Parametros de Limites de Velocidade, Trafego e Gestao de Consequências*).

All drivers of work equipment/vehicles that travel on public roads (internal roads, highways, intercity, interprovincial) must comply with the maximum permitted speed limits (Table 8):

Table 8: Project maximum permitted speed limits.

Vehicle type	Road type	Maximum speed limit
Trucks	Internal roads	40 km/h
	Motorways/intercity and interprovincial roads	80 km/h
	Urban roads	40 km/h
Cars	Internal roads	40 km/h
	Motorways/intercity and interprovincial roads	110 km/h
	Urban roads	60 km/h

The speeds of the vehicles will be registered through GPS and monitored through the Quatenus system. Upon identifying a violation, the offending driver's leader will be notified to apply consequence management (Table 9).

Table 9: Consequence of vehicles speed violation.

Violation	Consequence
1st violation	Verbal warning and refresher training
2nd violation	Written notice of occurrence/warning
3rd violation	Worker dismissal

2.4.1.1.13 Mechanized Equipment used for Construction

During the construction phase, the following mechanized equipment is expected to be used (Table 10):

Table 10: Expected mechanized equipment to be used during construction.

Code	Description	Quantity at work peak times
8010419	CAT 140H Motor Grader	5
8047409	40t Articulated Truck or similar	1
8080609	Track Tractor CAT D6 or Similar	5
8080809	Track Tractor CAT D8R or similar	2
8090529	Wheel loader CAT 950H or similar	2
8114109	Concrete Mixer Truck 7 to 9m³	3
8140319	Tank Truck 10 to 20m³	3
8150409	Body Truck	3
8160319	Crane Truck 15 to 25 t	3
8174119	Dump Truck 18 to 22m³	35
8184109	Scania P410 Truck with Board or similar	1
8220660	Cibi Concrete Plant MTH 3000 90m³/h - Site 1	1
8240950	Metso NW95 200 HP 200t/h crushing set	2
8310289	Backhoe CAT 428E or similar	4
8323209	Crawler Excavator 20t or similar	2
8323749	Crawler Excavator 40t or similar	8
8326509	Crawler Excavator 30t or similar	1
8474149	Telescopic Handler	4
8570359	Atlas Copco Hydraulic Drill or similar	1
8570509	Sandvik Hydraulic Drill or similar	1
8610539	Compactor Roller CAT CS 533E or similar	7
8610549	Compactor Roller CAT CS 533E or similar Pad Foot	7

Code	Description	Quantity at work peak times
8610559	Flat Tire Compactor Roller or similar	2
8650279	Farm Tractor	3
8022010	Concrete Pump Schwing Stetter SP 2000	1
8140340	Fire Fighting Tank Truck	2
8400340	500 kVA Generator Set	5
8415400	Crane Tires Grove RT 540E	2
8450501	Low Plank Trailer Platform	2
8460331	Hyster H60FT 3t to 7t forklift	2
8640420	Atlas Copco XAS 420 Air Compressor	1

The distribution of equipment use during the 48 months of construction is shown in the histogram below (Figure 43).

