**REPORT**

# New International Airport of Cabinda (NAIC Project) - Angola

*Environmental and Social Impact Assessment - Chapter 11 - Impact Assessment, Biological Components*

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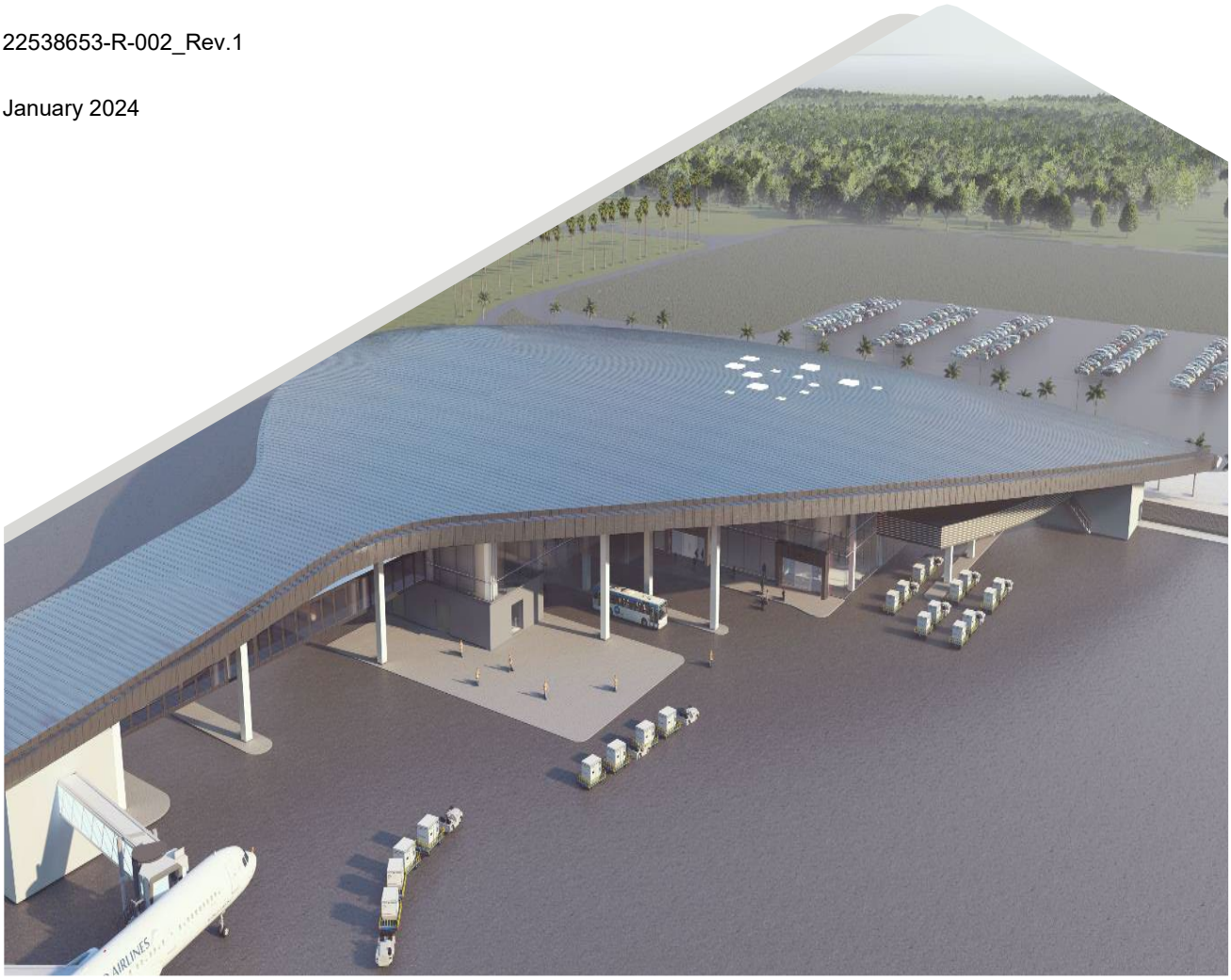

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# 11.0 BIOLOGICAL ENVIRONMENT – IMPACT ASSESSMENT AND MITIGATIONS

This section presents the results of the impact assessment on the biological components conducted according to the Impact Assessment Methodology described in Chapter 09 for construction phase. For each component it is presented an impact analysis, with related mitigation measures, and the residual impacts.

Regarding operation this section includes the preliminary impact assessment based on data currently available. Given the remote starting of operation, different responsibility and missing of some technologies that will be refined during the design phase, the assessment is done on a qualitative basis on the contrary of the construction phase which was done using also quantitative data.

## 11.1 Impact Assessment for Construction Phase

### 11.1.1 Impact Assessment

As described in Chapter 09 of this ESIA (IA Methodology), the Project actions carried out during the Construction phase could potentially generate direct and indirect impact on biodiversity. Direct impacts are expected within the Project footprint and of site installations, while indirect impacts are conservatively considered to be generated within a larger buffer zone of 2 km.

From a detailed analysis of the biodiversity in the Project's AoI (Area of Influence) it has been identified two components: "*Terrestrial habitat and ecosystem (flora and fauna)*" and "*Marine and freshwater habitat and ecosystem (flora and fauna)*".

The biological impacts that may be triggered by the identified impact factors during the construction phase are described in the following table (Table 1).

**Table 1: Impact Assessment for the biological components during the Construction phase.**

| Impact Factor | Impact Assessment | Components Affected |
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| Removal/degradation of soil and vegetation | Excavation activities prior to project construction unavoidably will lead to the removal of plant and soil material and their degradation. The area affected by this impact factor will be limited to the Project footprint. This area is mainly characterized by herbaceous vegetation and open shrublands with sparse trees. These habitats could potentially present some flora species of conservation, that could be directly affected by this impact factor through direct habitat loss and fragmentation. In addition, these habitats are populated and/or frequented by various species of fauna, of which some potentially of conservation concern.<br><br>The removal or degradation of vegetation and topsoil could cause habitat loss and degradation of suitable habitats for fauna species, the lack of food, the destruction of shelters and nesting sites. Moreover, local fauna could be directly impacted by activities performed during site preparation, in fact, they could cause the displacement of populations, the alteration of predation rate, the disruption of species interactions. | ■ *Terrestrial habitats and ecosystems (Flora and fauna)* |
| Change in the local morphology and topography | The construction of building foundations, buildings and airport facilities (*e.g.* roads, parking lots, aeronautical pavements) will lead to an irreversible change of the local morphology and topography. This could cause impact on: local surface drainage features, with a consequential decrease in water retention capacity of the soils; dry soil and the absence of adequate vegetation cover may increase localized erosion phenomena; and, could become a physical barrier for some species characterized by low mobility (such as amphibians and reptiles). | ■ *Terrestrial habitats and ecosystems (Flora and fauna)* |

| Impact Factor | Impact Assessment | Components Affected |
|---|---|---|
| | | |
| Change in the local hydrology and surface water quality | *See the description on the physical environment for more information on the type of impact.*<br><br>Any degradation of the surface water quality and changes of local hydrology could generate the destruction or modification of suitable habitats for fauna and flora that use the water as food (*e.g.* birds), shelter, and/or reproduction strategy (*e.g.* amphibians and invertebrate fauna). This factor could also generate modification in fresh- and marine water ecosystems (*e.g.* a river water velocity and river-bed characteristics will be modified), given the proximity to the coastal marine area. This impact could cause temporary fragmentation of the habitat suitable for fresh- and marine water species. Construction may also generate an uncontrolled release of sediment or other potential pollutants, which may cause a change in water quality (*e.g.* dissolved oxygen) due to silt deposition and accumulation. Although particulate run-off and sediment release would likely have a localized impact with sediments and pollutants moving downstream, the degradation of water quality may generate a loss in habitat suitable for fresh- and marine water species such as nursery areas. Although eutrophication is caused by air pollution, it affects our water bodies. This is a phenomenon where nutrients are abundant in an area, resulting in an overgrowth of algae and plant cover. This reduces the amount of oxygen and sunlight that penetrate the water. | ■ *Terrestrial habitats and ecosystems (Flora and fauna)*<br>■ *Marine and freshwater habitats and ecosystems (Flora and fauna)* |
| Emission of greenhouse gases<br><br>Emission of gaseous pollutants | *See the description on the physical environment for more information on the type of impact.*<br><br>These impact factors are potentially able to compromise the photosynthetic capacity of plants and cause different types of damage to the leaf apparatus, generating an overall depletion of the conditions of terrestrial habitats with consequent loss of biodiversity. Climate-changing gases can interfere with stomatal activity, causing an alteration of life cycles, an increase or anticipation of photosynthesis and an alteration of transpiration rates.<br><br>The most sensitive components of plant individuals are the foliar apparatuses. All habitats from herbaceous, shrub and tree species can be affected by the impacts of the emission of climate-changing gases.<br><br>The fauna component is also affected by the emission of polluting gases. These gases can cause injuries to the respiratory system, damage to the reproductive system, debilitative disorders of various species, leading in some cases to death. Moreover, the impacts could be also indirect, fauna species could be exposed to these pollutants through the frequentation of compromised habitats (*e.g.,* acidification phenomena) or the intake of contaminated food (*e.g.,* heavy metals). | ■ *Terrestrial habitats and ecosystems (Flora and fauna)*<br>■ *Marine and freshwater habitats and ecosystems (Flora and fauna)* |
| Emission of dust and particulate matter | *See the description on the physical environment for more information on the type of impact.*<br><br>The emission of dust into the atmosphere during the Project construction operations may negatively affect the structure of plant components in the surrounding area, causing phytotoxic effects, vegetation cover and also changes in the morphology and physiology of the flora, such as alteration and reduction of photosynthesis, respiration and transpiration with consequent leaf injury, stomatal damage, premature senescence, and reduced | ■ *Terrestrial habitats and ecosystems (Flora and fauna)*<br>■ *Marine and freshwater* |