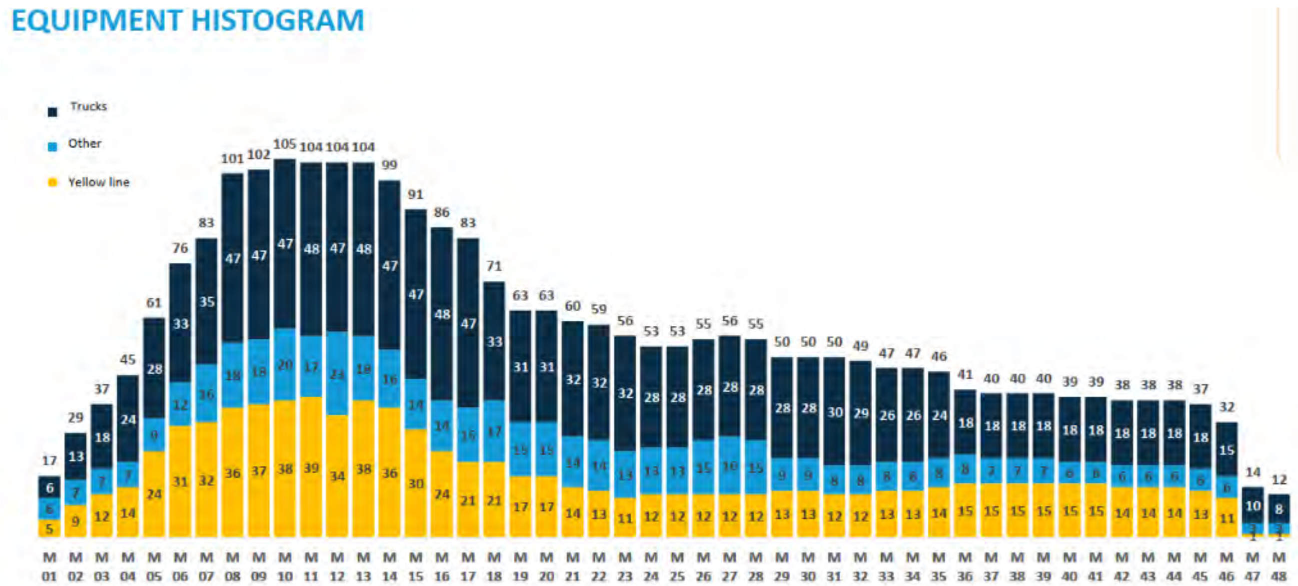


Figure 43: Equipment Histogram for construction phase (the yellow line indicates Earthworks and Paving Equipment (graders, excavators, backhoes, compactors, pavers).

2.4.2 Operational Phase

During operations, aircraft traffic forecast are as follows (Table 11):

Table 11: Annual Aircraft Movements (PAL 1, PAL 2 and PAL 3 mean phases of, respectively, 10, 20 and 30 years).

Year	Code E Arrival	Code E Departure	Code C Arrival	Code C Departure
2022	0	0	4,412	4,412
2023	0	0	4,716	4,716
2024	0	0	5,037	5,037
2025	52	52	5,379	5,379

Year	Code E Arrival	Code E Departure	Code C Arrival	Code C Departure
2026	52	52	5,742	5,742
2027	70	70	6,012	6,012
2028	87	87	6,295	6,295
2029	104	104	6,593	6,593
2030	122	122	6,905	6,905
2031	139	139	4,823	4,823
2032	156	156	5,053	5,053
2033	172	172	5,295	5,295
2034	188	188	5,550	5,550
2035	203	203	5,817	5,817
2036	219	219	6,099	6,099
2037	235	235	6,395	6,395
2038	250	250	6,706	6,706
2039	266	266	7,033	7,033
2040	282	282	7,378	7,378
2041	297	297	7,740	7,740
2042	313	313	8,121	8,121
2043	339	339	8,523	8,523
2044	365	365	8,945	8,945
2045	391	391	9,390	9,390
2046	417	417	9,858	9,858
2047	443	443	10,350	10,350
2048	469	469	10,869	10,869
2049	495	495	11,416	11,416
2050	521	521	11,991	11,991

The current airport will be dismissed once NAIC is completed. No information as of today are available about the dismantling. The people currently working in the airport will be transferred to NAIC.

SGA will be responsible for the airport operation once construction is completed. The main activities carried out by the SGA for Cabinda are as listed:

- management and development of airport infrastructure;
- provision of services aimed at ensuring the departure and arrival of aircraft;
- boarding, disembarking and forwarding of passengers and baggage;
- cargo and mail at airports, as well as at other airport infrastructure.

The development of the NAIC will consider 2 implementation phases:

- **Initial Phase** (Current Scope): which will encompass the demand for the next 15 years – until 2036. The General Layout Plan for this phase is shown in Figure 44. In the initial phase, the aerodrome reference code is “Code E”, with the Boeing 777 as the critical aircraft. In this phase, the runway does not have a full length of parallel taxiing[5] path and therefore a turning area will be required to facilitate a 180 degree turn of the planes. A turning area is proposed at each end of the runway to be used during take-off and landing operations in case an aircraft needs the full length of the runway, as shown in Figure 44 below.

- **Final Phase**: which will enable further airport expansion beyond the initial 15-year period, possibly into 2050 and beyond, with opportunities to double peak-time throughput. The General Layout Plan is shown in Figure 44.

Annual passenger demand is spread over 333 days (based on general practice which assumes that aircraft operate regularly 90% of the days).

Table 12: Passenger traffic according to forecast.

	2022[6]	2026	2032	2042	2050
Annual Passengers					
Domestic	**283,279**	368,625	486,614	782,092	1,154,747
International	**0**	19,861	59,584	119,167	198,612
Total	**283,279**	388,486	546,197	901,260	1,353,359
Peak Month Passengers					
Domestic	**35,410**	46,078	60,827	97,762	144,343
International	**0**	1,655	4,965	9,931	16,551
Total	**35,410**	47,733	65,792	107,692	160,894
Design Day Passengers					
Domestic	**944**	1,229	1,622	2,607	3,849
International	**0**	381	381	381	762
Total	**944**	1,610	2,003	2,988	4,611
Peak Hour Passengers					
Domestic					
Arrivals	**156**	203	268	352	375
Departures	**156**	203	268	352	375
Total	**312**	405	535	704	751
International					
Arrivals	**0**	190	190	190	381
Departures	**0**	190	190	190	381
Total	**0**	381	381	381	762

NAIC Peak Hour Coefficient for domestic and international passengers are shown in Table 13.

Table 13: NAIC Peak Hour Coefficient.