| Impact Factor | Impact Assessment | Components Affected |
|---|---|---|
| | growth. This could result not only in the death of the plant organisms themselves, but also in degradation or loss of habitats.<br><br>Furthermore, impacts could also affect fauna species that depend on those habitats for food and shelter and on fauna species through inhalation or ingestion of dust and particulate matter particles. | *habitats and ecosystems (Flora and fauna)* |
| Emission of noise and vibrations | *See the description on the physical environment for more information on the type of impact.*<br><br>During construction phase, mainly all the activities cause noise and vibrations, starting from vegetation removal, through earthworks, mobilization of vehicles and building construction and the emission of this impact factor is expected to be of high intensity.<br><br>Anthropogenic noise emissions can impact wildlife at both the individual and population levels. The vulnerability of the fauna component to this impact factor depends on the species, their adaptability and the level of impact generated, both behaviourally and physiologically.<br><br>Continuous acoustic stress can lead to the alteration of certain biological rhythms such as increased heartbeat or increased hormone production.<br><br>In addition to physiological damage, important alterations in the behaviour of the species occur, as the emission of new noises can lead to the masking of the sounds of nature (such as birdsong, emission of low-intensity echolocation signals), thereby inhibiting successful reproduction, foraging and territorial defence. Additionally, some particularly sensitive species could increase their vigilance, hiding and retreating behaviours resulting in altered predation rate.<br><br>These behaviours lead to the abandonment of noise-polluted habitats and migration of populations to other areas.<br><br>Species particularly sensitive to noise are found in several taxa, including birds, bats, reptiles, and mammals. Several studies show that many species are sensitive from levels of 40-50 dB. | ■ *Terrestrial habitats and ecosystems (Flora and fauna)* |
| Emission of light | The emission of lighting radiations (in case of nocturnal work and/or for security reason) will have an impact on the biological component.<br><br>Light emission is knowns to cause disturbance to nocturnal, crepuscular, and diurnal species, affecting their circadian rhythms and their activity cycles. This impact factor directly affects some behaviour pattern through the disorientation of nocturnal fauna species and changes of night habits, with repercussions on foraging behaviour, reproduction-rate, migration, and communication activities. In addition, light pollution can disrupt plants by distorting their natural day–night cycle. | ■ *Terrestrial habitats and ecosystems (Flora and fauna)* |
| Existence of new buildings/infrastructures, visual impact<br><br>Land occupation | *See the description on the physical environment for more information on the type of impact.*<br><br>The physical presence of new infrastructures and artificial works is directly connected with the impact factor “Emission of noise and vibrations”. Even if the impact factor area extension is limited on the territory it can potentially constitute an element of interference with the fauna component and act as a deterrent to the frequentation of | ■ *Terrestrial habitats and ecosystems (Flora and fauna)* |

| Impact Factor | Impact Assessment | Components Affected |
|---|---|---|
| | these areas, causing avoidance and / or temporary abandonment of the site.<br><br>These activities will take away portions of territory where there are potentially present natural habitats and floristic emergencies (*e.g.,* species of conservation concern or species of particular interest for the sustenance of wild animals). Therefore, land occupation during the construction phase and the existence of new buildings will directly and indirectly, affect flora and fauna as physical and behavioral barriers to wildlife movement, habitat loss and fragmentation. | |
| Production of solid waste<br><br>Production of wastewater | *See the description on the physical environment for more information on the type of impact.*<br><br>An inappropriate waste management, in addition to being linked to soil and water pollution, leads to the attraction of wild fauna to anthropized areas, increasing the risk of contact with villages, increasing the wildlife mortality, through the contact with vehicles, or for hunting purposes or being poisoned and also increasing the risk of spreading diseases.<br><br>Untreated sewage entering rivers (or into the ocean) may negatively affect the habitat in the Project's footprint and in the neighbouring area. During the construction phase, wastewater produced by the working force and the washing of pieces of machinery could introduce a variety of contaminants into the fresh- or marine waters. These contaminants include personal care products, faecal pollution, and oil and gasoline-based products retrieved from the surface of pieces of machinery. All these substances may pose threats from aquatic life to terrestrial wildlife. Their impacts include harm to wildlife physiology, oxygen depletion due to the increased microbial activity, restrictions on recreational water use, fish and shellfish harvesting, and contamination of drinking water by pathogens with an increased risk of diseases. | ■ *Terrestrial habitats and ecosystems (Flora and fauna)*<br><br>■ *Marine and freshwater habitats and ecosystems (Flora and fauna)* |
| Influx of population | Human presence in the Project area could lead to an increase in the exploitation of natural resources (*e.g.* illegal and unsustainable hunting and fishing, mining) with consequential pressure on the near forest habitats and marine and freshwater fauna. Moreover, Human-wildlife conflicts (*e.g.* fatal and non-fatal accidents) could increase. | ■ *Terrestrial habitats and ecosystems (Flora and fauna)*<br><br>■ *Marine and freshwater habitats and ecosystems (Flora and fauna)* |
| Increase of road traffic<br><br>Improvement of road network | During the construction phase, a considerable flow of traffic is expected, and it is expected to increase in various new areas due to the improvement of the road network and it will involve both ordinary and heavy vehicles. The worldwide decline of various animal species is attributed by many studies to mortality events due to road collisions. Fauna species are attracted to roads for a variety of reasons, and increased vehicular traffic in addition to cause direct mortality for animals could also cause the indirect habitat degradation and populations decrease. The elements most susceptible to road collisions are undoubtedly taxa with less mobility, such as amphibians, reptiles (snakes and lizards) and mammals, especially small ones. | ■ *Terrestrial habitats and ecosystems (Flora and fauna)*<br><br>■ *Marine and freshwater habitats and* |

| Impact Factor | Impact Assessment | Components Affected |
|---|---|---|
| | These impact factors are directly connected to the "Influx of population" and the increase of human pressure on wildlife (*e.g.* bushmeat trade and illegal hunting). | *ecosystems (Flora and fauna)* |
| Introduction and spreading of invasive alien species | The spreading of invasive alien (non-native) species could accidentally be introduced by cars, trucks, and other heavy machinery used during construction. These species are a threat to native biodiversity and related ecosystem services, they can heavily impacting native species as well as the structure and function of ecosystems through alteration of habitats, predation, competition, the transmission of diseases, the replacement of native species throughout a significant proportion of range and through genetic effects by hybridisation.<br><br>Invasive alien species tend to have an advantage in disturbed and anthropized ecosystems, thus, if a management and control plan for invasive species, with careful prevention measures, is not created, habitats around the construction site could experience a decrease in biodiversity, with a consequent trivialization (potential appearance of more dominant species) of the ecosystem in a small area close to the Project site. Local fauna that depends on those ecosystems could also be indirectly affected by the habitat degradation. | ■ *Terrestrial habitats and ecosystems (Flora and fauna)*<br><br>■ *Marine and freshwater habitats and ecosystems (Flora and fauna)* |

### 11.1.2 Mitigation Measures

The mitigation measures listed in the Table 2 follow the mitigation hierarchy and are proposed for the construction phase; these measures will be implemented in addition to the embedded Project mitigation measures which are a standard procedure applied by the Contractor and, eventually, by ASGC to achieve compliance with legal requirements and regulations and alignment with good industry practice.

Some of the mitigation measures listed above are taken by the "Physical Impact Assessment" (Chapter 10 of the ESIA), since they must be considered of high priority for the effectiveness on the Biological and Ecological component.

**Table 2: Mitigation measures for biological and ecological component during the Construction phase.**

| Mitigation hierarchy | Mitigation Measure |
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| **Impact factor: Removal/degradation of soil and vegetation** | |
| Avoidance | Avoid the unnecessary removal or degradation of soil and vegetation.<br>The Contractor will forbid unnecessary soil excavations and vegetation clearance which can lead to a soil weakening and an excess of waste generation. The Contractor will plan the soil and vegetation removal activities.<br>The Contractor will ensure that:<br>• the Project's footprint will be minimized, only the strictly necessary soil portion will be degraded and – consequently - only the strictly necessary buildings and facilities will be built;<br>• the amounts of excavated soils and rocks and the vegetation clearance will reflect the Project's specifications (about 270k $m^3$ of topsoil and 630k $m^3$ of subsoil, inclusive of the areas already excavated);<br>• an attentive planning and supervision of the activities will prevent potential unnecessary intentional or accidental deterioration of soil and vegetation;<br>• the excavation fronts, considering the lithology on site, will have a natural slope angle of 30° (in case no barrier, mash or other types of soil containing measures will be installed) for preventing further soil deterioration through sliding and falls. |
| Avoidance | Avoid using pollutant practices for removing the vegetation.<br>The use of fire, harmful herbicides or similar substances will be strictly prohibited. For preventing the spread of pollutants, the Contractor will forbid the usage of those pesticides considered dangerous, herbicides and additives which are harmful for the human health and the environment. A Pesticides Management Plan will be developed with provisions on the management of harmful pesticides. The Contractor will also ensure that vegetation will be removed mechanically and not with the use of fire.. |
| Avoidance | Avoid works during nesting/breeding periods.<br>An expert ecologist will perform a site reconnaissance in the footprint area, to identify any fauna species (i.e. within 7 days before clearing). If any nest site are found in the Project footprint, the Contractor will forbid any tree/bush cutting during the nesting/maternity period for birds (from April until July) and bats (two pick seasons one in May-July and the second one in November-December). During the same period ground disturbance activities will also be limited to avoid disturbing ground-nesting species, and species with limited mobility, such as reptiles and amphibians. |
| Minimization | Flora site recognition<br>The Contactor (or the Project owner) will ensure to have an expert ecologist (flora and fauna specialist) in the HSE department to manage the field activities according to the proposed mitigation measures.<br>As a result of the "Additional Field Survey", which will be performed during the dry season, should any CH species identified in the Project's footprint area, this mitigation measure will be performed.<br>An expert ecologist will perform a site reconnaissance in the footprint area to check the presence of Flora individuals belonging to flora species triggering CH, directly impacted by the project will be identified. Upon this reconnaissance, the flora species identified are going to be salvaged prior to construction and directly translocated to the appropriate sites. The identification and |

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| | flagging of individuals to be translocated will take place preferably during the flowering season of the species, while the translocation of individuals be performed during the dormant stage to minimize stresses to the plant. The data regarding date, location, source populations, and number of individuals collected and translocated will be recorded.<br>A *Biodiversity Management Plan* will be developed to address the protection of flora species over the construction period. A Salvaging and Translocation section will be prepared based on the construction schedule. Collection and translocation techniques and suitable translocation sites will also be identified within the Plan. |
| Minimization | Fauna site recognition<br>An expert ecologist to minimize fauna mortality, will perform a site reconnaissance in the footprint area, to identify and relocate fauna species (i.e. within 7 days before clearing). The survey will focus on fauna species with limited mobility (e.g., reptiles and amphibians) that cannot move ahead of construction as well as the presence of nests and subway dens. If any of these species are observed, they will be collected by the ecologist and translocated to undisturbed and suitable local habitats identified.<br>A *Biodiversity Management Plan* will be developed to address the protection of fauna species over the construction period. Instruction regarding collection and translocation techniques and suitable translocation sites will also be identified within the Plan. |
| Minimization | Fauna site recognition<br>This action is only relevant where vegetation clearance activities cannot be avoided during the breeding season; main bird breeding season in the Project area is from April to July. The Contractor will plan the check for nesting birds that will be undertaken within 48 hours of vegetation clearance by a qualified ecologist. If breeding birds are discovered, then works will be postponed in that area until the breeding cycle is complete (this may take up to three weeks). A species-specific buffer zone (minimum 25 m) will be set up around the nest site following consultation with a qualified ecologist. |
| Minimization | Flora seed collection.<br>As a result of the “Additional Field Survey” which will be performed during the dry season, if any flora species triggering CH are found in the Project’s footprint area, this mitigation measure will be performed.<br>Seed collection will be performed for endemic/rare/protected flora species, identified within the Project AoI, with regard for those triggering CH.<br>The seed collection and conservation will follow the best practice indicated by the Millenium Seed Bank.<br>Seeds collected will be separately stored for each species and sub population using clearly identifiable codes and will be donated to the most appropriate Seed Bank in Africa for storage and scientific research. |
| Minimization | Minimize the effects of the moving vehicles.<br>The over consolidation of soils and the vegetation disruption will be prevented or at least limited by keeping the moving vehicles (e.g., dumper trucks, concrete mixers, bulldozers) on predefined paths and roads to be well identified prior starting the construction activities. Such roads will be properly paved, highlighted, and delimited. The same rules will be applied to the area on which the construction operations already started. Off road driving will be prohibited in order to avoid any unnecessary disturbance of natural vegetation. |
| Minimization | Demarcation of on-site natural habitats<br>On-site natural habitats adjacent to Project sites will be preserved by the Contractor from unintentional disturbance during construction. Temporary demarcation could be provided by highly visible wooden sticks (50 cm high) planted into the ground and /or flagging tape, while a more permanent fencing could be provided in areas of particular sensitivity (*e.g.,* forest, and non-permanent streams) or subject to higher risk of disturbance. In this case appropriate signage will be installed to make the area recognizable by operators and to comply with H&S regulations and plans. Awareness among employees and contractors working on site about the protected species/habitats potentially present in the area will be developed, to ensure constant monitoring and promote actions to be taken if wildlife is encountered. |
| Minimization | Minimize mortality in deep excavations.<br>The Contractor will cover or fence all the deep excavations to prevent the access of wildlife and people while not working (including at night). Twice weekly checks of open trenches and other |

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| | excavations will be undertaken to identify any entrapped mammals. Rescue of any entrapped animals will be undertaken with extra care to minimize animal stress and the risk of injury. For trenches that will need to be left open for a considerable time, install slopes or other escape measures for small animals at places that are not fenced of (where possible). This may reduce the need for twice weekly monitoring and therefore personnel costs considerably. |
| Minimization | Proper storage of topsoil.<br>Removed topsoil will be moved and stored by the Contractor in a proper area at the Project Site to be used for landscaping after construction. This topsoil will also be used for restoration activities. Topsoil will not be mixed with subsoil or rock-like topsoil materials. Topsoil shall be stored at a location that is shielded from the construction activities on geotextile sheeting will be covered to be protected from the weathering and will be marked clearly. The topsoil should not be positioned adjacent to ditches, water courses, future excavations, and other construction activities. |
| Restoratin | Restoration of degraded habitats<br>The Contractor will recover degraded areas during the construction phase by planting native flora species.<br>All recovered areas must be maintained, and specific instruction will be integrated in a specific *Biodiversity Management Plan*. The Contractor should implement a monitoring plan, keep track of the restoration activities, evaluate their effectiveness, and should implement a maintenance plan. The plan must include the control of the quality of the plant soil, the quality of mixtures for hydroseeding, the engraftment of planted trees and shrub individuals, the management of reforested areas over time, and the use of rescue irrigation if necessary. |
| **Impact Factor: Change in the local morphology and topography** | |
| Avoidance | Avoid unnecessary morphology and topography changes.<br>The Contractor will ensure that unnecessary leveling and excavations will be avoided. The excavation rates will follow the Project design specifications, which will be designed based on the site-specific characteristics and the natural state of the landscape. Likewise, even the creation of unnecessary high reliefs will be avoided. No unauthorized and uncontrolled piles and mounts of soil and rocks, debris, or waste (although temporary) will be raised, and no digging of materials will be allowed. |
| Minimization | Minimize the disturbance to the existing contour.<br>The Contractor will ensure that no excessive changes in the local morphology and topography will be generated and that – where possible - the general slope of the site will be preserved. The operations will strictly follow the Project design drafted accordingly to specific technical studies. The works will consider the morphology and topography of the site and the pattern of the water flow and the infiltration rates. During the vegetation clearance, the excavation and the foundations laying, no voids will be left (i.e., sinking prevention) and no unnecessary soil over consolidation will be carried out. |
| Restoration | Restore the excavated areas in a short time.<br>The Contractor will ensure that the excavated areas will be restored in a short time using the most effective bio-engineering techniques (*e.g.,* slope plantings, plant-root reinforced and anchored slopes). These actions will prevent generating landslides, collapses, and pits and ponds due to heavy rains. Restoring the excavated area will also have a positive effect on the overall visual impact of the construction site. |
| **Impact Factor: Change in the local hydrology and surface water quality** | |
| Avoidance | Avoid improper management of stormwater.<br>The temporary drainage system will generate stormwater surface, seasonal water channels and water ponds. These changes and alteration of hydrological regimes will attract animals whose growth, survival and breeding may be altered and compromised.<br>The Contractor will ensure that:<br>– the stormwater will be properly collected through a functional surface temporary drainage system and discharged, after applying a proper filtration or treatment, to ponds (for reusing it onsite, where possible) and/or to seasonal natural water channels/streams;<br>– the discharge into the seasonal natural water channels/streams will exclusively occur during the rainy season; |

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| | – the ponds content (i.e., rainwater) will be reused (prior assessing the absence of pollutants) to the extent possible;<br>– the ponds will be periodically emptied by vacuum trucks, operated by proper licensed companies;<br>– the ponds emptying frequency will be defined considering the rainy season and the dry season;<br>– the ponds bottom will be covered with a waterproofing layer for avoiding the soil absorption of the wastewater;<br>the ponds will be properly fenced, and their water level will be assessed continuously by appointed workers. |
| Avoidance | <u>Avoid leaks and spills to surface water bodies.</u><br>Even though there are no lakes, rivers, or ponds in the immediate vicinity of the Project area (the closest major river is the Chiloango, located about 5 km from the site, as already mentioned above) transportation of materials to site could be a potential source of surface water bodies pollution, especially in the wet season when seasonal water streams are generated in case of storms and heavy rains. Pollutant leaks and spills potentially generated during transportation by road will be avoided. The moving vehicles (e.g., trucks, dumper trucks, concrete mixers, bulldozers, etc.) will follow predefined paths and roads, will avoid crossing water bodies and will be regularly cleaned and repaired/maintained. For example, the Contractor will ensure that vehicles will be rinsed before leaving the construction site, goods and materials transported properly secured to avoid tripping, flipping and overflows . Vehicles will be equipped with spills prevention kits and the drivers will trained for properly behaving in case of incidents, accidental spills and leaks. A *Traffic Management Plan* will be drafted and adopted. |
| Avoidance | <u>Avoid discharging liquid, semi-solid or muddy materials into surface waters.</u><br>The Contractor will ensure that no intentional or accidental discharge of liquid, semi-solid or muddy materials into surface waters will be carried out. The proper supervision of materials quantities, paths and destination will help preventing such potential issue. |
| Avoidance | <u>Avoid generating water pits and ponds.</u><br>The Contractor will prevent any type of action that can lead to the generation of pits and ponds such as soil over consolidation and uncontrolled wastewater discharges. Proper runoffs and stream channeling design will prevent such risk. In case heavy rains leads to the generation of pits and ponds, the Contractor will promptly complete their removal by pumping the water by means of vacuum truck and disposing it of as per the Project specifications and requirements. |
| Minimization | <u>Minimize surface water the pollution of the sea.</u><br>The potential pollution of minor surface water bodies (*e.g.*, seasonal water channels) will be avoided by avoiding pollutant runoffs with potential adverse effects:<br>• the solid and liquid storage of products and waste on the construction site will be properly managed;<br>• the fine-grained material will be stockpiled, and placed 30 m from drains and water channels;<br>• spreading and runoff of uncontrolled wastewater, oils, fuels or chemicals will be avoided;<br>the Contractor will design and install a station for managing wastewater from the construction site activities (WWTP, see the section of the Impact factor *Production of wastewater* for further details). |
| Restoration | <u>Restoration of degraded freshwater and marine habitats</u><br>Proper mitigation and monitoring measures are put in place thought the physical component and the *Wastewater Management Plan.* If any freshwater and marine habitats are degraded by the construction activities, the Contractor will implement recovery actions for those habitats to maintain the form and function of these ecosystems. Specific instruction will be integrated in a section of the *Biodiversity Management Plan*. The various restoration techniques include physical methods such as sewage interception, dredging, algae removal, and biological processes which include restoration of aquatic plants and/or bio-membrane techniques.<br><br>All recovered areas must be maintained. The Contractor should implement a monitoring plan, keep track of the restoration activities, evaluate their effectiveness, and should implement a |