	Initial Phase	Final Phase
Peak Hour coefficient for domestic passengers	20%	15% (as traffic will be more distributed during the day)

[5] Aircraft Taxiing: movements performed by an aircraft on the surface of an aerodrome or operating site, under its own power, with the exception of take-off and landing.

[6] Existing Cabinda airport data

	Initial Phase	Final Phase
Peak Hour coefficient for international passengers	45%	35% (as traffic will be more distributed during the day)

The combined peak hour demands for arrivals and departures, in relation to the number of passengers per hour, is 700 passengers for domestic flights and 500 passengers for international flights in the initial phase.

In the final phase (after 2036), a complete parallel taxiway must be provided along the entire length of the runway, in order to accommodate, without significant delays, the demands of aircraft arrivals and departures on the runway system, as shown in Table 13. The combined peak hour demands for arrivals and departures is 1000 passengers for domestic flights and 700 passengers for international flights in the final phase.

The level of service provided to passengers is directly related to the critical moments in the airport operations and how these critical moments are perceived by them will influence the overall airport performance. Therefore, peak hours will directly affect the overall airport performance and the estimation of the peak hour passenger design is critical for the creation of airport terminals.

The combined peak hour demands for arrivals and departures, in relation to the number of passengers per hour, that must be considered are shown in Table 14 (for the purpose of better planning, values have been rounded).

Table 14: Combined peak hour demands for arrivals and departures.

	Initial Phase	Final Phase
Domestic Passengers	660 pax/h (700 pax/h for planning)	991 pax/h (1000 pax/h for planning)
International Passengers	464 pax/h (500 pax/h for planning)	721 pax/h (700 pax/h for planning)

Considering the information above, passenger service and baggage areas should be designed for:

Initial Phase:

- 700 pax/peak time (350 in departures and 350 in arrivals) for domestic passengers;
- plus 500 pax/peak time (250 in departures and 250 in arrivals) for international passengers.

Final Phase:

- 1000 pax/peak time (500 for departures and 500 for arrivals) for domestic passengers;
- plus 700 pax/peak time (350 for departures and 350 for arrivals) for international passengers.