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| | maintenance plan. The plan must include the control of water quality, fresh and marine biodiversity, and the maintenance of the ecological balance. |
| **Impact Factors: Emission of greenhouse gases and Emission of gaseous pollutants** | |
| Avoidance | <u>Avoid leaving the vehicles, equipment and machinery turned on while not in use.</u><br>The combustion of fossil fuel from construction machinery will generate GHGs, Sulphur compounds, Nitrogen oxides, Hydrocarbons, and other pollutants. Also, the diesel-fueled equipment and machinery such as heavy-duty vehicles (e.g., dump trucks, cement mixer, transport trucks, excavators, cranes and bulldozers) and stationary engines (e.g., generators, pumps, compressors, mobile cement mixer trailer) will generate exhaust emissions (i.e., Carbon, Polycyclic Aromatic Hydrocarbons PAH, and metals). The Contractor will ensure that engines, vehicles, equipment and machinery are properly switched off/turned off while not in use. |
| Avoidance | <u>Avoid using machinery, equipment and vehicles that don't undergo periodical control and maintenance.</u><br>For preventing the increase of the emissions and enhance the Project environmental impact, according to the Project standards the Contractor will carry out:<br>• regular periodical maintenance on equipment and machinery;<br>• periodical maintenance and control on the emission control systems (e.g., aspiration and filtration systems) serving the machinery, equipment and vehicles;<br>• periodical verifications on the fuel and oil types used and on their consumption;<br>• periodical control on the speed of moving trucks;<br>• periodical verification of the weight of the truckloads.<br>The Contractor will ensure that a specialized subcontractor will carry out the periodical maintenance and control activities and that such activities will be tracked by registering them on a dedicated log to be kept on site. |
| Avoidance | <u>Avoid using non-compliant chemicals.</u><br>The Contractor will ensure that the materials and chemicals used onsite (i.e., paints, glues, oils, thinners, and plastics) will all be sourced and purchased according to the Project standards. The usage of non-compliant or unlabeled chemicals will not be allowed. The chemicals bins and trays will be properly labelled. The materials and chemicals' labels will show the product name and the hazard pictograms (e.g., Hazardous to the environment or Acute toxicity symbols). Each product will be equipped with its updated MSDS showing the productor name, the chemical formula/the components, the hazard pictograms, the warnings and the danger indications and the safety advice on the proper personal or collective protection equipment to be used for the handling. |
| Avoidance | <u>Avoid unproper management of chemicals.</u><br>The Contractor will ensure that the materials and chemicals used onsite will be properly stored in dedicated locations which will be locked-up and well-ventilated. The bulks, cans, bins, and trays will be closed/sealed for avoiding pollutants runoffs. |
| Avoidance | <u>Avoid open burning of solid wastes.</u><br>Whether hazardous or non-hazardous, the Contractor will forbid the open burning of solid wastes. The generation of polluting emissions from this type of source cannot be controlled effectively. |
| Minimization | Minimize the greenhouse gases emissions.<br>ASGC shall report on the actual usage of fuels, electricity usage etc during the construction period as per detail provided by OEC in monthly monitoring reports. The quantification of GHG emissions will be conducted by OEC annually in accordance with internationally recognized methodologies and good practices. The Contractor will monitor/record/report relevant data to ASGC for and will decrease the overall greenhouse gases emissions throughout the construction phase by adopting specific measures such as:<br>– adopting a *Pollution Prevention Plan* and an *Air Quality Management Plan* that will include a specific section on the GHGs;<br>– minimizing, to the extent possible, the impact of materials and goods transportation to site by defining preferential roads (i.e., shorter paths). Considering that some construction activities related to the workers camp have already started, the Contractor should ensure |

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| | that the roads have been properly defined. The materials and/or equipment used at site will travel by road, by sea and by air as they will come from quarries close to Cabinda (i.e., via national roads) and from other parts of Angola, of Africa, Europe, South America and Asia. The Contractor should try to source materials from nearby suppliers and prefer, where possible, transportation methods with minor impact on the environment;<br>– sourcing, where practical and cost-effective, plants, machineries, vehicles, and equipment operating on carbon-neutral biofuels or renewable energies;<br>– ensuring that the cooling systems to be installed in the administration/offices area will contain exclusively refrigerant gases with low global warning potential (GWP); the cooling system will be periodically inspected for detecting potential pollutive gas leakages;<br>– defining strategies for decreasing waste generation through reuse and recycling limiting waste disposal to landfills (see section *Production of solid waste*);<br>preferring eco-friendly building materials and considering installing renewable energy on-site to be used for the construction phase and then also to be transitioned to the operational stage. It should be considered that concrete is one of the most carbon-intensive construction materials as it requires extreme heat and releases a great deal of $CO_2$. The Contractor should evaluate the opportunity of using low-carbon concrete over traditional materials (i.e., low embodied carbon construction materials). |
| **Impact Factor: Emission of dust and particulate matter** | |
| Avoidance | <u>Avoid dust emissions deriving from the construction materials storages and from the excavated soil and rocks piles and mounts.</u><br>The Contractor will draft and adopt a *Dust Management Plan*. Specific mitigation measures will be adopted on site for avoiding dust and particulate matter spreading:<br>– the excavated material temporarily stored at the different construction areas for later use, disposal, or reuse in other areas, will be properly segregated, kept wet by spraying water to limit dust generation;<br>– the granular material will be stored in stalls, or in controlled and treated heaps protected with tarpaulins;<br>– covered and uncovered warehouses for storing small/medium construction materials and equipment will be installed;<br>– the height of the mounds/piles of loose material will not exceed 2 m and the slope angle will not be more than 30° for preventing flows and sliding;<br>– wind barriers (protective fences) will be used when necessary.<br>The Contractor will supervise the construction site for ensuring the proper adoption of the mitigation measures and the compliance to the *Dust Management Plan* by carrying out periodical visual inspections. |
| Avoidance | Avoid dust emissions from moving vehicles.<br>The Contractor will define rules, guidelines, and indications within the Traffic Management Plan to manage dust emissions from the construction areas. The Contractor will periodically assess the site compliance to the management plan. Actions that will be implemented on the Project area during the construction activities for avoiding the dust spreading from moving vehicles could include:<br>– when needed under specific dust conditions and at designated areas roads will be sprayed to reduce dust generation;<br>– the definition of pre-defined routes for vehicles across the construction areas;<br>– adopt speed limit for heavy vehicles within construction site;<br>– when needed and at designated areas, gravel could be disseminated for increasing the surface strength and decreasing the particulate and dust emissions;<br>– trucks and other moving vehicles transporting loose materials will be covered up during transportation for avoiding dust and particles spreading;<br>– fenders will be applied to the wheels of the trucks against dust emissions. |

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| | – the access to the Project area will be forbidden to delivery trucks showing oils and fuel losses/dripping or clear signs of engines breakages;<br>– trucks and other moving vehicles that will leave the project site will be washed/cleaned if necessary prior to leave the construction site.<br>The Contractor will supervise the construction site for ensuring the proper adoption of the mitigation measures by carrying out periodical visual inspections. |
| Minimization | Minimize the dust emissions deriving from the construction activities.<br>Earthworks, excavation, soil stripping and earthmoving will generate dust and particulate matter, especially during the dry seasons. The Contractor will ensure that:<br>• the water available on site for the dust suppression is enough;<br>• the construction activities will not result in exceedances of the air quality objectives/limit values for gaseous pollutants and for dust deposition;<br>• the dust control and mitigation measures provided in the management plans and described in the Project standards will be effectively applied;<br>• the excavation surfaces will be stabilized, covered up and/or re-vegetated as soon as possible;<br>• abetment measures and control systems (e.g., welding tents and barriers or mobile aspirators equipped with filters) will be adopted, when needed. Operations such as welding, cutting, grinding and sandblasting (representing major sources of airborne particles) will be carried out by using proper equipment and techniques compliant to the environmental and safety measures, especially when harmful construction materials containing silica (e.g., concrete or abrasives) are processed;<br>• where possible, hazardous and pollutant operations such as cutting will be avoided by preferring prefabricated materials;<br>• mobile plants for crushing, screening, and grading the materials should be authorized by the appropriate local Authority and should be sited as far away from possible from sensitive receptors.<br>The Contractor will carry out periodical on-site visual inspection for assessing the proper management of dust control measures and will carry out also monitoring campaigns of dust, particles, and gaseous emissions (by measuring the air quality parameters $PM^{2.5}$, $PM^{10}$, $O_3$, $SO_2$, NO, $NO_2$, $NO_X$, metals and VOCs) for adopting proper measures is case the amount increases. |
| Minimization | Minimize the dust emissions deriving from the trucks loading and unloading.<br>The Contractor will ensure that the trucks loading and unloading operations will be carried out properly and that limited amounts of dust and particulate will be issued. The workers appointed, when possible, will spray down with water the materials over dump trucks before the unloading. |
| Restoration | Restore the highly degraded soil and excavated areas.<br>Where and to the extent possible, the Contractor will restore the roads and the construction area surfaces to their earlier conditions for preventing the continuous issuing of dust and particulate matter in time. |
| **Impact Factor: Emission of noise and vibrations** | |
| Avoidance | Avoid rearing and breading periods.<br>The Contractor will plan activities involving high noise levels to commence each year outside the breeding and rearing periods (depending on the species). |
| Avoidance | Avoid night works.<br>From 6pm to 6 am, at least, night works will be avoided to reduce impacts to nocturnal fauna species, especially bats. |
| Avoidance | Fauna deterrents.<br>Visual, physical, or audio deterrents will be installed to keep fauna away from construction areas. For example, using nets, fencing, or other barriers as well as streamers, reflectors, and flagging. |

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| Minimization | Use of sound barriers<br>The installation of acoustic barriers could help minimize the impact of noise emission and vibrations. The contractor should consider the installation of the following sound barriers or a combination of them, based on the availability on-site:<br>• artificial acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m² to minimize the transmission of sound through the barrier. Barriers should be located as close as possible to the source or to the receptor location to be effective;<br>• earth berms structures constructed from soil designed to block sound. Wind blowing from source to receiver can reduce the efficiency of noise barriers. Earth berms with gradual slopes less than 18 degrees can negate this effect. Steeper-sloped berms with a flat top are also effective. Include large, irregular features and surfaces (e.g., stepped, undulating topography) to attenuate more noise. Adjust berm height based on topography and the type of traffic using the road. Higher berms are more effective at noise reduction; however, higher berms require a wider base which can be a cost and space constraint. Conventional berm height is 3-4m. Plant berms with grasses, forbs, shrubs, and trees (where acceptable) to provide cover and attenuate some noise;<br>• low-height barriers: generally, have a height and width less than one meter. Cap barriers with low-density soil, coarser rock, and other natural materials. Prefer lower-gradient slopes to straight barriers to permit wildlife mobility. Roughen slopes and include irregular features (to depth of 25cm). Plant with grass, forb, and shrub species to attenuate noise and provide wildlife cover and forage.<br>Specific instruction will be integrated in a section of the *Biodiversity Management Plan*. |
| Minimization | Minimize noise emissions from facilities and vehicles.<br>During construction phase the Contractor will:<br>• select the equipment with lower sound power levels. The noise emission of equipment used at the site, expressed in terms of sound power level (LwA), must comply with the noise limits according to the power (kW) of the equipment;<br>• install silencers for fans, install suitable mufflers on engine exhausts and compressor components, install acoustic enclosures for equipment casing radiation noise, vibration isolation for mechanical equipment;<br>• maintain regularly the equipment to ensure noise levels are maintained within requirements;<br>• reduce noise impact from vehicle transport by switching off machinery or equipment engines during idle hours. |
| **Impact Factor: Emission of light** | |
| Avoidance | Avoid emission of light on sensitive areas<br>The Contractor during the construction phase will:<br>• avoid direct light to the adjacent natural areas. Direct lights solely onto work areas (i.e. use of spotlights instead of flood lights). For road and amenity lighting installations, light near to and above the horizontal should normally be minimized to reduce glare and sky glow;<br>• avoid long wavelength light sources, higher than 700 nm, thus red lights. Red lights showed the strongest attraction of migrant birds. Avoid light with blue/violet (400 – 500nm) and ultra-violet wavelengths ( < 400nm). Also, avoid use of white LEDs that contain high short wave blue light components. Most wildlife species are sensitive to shortwave blue/violet light. This light also scatters more readily and contributes to skyglow. |
| Minimization | Implement lighting solutions on the project site to reduce the potential fauna attraction.<br>The Contractor, during the construction phase, will:<br>• plan the lighting to ensure a level of light required for the safety of the workers and the safety of the equipment while minimizing the luminous level;<br>• minimize activities at night, particularly where the project is in proximity to sensitive ecosystems;<br>• when selecting luminaires ensure that suitable products are chosen and that their placement minimizes stray light and glare. Prefer dark-sky compliant full-shielded (i.e., |

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| | full cut-off) light fixtures that direct light downwards below the horizontal plane and result in no up-light;<br>• keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°. Higher mounting heights allow lower main beam angles, which can assist in reducing glare;<br>• when lighting vertical structures, direct light downwards wherever possible. If there is no alternative to up-lighting, then the use of shields, baffles and louvres will help reduce spill light around and over the structure to a minimum;<br>• in rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimize visual intrusion within the open landscape;<br>• use more warm-white light sources, as proposed by many organizations (The Dark and Quiet Skies consortium, the International Union for Conservation of Nature and United Nations Office for Outer Space Affairs). Use green “bird friendly” high-pressure sodium bulbs for lighting as a means to reduce attraction to nocturnally migrating birds, particularly in locations where turning lights off is not possible;<br>• use amber spectrum bulbs (wavelength of 500 – 700nm), with minimal blue. Best is with light sources higher than 560nm;<br>• consider lumens (amount of light produced) rather than watts (amount of energy used) when selecting lighting and prefer low glare lighting fixtures to reduce excessive brightness and diffuse light. Low glare options can also require less energy;<br>• using non reflective surface treatments for project facilities. Reduce building contrast levels by using finishes with low reflectance levels and colors that match natural landscapes. Where possible, structures on the site will be dark in color to absorb light reflection;<br>• consider flashing lights instead of steady lights. Flashing lights are believed to be less attractive to birds than steady lights;<br>• consider use of vegetative screens (e.g., trees and shrubs) and wildlife tunnels to shield habitat for light-sensitive wildlife. |
| **Impact Factors: Existence of new buildings/infrastructures, visual impact and Land occupation** | |
| Avoidance | <u>Avoid using locations not included within the Project area boundaries for storing materials and equipment.</u><br>The Contractor will ensure that no materials, waste, or chemicals storages will be carried out outside of the Project area boundaries. All the activities and operations will be limited to the Project area. The Contractor will appoint dedicated specialists who will periodically visit the site surroundings at the site boundaries and will ensure that the Project area perimeter is free, cleaned and in its natural pre-construction state. |
| Avoidance | <u>Avoid fauna from being trapped.</u><br>All conduits, excavations, pits etcetera will be covered/fenced by the Contractor to avoid fauna being trapped or to avoid falls and/or injuries. A dedicated specialist will periodically control the surroundings and Project's fences. |
| Minimization | <u>Minimize the project footprint.</u><br>The Contractor will organize the construction site areas and the storage areas of material and work vehicles in such a way as to optimize the spatial footprint and reduce as much as possible the footprint on the ground. |
| Minimization | <u>Minimize birds’ collision.</u><br>The Contractor will install window decals or non-reflective window covering to reduce the potential for bird window strikes. In addition, use bird-friendly glasses or bird bollards to be installed on glass to avoid reflective glass that birds confuse with habitat. |
| Restoration | <u>Restore immediately areas where spills and leaks occur.</u><br>In case of leaks and spills, the Contractor will appoint properly trained workers for removing the contaminated soil and replacing it with uncontaminated fill sand or other similar soil so that the level of contamination at the site will be immediately decreased and the human, the ecosystems, the fauna and flora exposure to contamination will be avoided. The excavated contaminated soil will be then properly stored on site and transported to a landfill or other facility for the appropriate |

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| | treatment and disposal based on the waste characteristics of the soil and based on the applicable legislation. |
| Restoration | Restore the areas where temporary deposits have been dismantled.<br>As storage and temporary deposits areas will be decommissioned, these will be restored, cleaned and destinated to other purposes or vegetated, with native species. |
| **Impact Factors: Production of solid waste and Production of wastewater** | |
| Avoidance | Avoid the unnecessary waste generation.<br>The Contractor will ensure that any type of unnecessary waste generation (solid and water) will be avoided during the construction phase. The HSE team onsite will develop systems and strategies for improving waste recycling and for reusing materials as by-products, where possible. The Contractor – when possible - will choose waste recycling or recovery plants for landfills. Waste that cannot be recycled, will be transported to the closest suitable treatment or disposal site. The waste management will be compliant with the Project specifications and the *Waste Management Plan* to be drafted and adopted on site. |
| Avoidance | Avoid exceeding the estimated generation of wastewater.<br>The Contractor will ensure that:<br>• the construction site maximum monthly production of wastewater will be of 60,000 liters/day by measuring the discharges. A flow meter (or a flow sensor) will be installed on the wastewater discharge outputs for measuring the amount of liquid waste and the flow rates;<br>• the wastewater will be treated in the WWTP and that will include the civil/domestic wastewater (to be collected, treated and discharged to the sewage system installed onsite), the stormwater (to be collected through a surface temporary drainage system and discharged to natural courses) and the wastewater deriving from the equipment and machinery washing and cleaning;<br>• the discharges will be constantly monitored for avoiding negative effects on the quality and quantity of the local groundwater.<br>If the data will show any excess or peak values, the Contractor will immediately carry out an inspection on the equipment (plants, sensors, and flow meters) and will appoint a subcontractor to carry out the repair and maintenance eventually needed. |
| Avoidance | Avoid improper site waste management.<br>The Contractor will ensure that:<br>• the Project area will be equipped with proper temporary waste storage/accumulation areas;<br>• the temporary waste storage/accumulation areas will be roofed, concrete-paved or waterproofed or equipped with containment trays to prevent spills and leakages;<br>• the waste will be stored segregated per categories, and it will be labelled for its identification and classification;<br>• the drains of the waste storage/accumulation areas will collect the water runoffs and convey them into the wastewater treatment plant (WWTP);<br>• no waste mixing, no storing on the bare land and no burning will be allowed;<br>• the materials that can be recycled such as packaging paper, plastic and glass bottles will be sent to licensed recycling facilities, as far as practicable;<br>• the waste deriving from the equipment maintenance (e.g., filters, oily rugs and metal parts containing hydrocarbons, oils and lubricants) will be properly stored on a leak-proof floor covered with a shelter and then sent to recovery/disposal;<br>• the waste oils will be collected in specific containers; the different kinds of oils will not be mixed for storage;<br>• a specialist will carry out regular site inspections and for verifying the spills and leaks containment systems conditions and integrity;<br>• the site workers will be trained on good practices and arrangements for collection, safe handling and effective and correct disposal of both hazardous and non-hazardous waste. The training will include indications and best-practices for enhancing the waste reduction, reuse and recycling; the medical waste generated from the site infirmary will not be mixed to the general waste but it will be properly segregated and it will be managed by a company licensed for managing medical waste. |