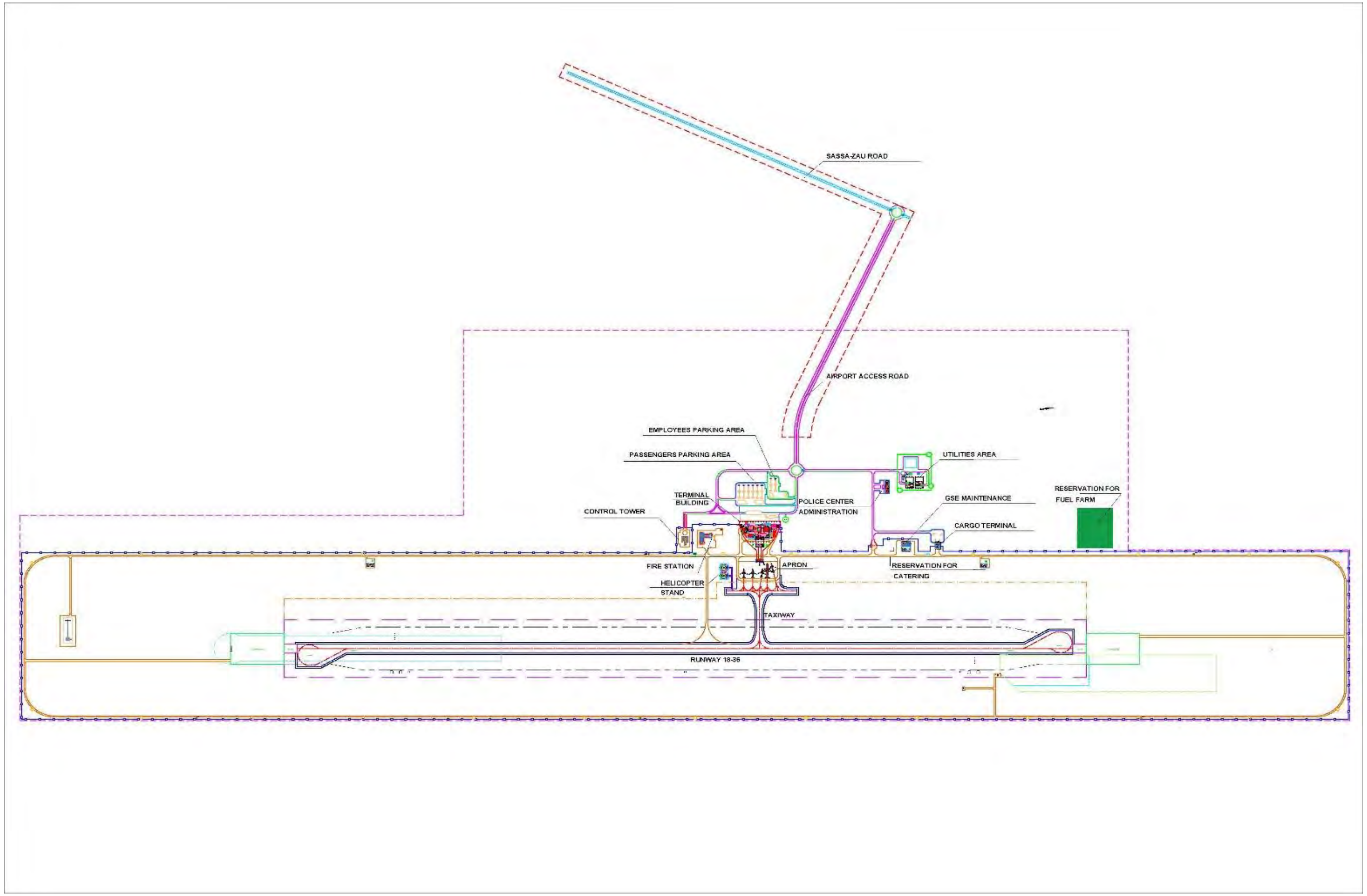


Figure 44: NAIC General Layout Plan (Initial Phase – Current Scope).

2.4.2.1 *NAIC Functioning*

The management of water supply, solid waste, wastewater, stormwater, electricity, materials, workforce and traffic during the operational phase of the NAIC are described below:

2.4.2.1.1 Water Supply Management

Just as in the construction phase, water will be supplied from the existing public network (see Figure 28) and from groundwater well located in the water technical area (see Figure 27) and built for Project purposes.

Groundwater will be treated in the Water Treatment Station as described in section 2.3.12.2.

2.4.2.1.2 Solid Waste Management

Waste generated during the operation phase will likely include the hazardous and non-hazardous (including recyclable) waste streams listed in the table below.

Table 15: Examples of hazardous and non-hazardous waste generated during the operation phase.

Non-hazardous waste
Metal scraps (ferrous and non-ferrous)
Putrescible waste
Cooking oils
Wooden pallets
Plastics
Paper and cardboard
Domestic waste from administrative duties
Glass
Tires
Hazardous waste
Waste electrical and electronic equipment
Waste motor oils and lubricants
Oil-contaminated filters and rags
Batteries
Medical waste

The solid waste generated during operations will be source-separated and dispatched to the Solid Waste Collection Area located on-site (described in section 2.3.12.5 above) before being sent to the landfill. As mentioned in section 2.4.1.1.3, the waste will be sent to the Subantando Sanitary Landfill, which is expected to be operative in the next 3 years according to the MoT.

2.4.2.1.3 Wastewater Management

A permanent Wastewater Treatment Plant will be constructed on the site, as described in section 2.3.12.4. The expected wastewater flows from the entire site including domestic and maintenance facilities is 96656 m^3/month.

According to the information received, the design of the WWTP will consider municipal wastewater characteristics in nature. Considering the type of the Project, it is expected that the wastewater generated will consist of:

1. Civil/domestic wastewater from airport buildings, airport kitchen and from airplane toilets (lavatory waste);

2. Wastewater deriving from the equipment and machinery repairing, washing and cleaning, from airplane hangars or other maintenance facilities which may contain traces of oil or heavy metals.

It has been informed that the generated effluent will be used for irrigation and that the sludge will be stored and aerated prior to disposal by tanker truck on a weekly basis. The final destination of the sludge is currently unknown; however it is expected that it will be collected by licensed operators and properly disposed into licensed facilities.

No information was provided in addition to other possible destinations for the effluent besides irrigation.

It is currently unclear how the wastewater from airplane hangars or other maintenance facilities will be handled, but according to information received it is expected that it will be pre-treated at source before discharging in the wastewater network. The type of technology used for the pre-treatment is unknown until the present moment.

In addition, it has been informed that depending on the salinity levels, the reject water from reverse osmosis (RO) process (brackish water) from the Water Treatment Station (see section 2.3.12.2 for more details), may be discharged via pumping into the wastewater network, if dilution allows so. In case this is not possible, the use of evaporation ponds for brine disposal or the re-introduction of the brine into the aquifer is being considered in the Project design.

2.4.2.1.4 Stormwater Management

The NAIC stormwater system is described in section 2.3.12.3.

2.4.2.1.5 Electrical Installations and Power Supply

Energy will be supplied by the existing public network from the Malembo Thermal Power Station located around 1.5 km from the Project site (Figure 45 and Figure 46). It is expected that this will involve a new supply cable infrastructure of about 4.5km to be constructed within the existing road corridor and site footprint with no land acquisition / economic or physical displacement foreseen. It is still under discussion who will be responsible of the construction of the transmission line.

The estimated load of the airport Phase 1 facilities including the Catering building is around 5.49 MVA, to be ensured from Malembo Thermal Power Station. A 100% standby power is provided in the Switching Station via 4 x 2500 kVA prime rated diesel generators.