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| Avoidance | Avoid discharging polluted wastewater.<br>The Contractor will ensure that:<br>• bimonthly qualitative and weekly quantitative data on wastewater will be collected;<br>• the monitoring campaigns will be completed as per the Project standards by appointed environmental specialists from the Contractor's HSE team<br>• the tests will be completed on both the effluents from the WWTP and the septic tanks;<br>• the food preparation areas will be equipped with special degreasers for separating the oil and grease from the wastewater flowing towards the sewage for the final discharge. The resulting amount of oil and grease waste will be properly collected and disposed of. |
| Avoidance | Avoid fauna from accessing waste storages.<br>The Contractor will ensure that fencing will be installed to keep off animals from accidentally entering the project areas and waste storages. Ensure that fencing used for delimiting areas is designed so that is not harmful to wildlife. Fence design will consider materials used (non-barbed wire), height of strands and permeability to ensure they are wildlife friendly. In addition, visual, physical and/or audio deterrents will be installed to keep fauna and avifauna away from waste storages. For example, using streamers, reflectors and flagging. |
| Avoidance | Avoid burning waste.<br>The toxic chemicals released during burning include nitrogen oxides, sulfur dioxide, VOCs and polycyclic organic matter. Burning plastic and treated wood also releases heavy metals and toxic chemicals, such as dioxin. The Contractor will ensure that no intentional or accidental waste burning will occur on site. The Contractor will take immediate actions – according to the legal framework - in case a waste arson starts. |
| Avoidance | Avoid the waste spreading all over the construction site.<br>The Contractor will install trash bins all over construction site for avoiding waste spreading, burning and burial. The domestic solid waste from the accommodation camp and the rest areas will be properly collected, segregated, and managed as per the Project standards. The site HSE team will raise the workers' awareness on the proper general waste disposal. |
| Minimization | Avoid the uncontrolled discharge of civil wastewater.<br>Since there is no wastewater collection system in the Cabinda province, the Contractor will provide the construction site with chemical toilets and with a sewage system served by storage tanks. The Contractor will ensure that:<br>• the civil wastewater 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;<br>• the civil wastewater yard collection system and the septic tanks are constantly properly functioning and in good conditions;<br>• periodical maintenance and control activities will be carried out for preventing malfunctioning of drains, pipelines, manholes, septic tanks, spills and leaks;<br>• periodical maintenance and control activities will be carried out for ensuring the storage tanks tightness and proper placement, under the tanks, of secondary containment systems;<br>• the inspections will be properly registered on a site log;<br>• the sewage sludge will be properly managed by licensed waste management companies that will send the sludge to the municipal sewage network or to licensed sanitary landfills (prior municipal authorization). |
| Restoration | Restore the areas where temporary deposits have been dismantled.<br>As the temporary waste storage/accumulation areas will be dismantled/decommissioned, these will be restored, cleaned and destinated to other purposes or revegetated. If revegetated, the Contractor should implement a monitoring plan, keeping track of the restoration activities, evaluating their effectiveness and should implement a maintenance plan. The plan must include the control of the quality of the plant soil, the quality of mixtures for hydroseeding, the engraftment of planted tree and shrub individuals, the management of reforested areas over time, the use of rescue irrigation if necessary. |

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| Offset | Compensate the excessive production on waste by recycling and reusing as byproducts.<br>The Contractor will maximize, as far as practicable in terms of material properties (i.e., technical, and economic feasibility), the re-use of waste soils and aggregates arising from excavations and materials processing like cutting. |
| **Impact Factor: Influx of population** | |
| Avoidance | Avoidance of any contact with wildlife.<br>The Contractor will prohibit the workers from engaging themselves in any types of fishing, hunting and arrangement of traps for animals and birds. In order to prevent workers to enter in the community forest in the surrounding areas, the Contractor should provide correct alimentation intake to the workers. In addition, during the construction phase, any fauna species encountered will not be interfered with or disturbed until it moves on by itself, or relocated by an expert ecologist This includes the cessation of operations if required. |
| Minimization | Employees and subcontractors' awareness raising<br>All employees and subcontractors will be trained and informed by the Contractor on the presence of conservation areas on site, on the biodiversity values, and how to behave in case of wildlife encounter. By partnering with agencies responsible for law control, the Contractor will strengthen law enforcement against illicit wildlife trade. |
| Offset | Anti-poaching<br>Additional mitigation/offset measures will be further defined for the Operational phase. |
| **Impact Factors: Increase of road traffic and Improvement of road network** | |
| Avoidance | Avoid exceeding the speed limits when transporting goods and materials onsite or offsite.<br>All drivers accessing the site will be briefed about the speed restrictions. Signs and labels showing the maximum speed allowed will be affixed at the site entrances and on the Project area roads. Any unsafe or irresponsible actions will be identified, corrected, and reported to HSE department. |
| Avoidance | Avoid unsafe or irresponsible actions by drivers.<br>All the vehicles will comply to with the site safety signs and will enter and exit the Project site in a predefined direction. Vehicles' maneuvering and U-turns will not be allowed on public roads. |
| Avoidance | Avoid the traffic vehicles offroad, outside of the Project area boundaries and of the defined paths.<br>The trucks and moving vehicles will travel on predefined paths. The Contractor will ensure that no vehicles and trucks will leave the predefined road for shortening the travel time or because of roads interruption without proper authorization. Entrance of unauthorized vehicles will be forbidden. |
| Minimization | Minimize effects of road kills.<br>If any fauna species are injured during the operational activities, a *Fauna Handling and Rescue Procedure* must be activated by the Contractor and species has to be taken to the allocated to the vet for treatment.<br>To reduce the likelihood that scavenging species will be struck by vehicles, roadkill will be removed or relocated and shall be reported as an environmental event. Moreover, all fauna deaths and real animal sightings in the project site and dumping areas will be reported.<br>Project traffic routing will be reduced through areas of particular interest for autochthonous fauna species (birds, amphibians, mammals) wherever possible and during sensitive periods (nesting, reproduction). |
| Minimization | Minimize the traffic-related risks, issues, and hazards.<br>For minimizing the issues and avoiding the potential risks and hazards due to the increase of traffic, the Contractor will:<br>• draft and adopt a *Traffic Management Plant* which will be updated any time when necessary;<br>• ensure that traffic and transport management will be carefully planned considering the potential developments and the sensitive receptors in the vicinity of the Project site;<br>• define measures for preventing the traffic congestion and the accidents (e.g., indicating the maximum speed limits and the safety distance to be kept between the moving vehicles, carrying out maintenance and controls on trucks, forbidding the circulation during the peak hours); |

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| | • ensure that all trucks and moving vehicles will be labelled with serial numbers for properly and readily identifying the potential transgressors or the vehicles needing maintenance;<br>• ensure that periodical consultation will be undertaken with stakeholders for collecting grievances and issues related to the increase of the traffic;<br>• ensure that, for preventing accidents such as persons hitting, the whole construction site area will have a good road visibility and no obstacles on the roads;<br>• provide an onsite parking. |
| Restoration | Restore damaged roads, damaged plots of lands and damaged fences.<br>The continuous riding of the trucks and moving vehicles reaching and leaving the construction area will generate deterioration of the road structures and will damage the roads paving. The Contractor will ensure that the damages will be periodically repaired. |
| Compensation | Compensate the public roads exploitation by carrying out their maintenance, repairing, and cleaning.<br>The Contractor will ensure that, even when not damaged or deteriorated, the public roads reaching the Project area will be properly maintained, repaired, and renewed and periodically cleaned. |
| **Impact Factor: Introduction and spreading of invasive alien species** | |
| Avoidance | Clean equipment.<br>The Contractor will apply rigorous and appropriate process of controls at all gates of the site used on a normal basis (*e.g.*, not at gates used only for emergency access), to prevent accidental introduction of invasive alien species. Furthermore, the wheels of the trucks must be cleaned before the trucks leave the dumping area sites. |
| Minimization | Management of established invasives.<br>In case alien (invasive) species are detected, reducing, or eliminating the impacts of established species by eradication, containment, exclusion, or population reduction by physical or biological control, according to the *Invasive Alien Species Management Plan* (IASMP). This plan will design and implement effective management programs appropriate for each species and habitats, incorporating best-practices standards. |
| Minimization | Monitoring of spreading of alien (invasive) species.<br>The contractor will adopt a monitoring plan, in which, annually, it will verify the presence of invasive species through field surveys and will evaluate the effectiveness of the actions undertaken following the IASMP. |
| Restoration | Post-management restoration.<br>Sometimes, control of an invasive species is followed by rapid and adequate recovery of the native ecosystem or of the economic or societal value affected by the target species. But in other cases, native species may fail to recover, or unforeseen adverse consequences may occur, such as invasion by other introduced species. In such cases, further intervention may be required to assist in the recovery of native biodiversity or other values. This may include specific restoration projects for individual native species, or management of other invasive species. The Contractor will design and implement a post-management restoration project to ensure the success of the recovery of native biodiversity, ecosystem, ecosystem services and other values, following the IASMP. |

### 11.1.3 Impact Value and Residual Impact Value Calculation

This section describes the Impact Value and the Residual Impact Values (after the implementation of mitigation measures) found for each impact factor on the two biological component, the *Terrestrial habitat and ecosystem flora and fauna)* described in the paragraph 11.1.3.1 and the *Marine and freshwater habitat and ecosystems (flora and fauna)* described in the paragraph 11.1.3.2.