In order to reduce energy consumption from the electrical perspective, all lighting will be specified based on energy efficient LED lamps. Lighting in offices, stores, toilets. etc. will be controlled via local switches or occupancy sensors. Large spaces will be controlled by lighting contactors installed in the lighting panels.

Figure 45: Malembo Thermal Power Station.

Figure 46: Location of the Malembo Thermal Power Station in relation to the NAIC footprint.

2.4.2.1.6 Project Road Traffic Management

The new airport site will be connected to the main road network via a modern road system that includes sufficient parking spaces and public transport capabilities that will cater for the needs of all airport end users, such as passengers, employees, visitors, goods delivery, logistics, etc. The E220 from the city of Cabinda that reaches the airport is mostly a two-lanes road until Futila settlement. In addition to the new airport there are other expansions in the area that will generate additional traffic (port of Caio and the Refinery), however this will be a progressive increase because of different timeline expected to have all these projects completed. There is a plan from the Government of Cabinda to upgrade the existing road in the future to make sure that the planned growth of the economic area is progressively supported.

2.5 Project Area of Influence (AoI)

The Applicable standards require that Project proponents identify and manage environmental and social risks and impacts within the Project "Area of Influence" (AoI). The appropriate level of assessment and management of risks and impacts is determined by the degree of control that the proponent is able to exercise over the Project facilities or activities and by the importance of the facilities or activities to the Project's successful operation.

IFC PS1 par. 8 requires that: "*Where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project's area of influence. This area of influence encompasses, as appropriate: 1) The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent; 2) Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable. 3) Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted*".

The AoI of this Project is delineated as a basis for defining the minimum boundaries for baseline data gathering by taking into consideration the spatial extent of the facilities and activities and potential direct and indirect impacts of the Project, including:

- a 10 km radius around the Project footprint to assess potential environmental impacts on soil, air and water, and also the direct impact connected to human receptors, such as noise and waste generation;
- a 10 km radius around the Project footprint for the social baseline and social impact assessment to ensure an adequate assessment of liaison with communities and some specific impacts relevant to the generation of traffic, workforce, supply chain and security;
- a 50 km radius around the Project footprint to assess potential impacts on biodiversity.

The main aspects (environmental, social, biological) considered for the definition AoI are described below.

2.5.1 Environmental aspects

A buffer area of 10 km around the Project site is considered for assessing potential impacts on environmental aspects (Figure 49).

The Project will be located on a flat plateau predominantly vegetated in herbaceous and shrubs species (Figure 47 and Figure 48), with no human or economic activities present at the same level of altitude.

No presence of rivers or ponds is reported or has been identified within the Project footprint. The Chiloango river, the main river in the area, is situated around 5 km to the north of the airport footprint (Figure 50). Other smaller water streams, likely periodical, are identified close to the Project footprint. The water supply for the Project will be provided by the Cabinda water supply system, which captures water from the Chiloango river (see its location in Figure 50), at a location not far from the Project footprint.

Energy will be supplied by the Malembo Thermal Power Station located around 1.5 km from the Project site (see Figure 46).

Moreover, the Project footprint area is not subject to any source of noise or activities that may generate air pollutants. The presence of the power station and the Cabinda refinery in proximity of the proposed site will likely generate cumulative impacts which will be detailed and discussed in Chapter 16.

Figure 47: Overview of the Project site (February 2023).

Figure 48: Site photographs taken during the site visit (February 2023).

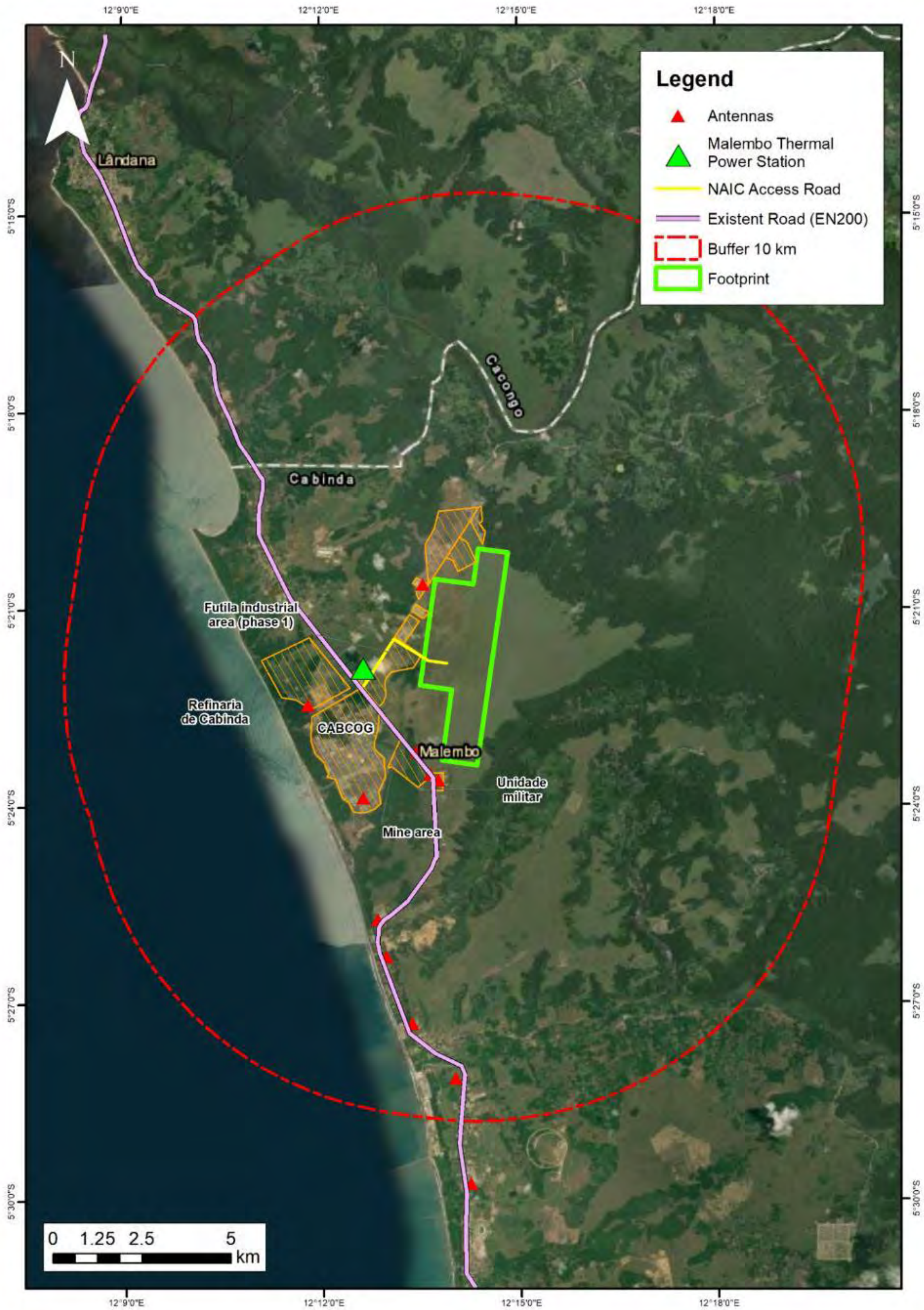


Figure 49: Project footprint within the 10 km buffer, and other features present within the AoI.

2.5.2 Biological aspects

While directs damage (*e.g.,* habitat destruction and bird collisions) are relatively well understood, many activities might affect wildlife in less apparent ways, such as noise and light disturbance which have direct consequences for animal survival and reproductive success.

Given the type of Project and the ecology and the ethology of the various taxa and groups of species, the Project's Area of Influence (AoI) for biological components has been considered differently. Three AoI have been designed specifically at 2 km, 5 km, and 50 km to carry out a solid and robust field survey and consequently the biodiversity baseline.

The Project site is predominantly vegetated with herbaceous vegetation and shrubland. The area surrounding the Project from the northwest to southeast is more vegetated with a variety of habitats represented from a mix of evergreen and semi-deciduous forests, with some patches of open forest and herbaceous wetlands. These areas are characterized by a wide variety of very tall tree species which often reach 50 m in height and form a continuous multi-storeyed canopy, home of rich avifauna, abundance of flower and fruits for frugivorous mammals, birds and threatened and endemic wildlife. Heading north, and immediately behind the footprint Project's areathere is a forest on a hilly area and at about 3 km the Chiloango river flows forming an inlet, which then turns towards the sea in the northern area of Landana Bay.

Within a buffer zone of 50 km, two protected areas are located in this area such as small portion of Cayo-Loufoualeba Ramsar Site (in the north)and the Mangrove National Park (in the south). The latter, is marine-oriented, with important wetlands with a mix of mangroves, lush forests, oak, cedar and walnut trees, and create a unique habitat and specials for endangered fauna and flora. (Figure 50).

Angola and even more Cabinda, are among Africa's ornithologically least-known countries, however the presence of an Endemic Bird Area (Western Angola) on the southern coast at 60 km from the Project site, suggests that the area is likely a corridor of migration species during the spring and autumn seasons.

For the terrestrial biodiversity (flora and fauna), considering the surrounding characteristics the AoI is defined similarly to the physical environment and social components. An area of 2 km from the Project footprint will be considered with an exception for mammals for which the area will be extended to 5 km to be sure to catch any potential species of significant conservation relevance.

Figure 50: Biodiversity aspects within the 50 km buffer area of influence.

2.5.3 Socio-economic aspects

From a socio-economic perspective, the proposed airport footprint has few direct socio-economic receptors. The site is completely covered with vegetation and no site-based human activities were reported nor noted . In visiting the 853-ha area, the team observed no settlements, households or evidence of agricultural activities. This may have been because this area had not been de-mined until very recently and may have been considered as a no-go area for the local population..