The description of how the calculation is performed can be found in Chapter 09 of this ESIA. The Sensitivity (S) scale is given in the paragraph 9.3 of the above-mentioned Chapter and varies according to the baseline conditions identified for each biodiversity features.

#### 11.1.3.1 Terrestrial habitats and ecosystems (Flora and fauna)

During the construction phase, the Project will generate **negative** impacts in areas with a *medium-high* (4) sensitivity.

Considering the application of all the above-mentioned mitigation measures, the negative residual impacts on the *Terrestrial habitat and ecosystems (flora and fauna)* component has been assesses to be **medium** to **low**, as shown in the matrix below (Figure 1and Figure 2).

| Impact Factor | Impact Factor Features | | Component Sensitivity | Impact Reversibility | Impact Value | Mitigation effectiveness | Residual impact value |
|---|---|---|---|---|---|---|---|
| Production of solid waste | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Medium | | | | | |
| Production of wastewater | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Medium | | | | | |
| Influx of population | Duration: | Medium-long | Medium-high | Short-mid-term | **Medium** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Beyond regional | | | | | |
| | Intensity: | High | | | | | |
| Increase of road traffic | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium | **Medium** |
| | Frequency: | Frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Medium | | | | | |
| Improvement of road network | Duration: | Medium-long | Medium-high | Mid term | **Medium** | Medium | **Low** |
| | Frequency: | Sporadic | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Medium | | | | | |
| Introduction and spreading of alien invasive species | Duration: | Medium-long | Medium-high | Long term | **High** | Medium-high | **Medium** |
| | Frequency: | Moderately frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | High | | | | | |

| Impact Factor | Impact Factor Features | | Component Sensitivity | Impact Reversibility | Impact Value | Mitigation effectiveness | Residual impact value |
|---|---|---|---|---|---|---|---|
| Removal/degradation of topsoil and vegetation | Duration: | Medium-long | Medium-high | Long term | **High** | Medium-high | **Low** |
| | Frequency: | Moderately frequent | | | | | |
| | Geo. Extent: | Project footprint | | | | | |
| | Intensity: | High | | | | | |
| Change in local morphology and topography | Duration: | Medium-long | Medium-high | Long term | **High** | Medium-high | **Low** |
| | Frequency: | Moderately frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Medium | | | | | |
| Change in the local hydrology and surface water quality | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Medium | | | | | |
| Emission of greenhouse gases | Duration: | Medium-long | Medium-high | Long term | **Very High** | Medium-high | **Medium** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Global | | | | | |
| | Intensity: | Medium | | | | | |
| Emission of dust and particulate matter | Duration: | Medium-long | Medium-high | Short-mid-term | **Medium** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | High | | | | | |
| Emission of gaseous pollutants | Duration: | Medium-long | Medium-high | Long term | **High** | Medium-high | **Medium** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Medium | | | | | |
| Emission of noise and vibrations | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | High | | | | | |
| Emission of light | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | High | | | | | |
| Existance of new buildings/infrastructures, visual impact | Duration: | Medium-long | Medium-high | Long term | **High** | Medium | **Medium** |
| | Frequency: | Continuous | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Medium | | | | | |
| Land occupation | Duration: | Medium-long | Medium-high | Long term | **High** | Medium | **Medium** |
| | Frequency: | Continuous | | | | | |
| | Geo. Extent: | Project footprint | | | | | |
| | Intensity: | High | | | | | |

**Figure 1: Residual impact assessment matric for the *Terrestrial habitat and ecosystems (flora and fauna)* component in areas of medium-high sensitivity during construction phase (part 1 of 2).**

| Impact Factor | Impact Factor Features | | Component Sensitivity | Impact Reversibility | Impact Value | Mitigation effectiveness | Residual impact value |
|---|---|---|---|---|---|---|---|
| Production of solid waste | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Medium | | | | | |
| Production of wastewater | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Medium | | | | | |
| Influx of population | Duration: | Medium-long | Medium-high | Short-mid-term | **Medium** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Beyond regional | | | | | |
| | Intensity: | High | | | | | |
| Increase of road traffic | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium | **Medium** |
| | Frequency: | Frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Medium | | | | | |
| Improvement of road network | Duration: | Medium-long | Medium-high | Mid term | **Medium** | Medium | **Low** |
| | Frequency: | Sporadic | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Medium | | | | | |
| Introduction and spreading of alien invasive species | Duration: | Medium-long | Medium-high | Long term | **High** | Medium-high | **Medium** |
| | Frequency: | Moderately frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | High | | | | | |

Figure 2: Residual impact assessment matric for the *Terrestrial habitat and ecosystems (flora and fauna)* component in areas of medium-high sensitivity during construction phase (part 2 of 2).

To monitor the mitigation performance, monitoring activity measures are suggested in the Monitoring paragraph.

#### *11.1.3.2 Marine and freshwater habitats and ecosystems (Flora and fauna)*

During the construction phase, the Project will generate **negative** impacts in areas with a *medium-high* (4) sensitivity.

Considering the application of all the above-mentioned mitigation measures, the negative residual impacts on the *Marine and freshwater habitat and ecosystems (flora and fauna)* component has been assesses to be **medium** to **negligible**, as shown in the matrix below (Figure 3).

| Impact Factor | Impact Factor Features | | Component Sensitivity | Impact Reversibility | Impact Value | Mitigation effectiveness | Residual impact value |
|---|---|---|---|---|---|---|---|
| Change in the local hydrology and surface water quality | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Medium | | | | | |
| Emission of greenhouse gases | Duration: | Medium-long | Medium-high | Long term | **Very High** | Medium-high | **Medium** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Global | | | | | |
| | Intensity: | Low | | | | | |
| Emission of dust and particulate matter | Duration: | Medium-long | Medium-high | Short-mid-term | **Medium** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Low | | | | | |
| Emission of gaseous pollutants | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Low | | | | | |
| Introduction and spreading of alien species | Duration: | Medium-long | Medium-high | Long term | **High** | Medium-high | **Low** |
| | Frequency: | Moderately frequent | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Medium | | | | | |
| Production of solid waste | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Medium | | | | | |
| Production of wastewater | Duration: | Medium-long | Medium-high | Mid term | **High** | Medium-high | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Medium | | | | | |
| Influx of population | Duration: | Medium-long | Medium-high | Short-mid-term | **Medium** | Medium | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Beyond regional | | | | | |
| | Intensity: | Medium | | | | | |
| Increase of road traffic | Duration: | Medium-long | Medium-high | Long term | **High** | High | **Low** |
| | Frequency: | Highly frequent | | | | | |
| | Geo. Extent: | Regional | | | | | |
| | Intensity: | Low | | | | | |
| Improvement of road network | Duration: | Medium-long | Medium-high | Long term | **High** | High | **Negligible** |
| | Frequency: | Sporadic | | | | | |
| | Geo. Extent: | Local | | | | | |
| | Intensity: | Low | | | | | |

**Figure 3: Residual impact assessment matric for the *Marine and freshwater habitat and ecosystems (flora and fauna)* component in areas of medium-high sensitivity during construction phase.**

To monitor the mitigation performance, monitoring activity measures are suggested in the Monitoring paragraph.

### 11.1.4 Monitoring

The **Biodiversity Management Plan** (BMP) and the **Invasive Alien Species Management Plan** (IASMP) are foreseen to monitor the implementation and effectiveness of the proposed mitigations. These plans will be further articulated when the relevant management plans will be prepared as part of the Project's ESMP.

The following measures are proposed specifically for the Construction phase:

- Natural Habitat and flora species triggering Critical Habitats
  - *Flora On-site Conservation*: on-site conservation areas identified for flora species shall be monitored periodically and any signs of disturbance will be noted (*e.g.,* trampling, dust deposition, soil erosion, presence of stagnant water). During the construction phase a monitoring activity shall occur monthly from an expert ecologist.
  - *Demarcation of on-site natural habitat:* on-site natural habitats adjacent to the Project footprint area will be protected from any unintentional disturbance during construction. During the construction phase a monitoring activity shall occur monthly from an expert ecologist.
  - *Flora Salvaging and Translocation*: translocation sites identified for salvaged and translocated flora species shall be monitored periodically for any sign of stress or disturbance. During the first two years after translocation monitoring shall occur monthly during the vegetative season. After the first three years monitoring shall occur every three months during the vegetative season (unless particular issues are recorded during previous monitoring).
  - *Invasive alien species*: the presence and spreading of invasive alien flora species within and around the construction site will be monitored every three months during the vegetative season by an expert ecologist; if necessary, extirpation campaign will be put in place in order to avoid the spreading of the invasive species.
- Fauna
  - *Fauna site recognition and translocation*: an expert ecologist will perform a site recognition in the footprint areas, to identify and relocate fauna species (with special attention to fauna with limited mobility). Translocation sites are going to be evaluated by the ecologist in undisturbed and suitable local habitats.
  - *Fauna on-site monitoring:* an expert ecologist will perform twice weekly checks of open trenches, pits, and other excavations within the Project footprint areas, in order to identify any entrapped fauna and to minimize mortality.
  - *Fauna Handling and Rescue:* if any fauna species are injured, an expert ecologist should take it to the nearest vet for treatment. In case of roadkill, the carcass will be removed as soon as possible. Any observation of live animal or carcasses along the access roads or on the construction site will be recorded. Additional mitigation measures to discourage wildlife presence on site and avoid roadkill will be taken if needed.