There are various tracks across the site, most of them were recently cleared by the appointed contractor, as part of the demining process and to complete the site recognition activities. There was also one or two routes that may have been developed previously and links areas and communities located at aprox. 3 km to the East of the site to the main road. The team observed road users on one of these roads during the visit and confirmed that they were travelling to their village.

The team also found a seemingly abandoned well in a more densely vegetated part of the site which could indicate that the area may have been important from an agricultural point of view in the past. This may also have been linked with the military who had used the area for training of some sort. Considering the small munition that was discovered during the demining exercise and the presence of a military compound to the South of the site, this may be plausible.

Although most of the land surrounding the site is either forested or open grassland, the area is home to various industrial activities. In the Northeast of the proposed site is a secondary road that links various villages to the East with the main road to the West. This road will also form the access route between the main road and the Project site some 1600m away. The road is severely damaged and the stretch between the main road and the airport will be upgraded as part of the contractor's scope. Industries and businesses are located along the road including a worker camp that houses various workers from the area.

There are 9 villages in the district of which 3 (Bichassanha, Cagongo and Sassa Zau) are relatively close (up to 5km) to the proposed airport on the Eastern side and will be included in the survey. In addition, the towns of Futila and Malombo have been included within the area of influence (Figure 51).In proximity of the water treatment plant and pumping station, located on the river of Chiloango, it is noted a school at Bichassanha that is situated within the flight path and could be impacted from airport activities.

It is expected that much of the unskilled workforce will come from these villages. Project will lead to an influx of workers and jobseekers to the area with a series of associated impacts. Fortunately, the contractor is familiar with the development and implementation of appropriate labor recruitment strategies including training opportunities to maximize opportunities for local residents thereby limiting influx. Even with a huge billboard advertising the new airport and the selected site, there were no signs of any new houses and structures in the vicinity.

For the purpose of the study, the area of influence that has been considered comprises a buffer zone of 10 km. (see Figure 51).

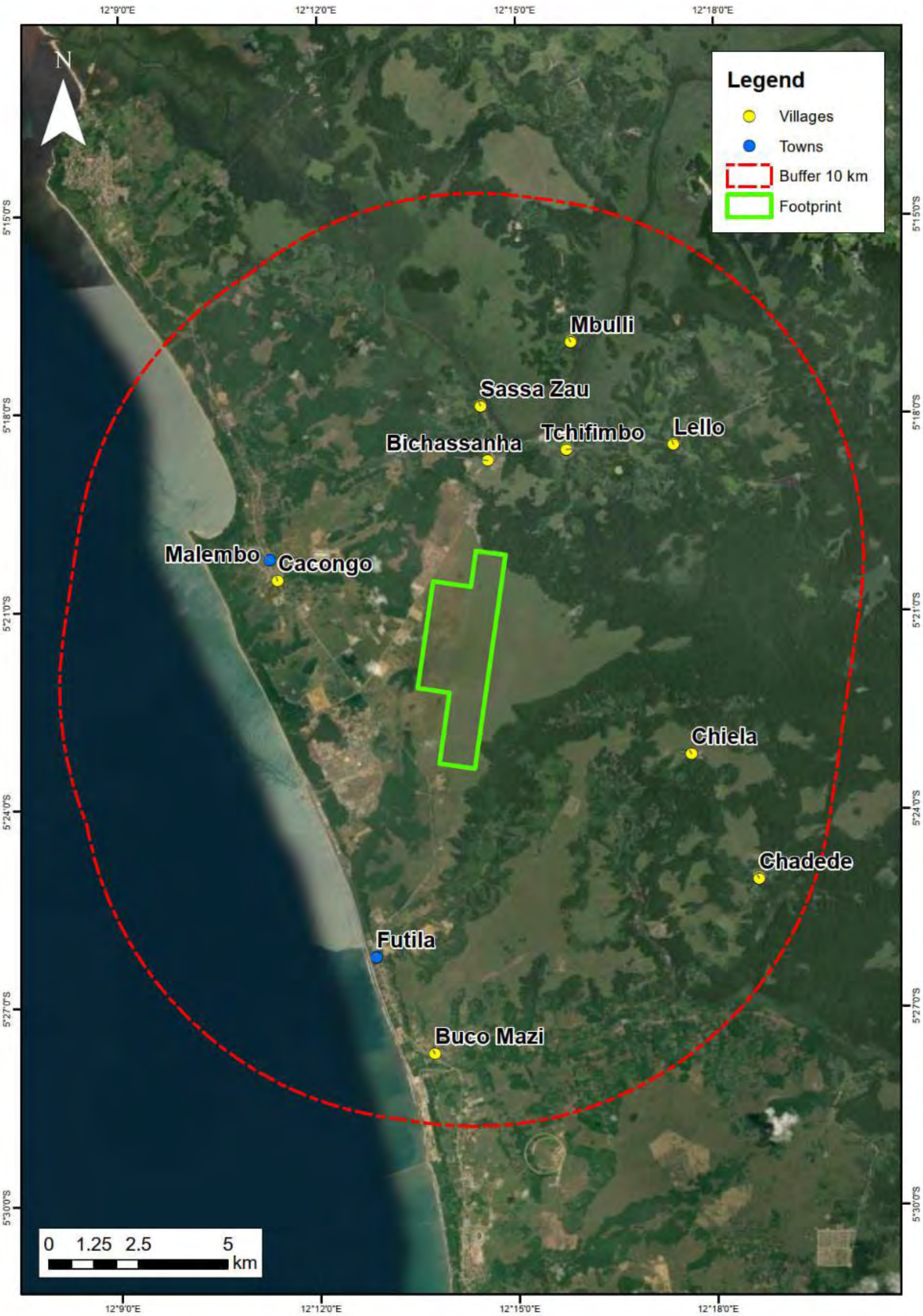


Figure 51: Villages and towns within the Project AoI.

2.6 Project Facilities and Associated Facilities

In the context of this ESIA, the following definitions apply:

- **Project Facilities:** the facilities constructed and operated by the Project, and activities directly associated with their construction and operation. The Project is expected to have full control of these components in terms of management of risks and impacts during construction and operations. These are described in section 2.3. The Airport access including the Sassa Zau roundabout, the Sassa Zau Road (EN202) and the NAIC access road are also considered Project facility, as defined in section 2.3.11.
- **Associated Facilities:** facilities that are not funded as part of the Project and that would not have been constructed or expanded if the Project did not exist and without the Project the facility would not be viable. These types of facilities are considered to meet the definition of an associated facility per IFC Performance Standard 1, par.8, second bullet and per the OECD CAs. Based on information available to date, an overhead power line of aprox 2 km will be constructed from Futila/ Malembo power plant to the Project site for supplying energy to the airport. As of today it is noted that the construction will be under the Ministry of Electricity responsibility and the power line will not be financed. This is considered an Associated Facility, however as it will be included entirely in the Area of Influence, impacts are assessed as part of the ESIA. A discussion about potential impacts generated by the construction of this facility associated to some mitigation measures are proposed in the Cumulative Impacts (see Chapter 17).f.
- **Primary supply chain:** facilities owned and operated by third parties supplying goods or materials that are essential to the successful operation of the Project, on an ongoing basis. These facilities are existing and will not be modified or expanded as a consequence of the Project or to make it viable. The level of control the Project can exercise may be limited, especially for suppliers further along the supply chain. Included is this category are the Futila/Malembo Thermal Power Station, the Cabinda water supply system and the quarries.
- **Other supply chain.** Facilities owned and operated by third parties and associated activities, which are not essential to the successful operation of the Project.

it should be noted that the Government of Cabinda has reported that the upgrade of the road network to/from Cabinda City (EN 100) is part of the broader development of the economic zone (as per the Government Master Plan), therefore, is not considered exclusive of the airport project. Accordingly, the upgrade of the road network will not be considered an associated facility as defined under IFC PS1. This will be considered in the Cumulative Impact Assessment (Chapter 17).

2.7 Land Acquisition

Land acquisition for government use in Angola is governed by a set of legal frameworks and administrative procedures, designed to balance the needs of development and public utility with the rights of landowners and any occupants.

Land rights are primarily defined in the Land Law (Lei de Terras e Angola), which was passed in 2004 and that outlines the principles under which land can be acquired, used, and disposed of within the country. This law recognizes different types of land rights, including those held by the state, communities, and private individuals. For government use, the law stipulates specific scenarios where land can be expropriated.

The government of Angola has the authority to expropriate land for public use. This is usually done for purposes such as infrastructure projects, urban development, or other public interest initiatives. Expropriation is typically a last resort and is subject to strict legal procedures to ensure fairness and compensation.

For this project the process began with a requirement to demonstrate the public interest and a justification of the reasons for acquiring the land including the broader public good. This was done in the Memorandum of

Description and Justification (Memoria Descritiva e Justificativa) as signed on 28 October 2022 that forms part of the broader Location Sketches (Croquis de Localizacao) as submitted under Oficio No 648/GVG/ST/6.18/2022 (See Annex A – Part 3).

It has been reported that there were no landowners or occupants of the area to be notified and therefore consultations were limited. Any dialogue and feedback from potentially affected parties were managed by the Government and WSP has not been informed of any possible appeals to the process. During the ESIA process WSP relied on the Ministry information. In addition, the public disclosure process did not highlight any previous or related disputes over land ownership, inadequate compensation, or delays in the legal process. This was also confirmed during the stakeholder engagement process carried out by WSP and the Contractor.

The process was completed with Presidential Decree No. 171/23 of 22 August 2023 that can be found in Annex A – Part 3).

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