## 11.2 Impact Assessment for Operation Phase

During the operation phase the Project activities will inevitably generate impacts on the biodiversity values identified during the baseline studies for the habitats, flora and fauna components. Part of habitat will be lost as well as flora and fauna species will be affected by the airport traffic and routinary activities.

The following direct and indirect impacts on biodiversity have the potential to take place during the operational phase of the Project:

- Wildlife disturbance due to the increase in noise levels, artificial light and vibrations as a result of increased air and road traffic and light from the new airport buildings;
- Reduction in air quality and habitat degradation caused by increased emission of dust, particulate matter, and gaseous pollutants in atmosphere due to the air and road traffic movement;

- Wildlife disturbance and reduction in water quality due to the change in local hydrological regime, and the fallout of pollutants and dust in freshwaters features; and
- Accidental introduction and spreading of alien species; and
- Injury and/or killing of animals due to traffic collisions (road and air vehicles).

Direct impacts are expected within the Project footprint, while indirect impact is also conservatively considered within the 2km from the Project footprint. The quantification of the areas and each habitat type impacted by the project, are available on the Chapter 7. Moreover, due to the Project characteristics, assessment of the impact for each habitat is done within 2 km of buffer zone, but an assessment on individual species (*e.g.* birds and bats) needs also to be considered.

### 11.2.1 Protected Areas

There is no direct land take within protected areas but there may be potential indirect impacts to species that use and live in the Chiloango Mangroves, a proposed Protected Area, located approximately at 5km north-west of the site depending on the flight path of aircraft and taking off and landing on operations.

### 11.2.2 Natural and Modified Habitat

The Habitat map at the 2km buffer includes various habitats of which 30% have been identified as natural habitats and the remaining 70% is represented by modified habitats.

Direct impacts deriving for example from the increase of noise levels, artificial lights, wildlife disturbance etc. on the Project footprint is expected to be low. However, the indirect impacts are expected to be higher on natural habitats within 1 and 2km AoI due to the reduction of air quality and soil pollution (such as nitrogen deposition resulting from flight fuel), or wildlife disturbance, and other operational activities.

### 11.2.3 Flora species

From the surveys no threatened or protected species were identified as present withing the 2km AoI.

Because of the herbaceous vegetation (habitat: shrub savanna) in the project footprint, these flora species will directly be impacted and will be lost during the construction. Moreover, indirect impact on flora species are expected also within 1 and 2km from the airport's footprint due to the disturbance, by accidental introduction and spreading of alien species, and reduction in air quality and dust fallouts, leading to habitat degradation.

### 11.2.4 Fauna species

From the surveys, no threatened or protected mammals, herptile and freshwater species were identified as present within the 2km AoI.

However, some other small and common mammal species could be directly affected within the Project's footprint through noise and light disturbance, vehicular collision, etc.

Different consideration needs to be done regarding impacts on the avifauna which is considered potentially significant (high). Literature suggests Angola has 940 species of birds with 16 endemics. During the field studies 95 species were directly observed. An increasing level of disturbance and pollution, as well as the increased collision risk could impact bird species within the AoI. Migratory birds are likely to alter their flight paths as a result of increased air traffic.

Regarding Bats few species have been recorded on site. Increased levels of disturbance and pollution, as well as the increased collision risk (from plane numbers) could impact bat species within the AoI. Whilst local bat species are likely to be scarcely affected from night activities (flights should be during the day), the increased noise levels, artificial light and vibrations could have a negative effect on these animals.

### 11.2.5 Critical habitats

The results of Critical Habitat Assessment (see Chapter 7, section7.4.6) show that 7 species could potentially trigger critical habitat (2 mammals, 4 birds, 1 bat ) for the criterion 1 and 3 of the IFC PS6.

The two mammal's species (the African forest elephant and the chimpanzee) that potentially are triggering CH have not been directly observed during the two-field surveys. Due the use of adjacent habitats, to the habitat fragmentation and the environment condition present within the AoI, they are not likely considered present within the AoI. Because of the potential presence of chimpanzees, a consultation with the IUCN Great Apes Task Force has been activated. They confirmed that no data are available in Cabinda, consequently further monitoring through camera traps is recommended for a longer period.

One of the four bird species, the Grey Parrot, has been directly observed during the first field survey. The other 3 bird species (the Rufous-bellied heron, the Cape Gannet, and the Cape Cormorant) have not been observed during the two-field surveys, however, due to their ethology and the ecology of the AoI, the potential presence of these species cannot be totally excluded. These 4 species are likely to trigger CH if data will show that there are sensitive colonies on the coast or in the forest nearby the Project's footprint. For this reason, we recommend a longer period of monitoring data collection.

Last, the bat species (the Hayman's dwarf epauletted fruit bat) that potentially triggers CH, was not observed during the two-field surveys, however due to its ethology and ecology of the AoI, the potential presence of this species cannot be totally excluded. Also, for this species, we recommend a longer period of monitoring data collection.

### 11.2.6 Preliminary mitigation measures

In addition to IFC PS6, ICAO standard[1] recommend that the wildlife strike hazard on, or in proximity of, an airport shall be assessed through:

a) the procedure for recording and reporting wildlife strikes to aircraft prescribed;

b) the collection of information from aircraft operators, airport personnel, and other sources, on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operations; and

c) an ongoing evaluation of the wildlife hazard by the airport operators.

It is clear how the sensitiveness of this component is high due not only to the wildlife protection, but also to the security of the aviation system.

A set of actions to decrease the risk to aircrafts operations need to be put in place by adopting measures to minimise the likelihood of collision between the aircrafts and the wildlife. From conversation with SGA during the ESIA development, it was reportedly said that a current avifauna monitoring is ongoing at the existing Cabinda airport but no data have been available for the current study. Starting from the existing monitoring, although the distance of 14km, it is recommended to review the approach and adapt the process to the NAIC area.

As a preliminary set of measures, the Operator will be required to:

- conduct an Initial Wildlife Hazard Assessment before starting activities following the methodology described in *Chapter 2 of the ICAO Wildlife Management and Control Regulatory Framework & Guidance Material.* Part of this assessment can be considered covered by the Baseline of this study (i.e. methodology used for observation, scientific and local name), however, to determine the estimated number and location of each

[1] Wildlife Management and Control Regulatory Framework & Guidance Material.

species, local movement and daily and seasonal occurrence, there would be the need to rely on additional monitoring;

- prepare a Wildlife Management Program once the assessment is completed, with a set of defined continuous monitoring that should be carried out during the operation activities;
- rely on a biodiversity expert (possibly as a direct airport employee) to start working since an early stage of project construction with the airport owner and operation team, in order to conduct the initial assessment as required and develop the subsequent programme in partnership with the Government of Cabinda;
- include a mitigation plan for preventing bird strike during operation. For example, Robin Radar have a bird radar system that tracks the exact flight paths of both flocks and individual birds up to 10 kilometres away. They automatically detect and log hundreds of birds simultaneously, including their size, speed, direction and flight path;
- develop and implement a Biodiversity Management Plan to consider integrated, innovative and real-time approaches to make sure that the transition from construction to operation is done considering the adaptive management approach;
- prepare a Waste Management Plan in order to avoid garbage accumulation that can be an attractive for animals;
- prepare a Water Management Plan to consider water ponds in the area, water availability and to avoid water pollution and waste of clean water;
- prepare a Groundwater Management Plan to ensure that the ponds are equipped of birds deterrent and are periodically maintained and discharged;
- carry out a carcass monitoring in the 1km area especially during the breeding season in order to understand characteristics and habits of fauna species;
- carry out an additional one-year monitoring program following ICAO standard and IFC PS6 and to put a clear action in the environmental and social action plan as a commitment of the Project owner to have this assessment completed with the set of resulted operation MPs in place at least one year before starting operation.

It is WSP opinion that at this stage with the information available, it would be only possible to determine the level of monitoring needed to understand the likelihood to have some species in the area as well as the habits of such species based on the anthropic factors. On the other side, however it would be very difficult to define a robust set of mitigation measures to address the Biodiversity Management Plan and Wildlife Management Program in accordance with international requirements.

Thus, considering the precautionary principle (worst-case-approach), flight activity surveys should be focussed only in the direct AoI, not further than the 5km buffer. Appropriate monitoring and deterrent mitigation can be applied at the airport as per airports and airfields all over the world. Robin radar has a very effective bird detection radar system for birds that is widely used.

For mammals and flora no real need to extend much beyond the 2km the development area unless design elements suggest that disturbance from aircraft will displace species from the wider area.

The additional monitoring programme will also serve to confirm or exclude the presence of Critical Habitat. In case these species are found during the additional studies, the presence of direct and indirect impact to the fauna species populations will be evaluated as well as the quantification of net loss. As net gain in that case, is required, a *Biodiversity Action Plan* should be prepared by the Operator. This would also mean that the design

of a biodiversity offset (through the preparation of an *Offset Management Plan*), to achieve measurable conservation outcomes, should be carried out in alignment with best available information and current practices. This will involve partnership with national organization for biodiversity conservation, government authority and stakeholder consultation.

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